IAP5 Rec'd PCT/PTO 30 AUG 2006

FORM PTO-1390 (Modified) (REV. 7-2005) U.S. PATENT AND TRADEMARK OFFICE; U.S. DEPARTMENT OF COMMERCE

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A SUBMISSION UNDER 35 U.S.C. 371

ATTORNEY'S DOCKET NUMBER: L8638.06115

U.S. APPLICATION NO. (If known, see 37 CFR 1.5): 10/591184

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/JP2005/003390	March 1, 2005	March 2, 2004 & July 16, 2004

TITLE OF INVENTION

SYSTEM AND METHOD FOR NEGOTIATION OF WLAN ENTITY

APPLICANT(S) FOR DO/EO/US

Hong CHENG

Pek Yew TAN

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a submission under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a submission under 35 U.S.C. 371.
3. ☒ This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include items (5), (6), (9) and (24) indicated below.
4. ☐ The US has been elected (Article 31).
5. ☒ A copy of the International Application as filed (35 U.S.C. 371 (c)(2))
   - a. ☐ is attached hereto (required only if not communicated by the International Bureau).
   - b. ☒ has been communicated by the International Bureau.
   - c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☒ An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)).
   - a. ☒ is attached hereto.
   - b. ☐ has been previously submitted under 35 U.S.C. 154(d)(4).
7. ☐ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371 (c)(3))
   - a. ☐ are attached hereto (required only if not communicated by the International Bureau).
   - b. ☐ have been communicated by the International Bureau.
   - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
   - d. ☐ have not been made and will not be made.
8. ☐ An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☐ An oath or declaration of the inventor(s) (35 U.S.C. 371 (c)(4)).
10. ☐ An English language translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371 (c)(5)).
11. ☐ A copy of the International Preliminary Examination Report (PCT/IPEA/409).
12. ☒ A copy of the International Search Report (PCT/ISA/210).

Items 13 to 23 below concern document(s) or information included:

13. ☒ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
14. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
15. ☐ A **FIRST** preliminary amendment.
16. ☐ A **SECOND** or **SUBSEQUENT** preliminary amendment.
17. ☐ A substitute specification.
18. ☐ A power of attorney and/or change of address letter.
19. ☐ A computer-readable form of the sequence listing in accordance with PCT Rule 13*ter*.2 and 37 CFR 1.821 - 1.825.
20. ☐ A second copy of the published International Application under 35 U.S.C. 154(d)(4).
21. ☐ A second copy of the English language translation of the International Application under 35 U.S.C. 154(d)(4).
22. ☐ Express Mail Label No.

IAP5 Rec'd PCT/PTO 30 AUG 2006

PTO-1390 (Rev. 07-2005)
Approved for use through 3/31/2007. OMB 0651-0021
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

U.S. APPLICATION NO. (If known, see 37 CFR 1.5)	INTERNATIONAL APPLICATION NO.	ATTORNEY'S DOCKET NUMBER
10/591184	PCT/JP2005/003390	L8638.06115

23. Other items or information:

Claim for Priority with PCT/IB/304
PCT/IB/308 (First Notice & Second & Supplementary Notice)
Partial Application Data Sheet

The following fees have been submitted:	CALCULATIONS	PTO USE
24. ☒ Basic national fee $300	$ $300.00	
25. ☒ Examination fee (37 CFR 1.492(c)) If the written opinion prepared by ISA/US or the international preliminary examination report prepared by IPEA/US indicates all claims satisfy provisions of PCT Article $0; All other situations. $200	$ $200.00	
26. ☒ Search fee (37 CFR 1.492(b)) If the written opinionof the ISA/US or the International preliminary examination report by IPEA/US indicates all claims satisfy provisions of PCT Article 33(1)-(4). . . $0; Search fee (37 CFR 1.445(a)(2)) has been paid on the international application to the as an International Searching Authority. . . . . $100; International Search Report prepared by an ISA other than the US and provided to the previously communicated to the US by the IB. . . . . $400; All other situations. $500	$ $400.00	
TOTAL OF 24, 25 and 26 =	$ $900.00	
☐ Additional fee for specification and drawings filed in paper over 100 sheets (excluding sequence listing in compliance with 37 CFR 1.821(c) or (e) or computer program listing in an electronic medium) (37 CFR 1.492(j)). The fee is $250 for each additional 50 sheets of paper or fraction thereof.		

Total Sheets	Extra Sheets	Number of each additional 50 or fraction thereof (round up to a whole	RATE	CALCULATIONS	PTO USE
- 100 =	0 /50 =	0	x $250.00	$ $0.00	

	CALCULATIONS	PTO USE
Surcharge of $130.00 for furnishing any of the search fee, examination fee, or the oath or declaration after the date of commencement of the national stage (37 CFR 1.492(h)).	$	

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE	CALCULATIONS	PTO USE
Total claims	31 - 20 =	11	x $50.00	$ $550.00	
Independent claims	13 - 3 =	10	x $200.00	$ $2,000.00	
MULTIPLE DEPENDENT CLAIMS (if applicable)		☐	+ $360.00	$ $0.00	

	CALCULATIONS	PTO USE
TOTAL OF ABOVE CALCULATIONS =	$ $3,450.00	
☐ Applicant claims small entity status. See 37 CFR 1.27. Fees above are reduced by 1/2.	$ $0.00	
SUBTOTAL =	$ $3,450.00	
Processing fee of $130.00 for furnishing the English translation later than 30 months from the earliest claimed priority date (37 CFR 1.492(i)).	$ $0.00	
TOTAL NATIONAL FEE =	$ $3,450.00	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). $40 per property +	$ $0.00	
TOTAL FEES ENCLOSED =	$ $3,450.00	
	Amount to be	$
	Amount to be	$

PCTUS1/REV07

10/591184

IAP5 Rec'd PCT/PTO 30 AUG 2006

PTO-1390 (Rev. 07-2005)
Approved for use through 3/31/2007. OMB 0651-0021
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

a. ☒ A check in the amount of $ \$3,450.00 to cover the above fees is enclosed.

b. ☐ Please charge my Deposit Account No. ________ in the amount of $ ________ to cover the above fees. A duplicate copy of this sheet is enclosed.

c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 19-4375. A duplicate copy of this sheet is enclosed.

d. ☐ Fees are to be charged to a credit card. **WARNING:** Information on this form may become public. **Credit card information should not be included on this form.** Provide credit card information and authorization on PTO-2038.

NOTE: Where an appropriate time limit under 37 CFR 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the International Application to pending status.

SEND ALL CORRESPONDENCE TO:

James E. Ledbetter
STEVENS, DAVIS, MILLER & MOSHER, LLP
1615 L. Street, NW, Suite 850
Washington, DC 20036

James E. Ledbetter
SIGNATURE

James E. Ledbetter
NAME

28,732
REGISTRATION NUMBER

August 30, 2006
DATE

PCTUS1/REV07

IAP7 Rec'd PCT/PTO 30 AUG 2006

10/591184

The PTO did not receive the following listed item(s)

NO POST CARD

10/591184

IAP5 Rec'd PCT/PTO 30 AUG 2006

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of

Inventors:	Hong CHEN, et al.
Application No.:	New PCT National Stage Application
Filed:	August 30, 2006
For:	SYSTEM AND METHOD FOR NEGOTIATION OF WLAN ENTITY

CLAIM FOR PRIORITY

Assistant Commissioner of Patents
Washington, D.C. 20231

Dear Sir:

The benefit of the filing date of the following prior foreign application filed in the following foreign country is hereby requested for the above-identified application and the priority provided in 35 USC 119 is hereby claimed:

Japanese Appln. No. 2004-058245, filed March 2, 2004 and

Japanese Appln. No. 2004-209470, filed July 16, 2004.

The International Bureau received the priority document within the time limit, as evidenced by the attached copy of the PCT/IB/304.

It is requested that the file of this application be marked to indicate that the requirements of 35 USC 119 have been fulfilled and that the Patent and Trademark Office kindly acknowledge receipt of this document.

Respectfully submitted,

James E. Ledbetter
Registration No. 28,732

Date: August 30, 2006

JEL/spp
Attorney Docket No. L8638.06115
STEVENS DAVIS, MILLER & MOSHER, L.L.P.
1615 L STREET, NW, Suite 850
P.O. Box 34387
WASHINGTON, DC 20043-4387
Telephone: (202) 785-0100
Facsimile: (202) 408-5200

10/591184

IAP5 Rec'd PCT/PTO 30 AUG 2006

DESCRIPTION

SYSTEM AND METHOD FOR NEGOTIATION OF WLAN ENTITY

TECHNICAL FIELD

[0001]

The present invention relates to the field of wireless local area networks and in particular to the operation of such networks in heterogeneous environments.

BACKGROUND ART

[0002]

Wireless local area networks (WLANs) have invoked great interests from both consumers and the industry. The current most popular WLANs are based on the [Non Patent Document 1] standards. While these standards have helped the initial uptake of WLANs, in their current form, they are not suited for large-scale wireless network deployments. This is because the cost and control of WLAN entities become complex in large environments.

[0003]

Currently, many WLAN equipment manufacturers have addressed large-scale deployments by introducing new split architecture. Here, control aspects of the [Non

Patent Document 1] WLAN specifications are centralized at controller nodes (CNs) while other aspects are distributed to numerous wireless access points (WAPs). With the diversity of manufacturers and their implementations of the split architecture, there are incompatibilities between WLAN entities from different manufacturers.

[0004]

There are currently some efforts to provide standardized means for managing large-scale WLANs in the Internet Engineering Task Forces (IETF) Control and Provisioning of Wireless Access Point (CAPWAP) working group. [Non Patent Document 2] describes the efforts of the CAPWAP working group. However these efforts do not consider the problems of accommodating WAPs with dissimilar functional capabilities within a single WLAN. As such these problems limit the development of the WLAN market.

[0005]

Furthermore, it is expected that future deployments of WLANs will feature dynamic wireless networks. In such types of deployments, network topologies will change during the operational lifecycle of the WLAN to enable enhanced applications and services. WLAN elements in such networks will be provisioned with both wired and wireless connectivity to enable dynamic topologies. However current assumptions of WLANs (and also CAPWAP) only refer to static network topologies. So while current WLANs are capable of adjusting to the dynamic conditions of the wireless medium, they are unable to accommodate the effects of dynamic topology changes.

[0006]

For example, current WLAN systems adjust to declines in the signal-to-interference ratio (SIR) of the wireless medium by increasing the signal transmission power. However such minor corrections are inadequate to accommodate the variances in latency and overhead introduced by changes in WLAN topology. Furthermore, these variances in latency and overhead impede the operation of the CAPWAP split architecture. This is because the split architecture is sensitive to delays due to the very nature of the distributed operations. The redundancies of WLAN and CAPWAP processing performed at intermediate wireless access points (WAP) of a dynamic CAPWAP topology together with the corresponding physical overheads are detrimental to the CAPWAP split operations.

[0007]

Given such scenarios, WLAN entities currently available from various vendors are incapable of interoperation in a single WLAN and are also incapable of operation in a dynamic topology WLAN.

[0008]

These problems refer to static differences between WLAN entities as they are results of differences in basic design. In addition to these, there are also problems related to dynamic differences between WLAN entities.

[0009]

In particular, during the functioning of a WLAN, the processing load at a WAP can become substantially high even exceeding the processing capacity of the WAP. This could be due to increases in the number of associated mobile terminals (MTs) or due to increases in the volume of traffic from the associated MTs. These differences in processing load over time constitute a dynamic factor as they are dependent on the dynamics of the MTs.

[0010]

These dynamic differences in processing load across the WAPs consisting of a WLAN have traditionally been addressed by affecting handovers of MTs from their associated WAPs where processing load is high, to re-associate the MTs with other WAPs where processing load is relatively low.

[0011]

[Patent Document 1] discloses means for addressing dynamic differences in the levels of processing load at WAPs by means of proactive handovers of associated MTs. While [Patent Document 1] addresses the problem of dynamic differences in processing loads across WAPs, it does so by mandating that MTs associated with one WAP also be within the coverage areas of other WAPs so as to be able to perform handovers and re-associations. If a MT is not within the coverage area of one or more other assisting WAPs, it is then expected to physically displace to such a coverage area in order to relieve the first WAP of some processing load. These constraints are rigid and limit the efficacy of [Patent Document 1]. Such limitations are common to all handover-based methods.

[0012]

[Patent Document 2] presents a method for WAPs to modify, based on prevailing processing load levels, the intervals between the beacon signals that they transmit in order to attract or dissuade MT associations. This method also involves the constraints of requiring a MT to be within the coverage areas of alternate WAPs where processing load is low or being agreeable to displace towards such areas.

[0013]

[Patent Document 3] focuses on proactive MTs that make association decisions. However the method is also limited by the factors described earlier.

[0014]

While such methods attempt to solve the problem of dynamic differences in processing load, they do so by introducing stringent prerequisites and thereby introduce more problems. Another shortcoming of [Patent Document 1], [Patent Document 2], [Patent Document 3] and other handover-based methods for dealing with dynamic differences in WAPs is related to the bulk shifting of communication sessions. In practice MTs maintain a number of communication sessions with the WAPs with which they are associated. As a result, it is very likely that the communication sessions of only one MT or a few MTs constitute a considerable amount of processing load at the WAP. If the WAP were to affect the said MTs to handover and re-associate with another WAP, the processing load at the first WAP would be reduced, however by adversely affecting the other WAP. The other WAP then becomes overloaded and reverses the handover to the first WAP. This may continue without delivering any net gains for the WLAN. This points out that the processing load is not finely distributed by methods of handovers. In other words, dynamic differences are not finely managed.

[Non Patent Document 1] Institute of Electrical and Electronics Engineers Standard 802.11 - 1999 (R2003)

[Non Patent Document 2] "CAPWAP Problem Statement", draft-ietf-capwap-problem-statement-02.txt

[Patent Document 1] "Method and apparatus for facilitating handoff in a wireless local area network", US 2003/0035464 A1

[Patent Document 2] "Dynamically configurable beacon intervals for wireless LAN access points", US 2003/0163579 A1

[Patent Document 3] "Method and apparatus for selecting an access point in a wireless network", US 6,522,881 B1

DISCLOSURE OF THE INVENTION

[0015]

In view of the above discussed problems, it is the objective of the present invention to provide an apparatus and method for negotiations between controlling nodes (CNs) and wireless access points (WAPs) of a WLAN based on policies that allow for accommodating static and dynamic differences among the

WLAN entities including dynamic changes in WLAN topologies within a single WLAN.

[0016]

It is another objective of the present invention to provide a method and policy for negotiations between WLAN entities for the purpose of determining selected subsets of functional, load or other components to be processed by each of said WLAN entities so as to accommodate variations in system design, processing load or network topology.

[0017]

It is another objective of the present invention to provide an apparatus and method for negotiations between WLAN entities based on polices that allow for accommodating the dynamic differences between them such as differences in processing load levels at various WLAN entities within a single WLAN.

[0018]

It is yet another objective of the present invention to provide means for accommodating the operations of split architecture WLANs in the presence of dynamically changing network topologies.

[0019]

The disclosed invention relates to wireless local area networks (WLANs) and particularly to means of addressing the issues of static and dynamic differences among WLAN entities. It introduces policies for negotiations between WLAN entities for the purpose of accommodating these differences.

[0020]

One aspect of the present invention deals with negotiations between controlling nodes (CNs) and wireless access points (WAPs) of a WLAN based on policies that allow for accommodating static differences among them. Specifically, it presents means for determining a flexible division in WLAN functionality between the negotiating entities. The present invention first involves classifying the functional capabilities of WLAN entities. The entities then determine the capabilities of other entities followed by negotiations between them on how best to divide the functionality among them. Further operations of the WLAN entities are then based on the determined division of functionality. This aspect of the present invention enhances interoperability for WLAN entities.

[0021]

Another aspect of the present invention deals with negotiations between WLAN entities based on polices that allow for accommodating the dynamic differences between them. Particularly, it addresses the issue of distributing processing load among WAPs without requiring physical displacement of associated mobile terminals (MTs). It involves first determining the need to distribute parts of processing load at a WAP. This is followed by the determination of which parts of processing load may be distributed while at the same time maintaining existing association relationships between MT and WAP. Next, an overloaded WAP enters into negotiations with other WAPs in order to determine how the determined parts of processing load may be distributed among them. This aspect of the present invention overcomes the limitations of handover-based methods for managing dynamic differences between WLAN entities.

[0022]

In its broadest aspect, the present invention provides a system for providing service in a WLAN whereby a control node negotiates with WAPs and provides similar or different complimentary functionality for each of the WAPs to form a complete functionality defined for the WLANs.

[0023]

In its preferred form, the present invention allows for a controller module for control nodes to comprise a single or plurality of processing schedules composed of sequential lists of descriptors for subsets of functional components used for each wireless access point.

[0024]

In another preferred form, the present invention provides a method for providing services in a WLAN wherein a control node dynamically discovers the capability of a WAP by sending a single or plurality of messages to a WAP containing a section that emulates the data unit sent by a mobile terminal, a WAP receiving said message processes said section using the same procedure for processing data units received from a mobile terminal and sends it back to said control node in a reply message and said control node obtaining capabilities information of said WAP by examining the processed data units in the reply message.

[0025]

In another preferred form, the present invention allows a method for providing service in a WLAN that allows defined WLAN function split between WAPs and one or more control nodes wherein a subset of WAPs processes the total of their subset of functionality defined for the WLAN, a control node provides distinct subsets of complementary functionality defined for the WLAN to each of the subset of WAPs.

[0026]

In yet another preferred form, the present invention allows for means for determining a flexible division in WLAN functionality between the negotiating entities. The present invention first involves classifying the functional capabilities of WLAN entities. The entities then determine the capabilities of other entities followed by negotiations between them on how best to divide the functionality among them. Further operations of the WLAN entities are then based on the determined division of functionality.

[0027]

In another aspect, the present invention provides a system for load-balancing in a WLAN without requiring association handover at a mobile terminal whereby a data unit for a mobile terminal is processed with the complete WLAN functions by a single of plurality of WAPs where each WAP processes the data unit with only a subset of complete WLAN functions.

[0028]

In its preferred form, the present invention allows for a method of carrying out load balancing in a WLAN without requiring a mobile terminal to change association relationship with a WAP wherein the WAP separates the processing functions provided to the mobile terminal into an association specific part and a non-association specific part, the WAP negotiates with another WAP to process the non-association specific part and establishes a secure tunnel with the another WAP, the WAP tunnels a data unit from a mobile terminal to the another WAP through the tunnel after processing the data unit with the association specific part of functions and the another WAP receiving the processed data unit through the tunnel and processing it with non-association part of the functions.

[0029]

In another preferred form, the present invention provides a method for determining the distribution of non-association specific functions based on information comprising the size of the data unit to be processed, the expected average time for processing a data unit, the overhead time for processing a data unit or a weighted sum of said information.

[0030]

In another aspect, the present invention provides a method for accommodating variances in a wireless network topology wherein the method comprises the step of dynamically adapting the operations logic of at least one network entity of the wireless network topology to alter processing of one or more functional sub-components.

[0031]

In its preferred form, the present invention allows for a method of accommodating variances in a WLAN by altering the processing of selected functional sub-components at at least one network entity by means of bypassing processing of said selected functional sub-components.

[0032]

In its preferred form, the present invention allows for a method of accommodating variances in a WLAN by altering the processing of selected functional sub-components at at least one network entity by means of selectively processing said selected functional sub-components.

[0033]

In another preferred form, the present invention provides a method for altering local-level functional semantics while maintaining system-wide functional semantics of a wireless network by selectivity activating functional sub-components of selected network entities such that the sum of activated functional sub-components across said wireless network corresponds to complete functional sub-components of said wireless network.

[0034]

In yet another preferred form, the present invention provides a method for altering local-level functional semantics while maintaining system-wide functional semantics of a wireless network by means of shifting the processing of said activated functional sub-components from a first network entity to a second network entity.

[0035]

Based on the aspects and preferred forms of the present invention, the problem of incompatibility of WAPs of different functional capabilities is solved. The present invention also solves the problem of WLAN operations in dynamic topology environments. In yet another aspect, the present invention solves the problem of accommodating dissimilar volumes of processing loads over time.

BRIEF DESCRIPTION OF THE DRAWINGS

[0036]

FIG. 1 is a diagram illustrating an operational representation of a wireless local area network (WLAN) system used to illustrate a first aspect of the disclosed invention dealing with policies for negotiations between WLAN entities, particularly between a controlling node (CN) and wireless access points (WAPs);

FIG. 2 is a diagram depicting the general operational steps involved in a first aspect of the present invention dealing with policies for negotiations between a CN and WAP;

FIG. 3 is a diagram showing an integrated WLAN entity exemplifying one embodiment of a first aspect of the present invention in which the capabilities of a CN and WAP are integrated into one entity;

FIG. 4 is a diagram illustrating a simplified framework for a second aspect of the present invention dealing with policies for negotiations for the purpose of accommodating dynamic differences among WLAN entities, particularly between WAPs;

FIG. 5 is a diagram depicting the general operational steps involved in a second aspect of the present invention dealing with policies for negotiations for accommodating dynamic differences among WLAN entities. Specifically, it deals with processing loads at various entities;

FIG. 6 is a diagram serving to explain the reasoning for one embodiment of a second aspect of the present invention, wherein the definition of processing load is taken to be the size of the protocol data unit

(PDU) that is received by the WAP from associated MTs;

FIG. 7 is a diagram illustrating one embodiment of a second aspect of the present invention in which a central controller performs a supervisory role in the negotiations for accommodating dynamic differences among WLAN entities;

FIG. 8 is a diagram illustrating one embodiment of a first aspect of the present invention in which negotiations strategies are applied to enable CAPWAP split operations in dynamic WLAN topologies;

FIG. 9 is a diagram exemplifying a particular embodiment of a first aspect of the present invention relating to IEEE802.11 WLAN specifications; and

FIG. 10 is a diagram depicting a sequence of steps of a first aspect of the present invention in which dynamic WLAN topologies are enabled.

BEST MODE OF CARRYING OUT THE INVENTION

[0037]

The disclosed invention of policies for negotiations between entities of a wireless local area network (WLAN) is described in two major aspects, the first focusing on negotiations for accommodating static differences among WLAN entities also comprising accommodating changes in WLAN topologies. While the second aspect illustrates means of dealing with dynamic differences, particularly in levels of processing load.

[0038]

In the following description, for purpose of explanation, specific numbers, times, structures, and other parameters are set forth in order to provide a thorough understanding of the present invention. However, it will be apparent to anyone skilled in the art that the present invention may be practiced without these specific details.

[0039]

Negotiations for Accommodating Static Differences:

[0040]

A WLAN system embodying a first aspect of the present invention dealing with accommodating static differences among WLAN entities is exemplified in FIG. 1. The diagram illustrates a WLAN system 100 comprising a controller node (CN) 101, a number of wireless access points (WAPs) 105 and 107, a plurality of mobile terminals (MTs) 113 and a network backbone 117. For the sake of simplicity, the WLAN system 100 is shown with a single CN whereas the system embodying the present invention may comprise any number of CNs. Also, the diagram indicates a direct connection between CN 101 and the WAPs 105 and 107. Alternatively there may be a number of intermediate nodes between them. Similarly, the connection between CN 101 and the network backbone 117 may also include a number of intermediate nodes. In all such cases, the disclosed invention holds scope.

[0041]

The CN 101 provides support and control to the WAPs 105 and 107 that associate with it. A new WAP in the WLAN system must first choose and establish association relationships with one or more CNs before it receives support and control from the one or more CNs. As such, WAPs may simultaneously hold more than one association relationship with one or more CNs. Similarly, the MTs 113 choose and maintain associations with the WAPs, which in turn provide them with services. These services include radio transmission and reception, secure transport and mobility. An MT may maintain a number of associations with one or more WAPs, however FIG. 1 simplifies this with each MT maintaining only one association with one WAP.

[0042]

It can be inferred about the WLAN system 100 that the WAPs connect to the network backbone via the CN. Alternatives to this include the WAPs connecting to the network backbone by other means possibly through other intermediate nodes. In such cases, the CN will only be responsible for the control and management of the WAPs associated with it, while connectivity to an external network may be handled by other entities.

[0043]

FIG. 1 shows the CN 101 capable of performing the complete set of WLAN functional operations, as specified by some established WLAN standard. It is also capable of other control and management functional operations. Each functional operation is logically represented by one of the functional components 115. The operations represented by each of the functional components may include encryption, decryption, medium access control protocol data unit (MAC PDU) processing, authentication, association, quality of service (QoS) processing, Internet Protocol (IP) processing etc.

[0044]

Each functional component is represented by a functional component code. For the purpose of illustration, some of the functional components in FIG. 1 are represented by functional component codes 'a', 'b' and 'c'. For example functional component 'a' may denote the processing required for a certain type of encryption, for example Wi-Fi Protected Access (WPA) or Advanced Encryption Standard (AES), functional component 'b' for QoS processing, for example priority handling, while functional component ‘c’ may be that for power control during radio transmission and reception. The functional components are logical units and may be implemented with a single processor using different sets of instructions and context for different functional components. Alternatively, each functional component may be implemented by individual processing entities possibly in disparate entities. While it is envisaged that the actual implementations of the functional components may vary among manufacturers and their implementations, the interfaces linking different components will be common or compatible so as to allow seamless processing of a control or data unit from one WLAN entity to another.

[0045]

Since the WAPs may be from different manufacturers or of different implementations, they may incorporate among them varying degrees of WLAN functional components. These correspond to the different divisions in functionality between CNs and WAPs. For example, WAP 105 is shown to be capable of processing functional components ‘a’ , ‘b’ and ‘c’ whereas WAP 107 is only capable of processing functional components ‘b’ and ‘c’ . The remaining functional components necessary for their WLAN operations and their control are left to be processed by CN 101. These differences between the WAP and CN entities represent the static differences that are to be accommodated by each other WLAN entity by means of the disclosed method for negotiations.

[0046]

For the proper operation of the present invention, it is necessary for the CNs and WAPs from different manufacturers to follow pre-defined naming conventions for the functional components that they incorporate and recognize. This ensures that negotiating entities can precisely distinguish which functional components a peer entity implements. To this end, the functional component codes need to be consistent in representing various functional components. This convention however need not be followed strictly to the letter. For example, the convention may present standard descriptors for various functional components from which the negotiating entities may discern their properties. As an illustration, "IEEE 802.11i" describes an IEEE WLAN standard pertaining to security functionality. So based on such descriptors, negotiating CNs and WAPs may match parts or all of the names with other descriptors to infer the nature of the functionality components which the descriptors represent.

[0047]

As mentioned earlier, the interfaces between functional components also need to be consistent across WLAN entities. This is to ensure that the processing of a control or data unit may be performed seamlessly from one WLAN entity to another. For example, a WAP may perform decoding with an appropriate functional component and then send the decoded data unit to a CN in a form suitable for further processing, say, a form that may be readily decrypted by a decryption functional component at the CN. So although there are different functional components in different WLAN entities, the interfaces between them are mutually recognizable so as to provide seamless processing.

[0048]

Each WLAN entity is controlled in general by a controller entity. Thus, CN controller 103, WAP controllers 109 and 111 are responsible for the overall operations of CN 101, WAPs 105 and 107, respectively. While the WLAN system 100 shows the controllers to be integral to the WLAN entities, the controllers may also be separate entities. As such, they may remain disparate for each WLAN entity or combined together for a number of WLAN entities. It may be envisaged that specialized controllers exist for each type of entity.

[0049]

The controllers are particularly responsible for establishing processing schedules for each of the entities that associate with the entities managed by the controllers. Consistent with this, the CN controller 103 maintains processing schedules for WAPs 105 and 107 whereas the WAP controllers 109 and 111 in turn maintain processing schedules for their respectively associated MTs 113.

[0050]

A processing schedule refers to a sequence of functional components that are to be processed for control and data units received from associated devices by the entity that the said controller manages. For example, WAP controller 109 for WAP 105 maintains a processing schedule comprising a sequence of its functional components 'a', 'b' and 'c'. When a control or data unit arrives from an associated MT 113, WAP 105 performs the processing of functional components 'a', 'b' and 'c' based on the established processing schedule. The processing schedule at a WAP may be the same for all associated MTs if all the MTs incorporate consistent functionality. However if MTs implement different degrees of functionality, WAPs may also maintain separate processing schedules for processing the control and data units from different MTs.

[0051]

In one embodiment of this first aspect of the present invention, WAP controllers 109 and 111 for WAPs 105 and 107, respectively, first perform a step 201 in the figure of discovering CNs. The CNs to be discovered may be within the same administrative domain as the WAPs or the CNs may belong to different administrative domains. This step of discovery may be accomplished based on any node discovery protocol or by the broadcast/multicast/anycast of a specific, mutually recognizable message invoking responses from available CNs.

[0052]

Next the WAP controllers choose which among the discovered CNs to associate with in a step 203. One possible metric for this choice may be the round-trip latency between the WAPs and CNs. This metric has the advantage of allowing for prompt exchanges of control messages between the WLAN entities. Other metrics that may be used for CN selection include network status, congestion, subset of WLAN functions offered by CN, cost of using the CN, the vendor of the CN, the characteristics of the connection to the CN, link status, random selection, cost of using the link, manufacturer identification and a weighted sum of these metrics.

Having chosen a CN 101 with which to associate, WAP controllers 109 and 111 then enter an association phase with the CN. This phase may include mutual authentication, exchanges of security information and the establishment of communication protocols for further exchanges.

[0053]

Then, in a step 205, WAP controllers 109 and 111 enter a negotiation phase with CN controller 103 for the purpose of establishing means to accommodate the possible differences in their respective functional capabilities. In particular, the negotiations are to establish a division of WLAN functionality that is consistent with the capabilities of the negotiating entities and are optimal for the operation and management of the whole WLAN.

[0054]

The negotiations may be initiated by either a WAP controller or a CN controller as in a step 207. WAP controllers initiate by sending information regarding the functional capabilities of the associated WAPs to the chosen CN. This information includes the appropriate codes corresponding to the functional components that the WAPs are capable of processing and their processing schedules. A CN controller initiates negotiations by requesting for functional capabilities information from the associated WAPs.

[0055]

Upon receiving capabilities information from the associated WAPs and based on established policies, CN controller 103 determines an initial division of WLAN functionality. This division is then enforced between CN 101 and the associated WAPs 105 and 107 as in step 209. The functionality division specifies which of the functional components that can be processed by the WAPs needs to be active and processed by the WAPs themselves and which of them needs to be inactive so that they may be processed by the CN.

[0056]

In one embodiment, the initial division of functionality is based on a policy that allows each associated WAP to process all the functional components that they are capable of. With such a division, only those functional components that an associated WAP cannot inherently process are left to the CN. Such functional components are then included in the processing schedule of the CN controller. Since WAPs may have dissimilar degrees of functional capabilities, the CN controller may be required to establish separate processing schedules for each associated WAP. As such this embodiment presents a policy which allows for the full capabilities of each WAP to be leveraged on. However this is achieved at the expense of running different processing schedules at the CN controller for different WAPs.

[0057]

In another embodiment, the initial division of functionality is based on a policy in which the CN controller first determines a subset of functional components that are common across all associated WAPs. The associated WAPs must then process only the determined subset of functional components even if they are capable of processing other functional components. Therefore, the remaining set of functional components required to be processed for each associated WAP will be common to all of them. This common set can then be processed by the CN. This embodiment presents a policy in which the CN controller may maintain a single processing schedule for all associated WAPs. If a new WAP, incorporating functionality components fewer than or incompatible with those specified in the existing processing schedule, associates with the CN, the CN controller repeats the step of determining the subset of functional components that are common across all currently associated WAPs. It is noted that this step need not be performed if a new WAP involves more functionality components than that specified in the single, previously established processing schedule.

[0058]

Alternatively, the association of a new WAP with a CN may invoke a grace period, in which two processing schedules are maintained simultaneously. The first corresponds to the existing processing schedule which was established before the association of the new WAP, while the second corresponds to the processing schedule which takes into account the functionality of the newly associated WAP. Then data units processed during the grace period are done so based on the processing schedule that is most appropriate. This embodiment provides uninterrupted services to existing MTs in the event of new WAPs associating with the CN.

[0059]

In another embodiment, the initial division of functionality is based on a combination of policies, where a subset of associated WAPs is allowed to process all the functional components that they are capable of. Another subset of associated WAPs process only a common subset of functional components that they are capable of processing even if they have greater capabilities. The CN controller determines the subset of functional components that are common across all of the subset of associated WAPs. The remaining set of functional components required to be processed for each associated WAP will be performed by the CN. Therefore the remaining set of functional components will be distinct for each of the associated WAPs of one subset of associated WAPs and be similar for each of the associated WAPs of the other subset of associated WAPs.

[0060]

Next, having determined an initial division of WLAN functionality, the division is then sent to the associated WAPs for confirmation as in a step 209. The WAP controllers in turn verify that the division is feasible and upon verification return a positive acknowledgement to the CN as in steps 211 and 213.

[0061]

Given that some WAPs may implement functional components in a non-partitioned manner, for example in a hardwire system, such WAPs may not be able to adhere to the specified initial functionality division. In these cases, the WAPs send a negative acknowledgement to the CN with an updated processing schedule that indicates operational dependencies between their functional components as in a step 215. The CN controller then takes this new processing schedule into account and formulates another functionality division that may be compatible with the WAPs. If the new division is feasible, the WAPs return a positive acknowledgement and if not, the negotiations continue in a similar fashion. As a last resort, upon a fixed number of unsuccessful negotiation exchanges, the CN allows the WAPs to process all their functional components.

[0062]

During the initial negotiation phase, either CN or associated WAP may choose to forcibly terminate further negotiations based on pre-defined policies and rules even before the negotiation phase is complete. These policies are enforced by either CN or WAP when it is inferred that further negotiations will be moot as in steps 219 and 221. For example, if the difference at the initial division of WLAN functionality is significantly dissimilar from the capabilities of a WAP, the WAP may choose to terminate negotiations as it may be futile to proceed further. Alternatively, if either entity determines that the other is illegitimate, the negotiations may be terminated. Many other policies may also be used to enforce termination of negotiations.

[0063]

Once a functionality division is acceptable to all participating WLAN entities, CN controller 103 establishes appropriate processing schedules for associated WAPs 105 and 107 as in a step 217. These schedules define the sequence of functional components that are to be processed by CN 101 for control and data units received from associated WAPs 105 and 107. Then, CN controller 103 manages each associated WAP in a manner consistent with the processing schedules.

[0064]

In one embodiment, WLAN functionality may be divided into four functional components that may be denoted by functional component codes 1, 2, 3 and 4. The functional component corresponding to code 1 relates to that parts of WLAN functionality concerning the radio aspects. This may include radio transmission and reception, coding, modulation, power control and beacon signal control. Such a division combining aspects concerning the radio interface will allow for simpler design. The code 2 functional component relates to security aspects, which may include authentication, association, encryption and decryption. The basis for this division is that processing for security involves mathematical computation for which reason they may be consolidated and optimized. Then, the functional component of code 3 deals with the processing required for control and data protocol data units (PDUs). This includes bridging, routing, retransmissions and Internet Protocol (IP) layer processing for which specialized network processors have been developed. Next, the code 4 functional component relates to the general control and management of the WLAN. Quality of Service (QoS) control, configurations and policy management are some of the aspects of this functional component. This embodiment presents simple and practical classification for WLAN functionality. Negotiations between various WLAN entities may then be based on these classifications. The classifications may also be used to describe different entities. For example, a WAP implementing only radio aspects of WLAN may be referred to as a type 1 entity which will then require a CN capable of the remaining functional components 2, 3 and 4.

[0065]

In another embodiment of the first aspect, a WAP controller need not explicitly send its functional capabilities information to a CN controller, however rather the CN controller infers the capabilities of an associated WAP. Such means for automated capabilities discovery allows for easier determination of functional capabilities without requiring the explicit exchange of functional component codes between a CN and associated WAPs. In this embodiment, a CN controller sends a special command to an associated WAP to which the WAP responds by generating a data unit and processing it based on its functional components. The emulated data unit is then sent to the CN after being processed by the WAP. The CN controller then infers the functional capabilities of the associated WAP based on the received emulated data unit. Subsequent operations then follow from a step 209 in FIG. 2. This embodiment requires associated WAPs to be capable of recognizing and responding to the special command issued by the CN controller.

[0066]

An alternate form of the embodiment involves a CN controller simulating a data unit as if it was a mobile terminal and sending the simulated data unit to an associated WAP. The destination address of the simulated data unit is set to be the CN itself. Upon receiving the data unit, the WAP performs its processing based on its capabilities and forwards the processed data unit back to the CN. The CN controller then infers the functional capabilities of the associated WAP from the processed data unit. After this, the CN controller devises an initial division of WLAN functionality and sends this to the associated WAP. Subsequent operations then follow from a step 209 in FIG. 2.

[0067]

In another embodiment of the present invention, a single entity that integrates both WLAN operational functionality and control and management functionality is presented. FIG. 3 exemplifies this embodiment in that it illustrates such an integrated WLAN entity 301. The integrated WLAN entity 301 is capable of both WAP operations and CN control and management operations for which there are a WAP controller 303 and a CN controller 305, respectively. Each of the WAP and CN functional operations is logically represented by one of the functional components 307 each denoted by a functional component code. These functional components encompass WAP operations like radio transmission and reception, in addition to CN operations like WLAN monitoring and configuration management.

[0068]

The set of functional components 307 are common to both WAP and CN controllers so that the processing schedule at each controller may include any of the functional components. Each controller operates in an independent manner with the understanding that the complete set of functional components is available for it to schedule. As such, during the negotiations phase between WAP controller 303 and CN controller 305, the

WAP controller sends its capabilities information so as to include the complete set of codes corresponding to all of functional components 307.

[0069]

Associated with the integrated WLAN entity 301 is a number of MTs 309. WLAN system 300 shows the associated MTs 309 connecting to a network backbone 311 via the integrated WLAN entity 301. It is also possible for this connection to be made through alternate means like that through other intermediate nodes. To the associated MTs however, there is no difference between an ordinary WAP and the integrated WLAN entity.

[0070]

Operationally, in this embodiment, the WAP controller of an integrated WLAN entity first performs a discovery of CNs. In essence, the discovery results in finding itself as a CN. Upon discovery, an association phase follows after which the CN controller and WAP controller enter a negotiations phase. Discovery and association are token operations as both the WAP and CN reside within a single entity.

[0071]

Next, the WAP controller and CN controller begin negotiations in order to determine a suitable division of functionality between them. The WAP controller first sends information regarding its capabilities to the CN controller. This information will include the functional component codes corresponding to all the functional components available within the integrated WLAN entity and a processing schedule that involves all the codes. In response to the capabilities information and based on established policies for functionality divisions, the CN controller devises an initial division of functionality and sends this to the WAP controller. The initial division of functionality will be feasible and acceptable to the WAP controller since its feasibility is based on that of the CN controller which in turn determines the division. As a result, the WAP controller sends a positive acknowledgement to the CN controller. Then both controllers establish processing schedules according to the accepted division in functionality and operate on that basis. This embodiment illustrates how the process of negotiations may take place within an integrated WLAN entity. As such, the disclosed invention will be consistent will various designs for these entities.

[0072]

In another embodiment of the first aspect of the present invention, different CNs may incorporate varying degrees of functionality. As such, a WAP associating with a CN may require the processing of functionality which is unavailable both with itself and with the CN that it associates. This embodiment serves to address such situations by allowing the various CNs in a WLAN to negotiate among them for the purpose of accommodating differences in their functional capabilities. The CNs may follow the steps put forth in FIG. 2 to determine how the static differences in their functionality may be managed. For example, a first CN may only incorporate 2 types of functional components and it may necessitate in a third component that it is not capable of, but yet it is required for providing services to the WAPs associated with it. In such a case, the first CN discovers and associates with a second CN in the WLAN with which it then negotiates. The negotiations are for the purpose of dividing functionality among the CNs. As a result, the first CN may allow processing of the third functional component to be performed by the second CN.

[0073]

In yet another embodiment of a first aspect of the present invention, dynamics changes in WLAN topologies is addressed. Fig. 8 illustrates the general aspects of a CAPWAP based dynamic WLAN system 800. Here, WLAN functions (represented by functional components 1 through 5) are divided between the central controlling node 801 and the set of distributed wireless access points, WAP1 803 and WAP2 805. It is emphasized that the central controlling node 801 is capable of managing WAPs, WAP1 803 and WAP2 805, of dissimilar capabilities.

[0074]

The first instance of the topology 807 represents a static case of operation. Here, WAP1 803 and WAP2 805 have fixed connections in the WLAN system 800. Then a transition 813 occurs in which the WLAN system 800 transforms into the second instance of the topology 809. In this instance, WAP1 803 displaces to an alternate location in which it establishes a new connection 815 to the controlling node 801 via WAP2 805. The transition 813 represents a dynamic change and the second instance 809 represents a new WLAN topology in which WAP1 803 still provides services to its mobile clients 811. At the same time, WAP1 803 behaves as another mobile client to WAP2 805.

[0075]

In the second instance of the topology 809, the communication unit 823 exemplifies the communication traffic from the mobile clients 811. The communication unit 823 is first handled by WAP1 803 (as seen by a step 817) where all three WLAN functional components and the CAPWAP control component are processed. It is noted that this step 817 also adds physical overhead in the form of a CAPWAP protocol header in addition to the header required for transmission to WAP2 805. This is illustrated by the 'C1' sub-field of a step 817. Next, at WAP2 805, a step 819 is performed where again another set of WLAN functional and CAPWAP control components are processed. Next, in a step 821, the central controller 801 performs complementary functions for each of the steps 817 and 819. Based the sub-fields of step 821, it is clear that central controller 801 duplicates some of the complementary functions. It is the aim of the present invention to avoid this processing duplication and transmission overhead.

[0076]

The operations of the present invention are herein described with respect to the steps in Fig. 10. In the steps 1001 and 1003, the topology of the wireless network is monitored so as to determine any changes in the network configuration. Means of realizing these steps is to analyze the header fields of received communication units and compare them to pre-established representations of network topology. For instance, in the case of IEEE802.11 specifications based WLANs, if the controlling node 801 receives an Association Request from WAP2 805 for a mobile client with credentials corresponding to WAP1 803, it is inferred that the topology between the controlling node 801 and WAP1 803 now includes the WAP2 805. Another means of establishing topology change is by periodically exchanging information on neighbouring network entities. A variance in these exchanges implies an alternate topology.

[0077]

Once a network topology change has been determined, the network entity that will accommodate the change, WAP2 805, is triggered with an 'Operational Associations' signal as in a step 1005. This signal comprises preliminary state information regarding the network entity affecting the topology change, WAP1 803, and the mobile clients 811 managed by said WAP1 803. In one embodiment based on the IEEE802.11 specifications, the preliminary state information comprises the number of mobile clients 811 managed by WAP1 803, association identifications for mobile clients 811 and Source MAC addresses of the mobile clients 811. The preliminary state information may also comprise additional state information exemplified by the MAC address of network entity effecting topology change, WAP1 803. Next, in a step 1007, the network entity accommodating the topology change, WAP2 805, is triggered with an 'Operations Update' signal to adapt its functioning so as to handle the topology change. In one embodiment based on the IEEE802.11 specifications, the 'Operations Update' signal comprises a code value corresponding to an action 'Forward Frames to Transmission Block' and a code value corresponding to those 'Data Frame' type for which said action is to be taken for. The 'Operations Update' signal may also comprise additional parameters exemplified by 'Basis Service Set Identification (BSSID)', 'Source MAC address' or 'Destination MAC address'. In another embodiment based on the IEEE802.11 specifications, the 'Operations Update' signal affects the Medium Access Control (MAC) management and control logic of WAP2 805. Specifically, the logic is altered such that communication frames from the mobile clients 811 managed by the network entity effecting the topology change (WAP1 803) may now be managed by WAP2 805 without going through the normal association and authentication phases. In yet another embodiment this logic alteration is realized by modifying the 'Filter_MPDU' process of the 'Reception' block of WAP2 805 so as to direct all communication frames received from the mobile clients 811 to the normal sequence of processing. Alternatively, the associations and authentications may be pre-established by the controlling node 801.

[0078]

After the network entity accommodating the topology change, WAP2 805, is updated, an 'Operational Associations Request' signal is triggered at the network entity effecting the topology change, WAP1 803, as in a step 1009. In one embodiment based on the IEEE802.11 specifications, the 'Operational Associations Request' signal comprises code values corresponding to 'Security Algorithm Type', 'Security Key', 'Session Identification' or 'Association Identification' parameters for which corresponding information values are requested. The request signal is to obtain specific state information regarding WAP1 803 and the mobile clients 811 which it manages. This state information is then made aware to WAP2 805 by an 'Operational Associations Update' signal, as in a step 1011, in preparation for future functioning. In one embodiment based on the IEEE802.11 specifications, the 'Operational Associations Update' signal comprises information values corresponding to 'Security Algorithm Type', 'Security Key', 'Session Identification' or 'Association Identification' parameters.

[0079]

Next, in a step 1013, an 'Operations Update' signal is triggered to the network entity effecting the topology change, WAP1 803, so as to alter its functioning logic. In particular the signal directs WAP1 803 to bypass certain processing that may be duplicated at WAP2 805(so that WAP2 805 neglects the processing at WAP1 803, and performs the processing at only WAP2 805). The intent of the step 1013 is to prevent duplication of WLAN and CAPWAP processing at both WAP1 803 and WAP2 805. Furthermore, bypassing of processing at WAP1 803 reduces the physical overhead for transmissions over the newly established wireless connection 815 and thereby reduces transmission delays. These two aspects combined ensure that the timing constraints between WAP1 803 and controlling node 801 are maintained according to the initial topology instance.

[0080]

In one embodiment based on the IEEE802.11 specifications and CAPWAP framework, Operational Association state information is exchanged between the network entities accommodating topology changes and network entities effecting topology changes via the central controlling node.

[0081]

In an alternative to the above described embodiment for exchanging Operational Association state information, said exchange is accomplished between the network entities accommodating topology changes and network entities effecting topology changes without establishing explicit operational associations between them. The network entity effecting the topology change, WAP1 803, is instructed to use a specific 'Frame Type' code for communication frames containing state information. Next, an 'Operations Update' signal is triggered to the network entity accommodating the topology change, WAP2 805, so as to enable it to handle communication frames with the specific 'Frame Type' code in alternate means. Alternatively, specific 'Subtype' , 'Duration/ID' codes are used. Specifically, the alternate means comprises de-capsulation of payload of said communication frames and using the payload as state information. In one case of the embodiment, the controlling node 801 governs the various trigger signals.

[0082]

In the dynamic CAPWAP framework, the network entity effecting topology change, WAP1 803, communicates with the controlling node 801 via the network entity accommodating topology change, WAP2 805.

[0083]

In steps 1007 and 1013, the local-level of WLAN and CAPWAP functional semantics (wherein functional semantics corresponds to the set and sequence of processing required for WLAN operation) are broken such that selected sub-components of said processing are bypassed at selected network entities, the network entities accommodating topology changes and the network entities effecting topology changes. However, with the combined steps of 1000 the present invention achieves system-wide semantics of WLAN and CAPWAP functional processing by dividing selected processing sub-components among the controlling node 801, WAP1 803 and WAP2 805. So the steps of 1000 selectively activate various processing sub-components and by doing so, achieve system-wide functional semantics. It will be clear to those skilled in the art that the steps put forth in 1000 may be combined, separated or generally altered for the purposes of optimization, implementation or any other aim without deviating from the essence of the present invention. As such the scope of the present invention is not limited to the specific steps of 1000.

[0084]

Fig. 9 illustrates an embodiment of the present invention operating on steps 1000 for the WAP1 901. The logical operations of WAP1 901 are based on the IEEE802.11 WLAN specifications but may readily exemplify other wireless specifications also. WAP1 901 manages mobile clients 903 by processing various data (D), management (M) and control (C) frames in addition to general operations. The processing logically comprises 'Reception' 905, 'WAP Processes' 909 and 'Transmission' 911 blocks. The 'Reception' block 905 further comprises a 'Filter_MPDU' process whose logic is based on a filter 907. The filter 907 is used to compare arriving frames based on various metrics and appropriately handle them.

[0085]

In response to the 'Operations Update' signal of step 1013, the filter logic is updated to include the changes of filter logic update 913. In the embodiment, data frames are directly sent to the 'Transmission' block 911 completely bypassing the 'WAP Processes' 909. As a result, processing time for the majority data frames is drastically reduced at WAP1 901. These data frames are then handled by WAP2 915 whose operations were updated according to a step 1007. Since management and control frames directly relate to the connection between WAP1 901 and the mobile clients 903, they are processed locally at WAP1 901. So the present invention selectively activates processing by affecting the reception logic of WAP1 901.

[0086]

In one embodiment, the network entities accommodating topology changes and the network entities effecting topology changes operate according to dissimilar wireless specifications. With respect to Fig. 8, WAP1 803 operates according to IEEE802.11 specifications and WAP2 805 operates according to IEEE802.16. The principles of adapting local-level functional semantics while maintaining system-wide functional semantics are then applied to the network entities operating according to dissimilar wireless specifications. It is noted that the dissimilarity in operations may comprise Bluetooth connectivity, IEEE802.20, cellular telephony or any other wireless specifications.

[0087]

There are a number of scenarios and applications in which the present invention for dynamic WLAN topologies will be incorporated. For example, future home networks will be capable of extending coverage areas in impromptu manners. Transportation systems will incorporate transmission and reception components so that the network topology changes with each passing stop, station or seaport. Manufacturing facilities will be provisioned with communication networks providing connectivity to diverse locations at various time instances. The present invention described insofar may be embodied in these scenarios to address the problems of latency and overhead in dynamic topology environments.

[0088]

The embodiments of this first aspect of the present invention described insofar illustrate policies with which WLAN entities may negotiate with each other in order to accommodate the varying degrees of static differences that each such entity incorporates. Additionally, the embodiments illustrate the application of the first aspect of the present invention wherein local-level of functional semantics are broken so as to enable dynamic changes in WLAN topologies in which system-wide functional semantics are maintained. They describe how WAPs incorporating varying degrees of WLAN functionality may be integrally managed by a controlling node. The disclosed method for negotiations provides for flexibility in deploying WLANs with entities from different manufacturers or of different implementations. While prior arts focus on mandating proprietary means of dividing functionality among WLAN entities, the present invention serves to accommodate entities of different degrees of functionality. As a result, the division of WLAN functionality between controlling nodes and wireless access points may be achieved in a flexible manner.

[0089]

Negotiations for Accommodating Dynamic Differences:

[0090]

This aspect of the present invention describes policies with which WLAN entities embodying the disclosed invention may negotiate with each other for the purpose of accommodating dynamic differences among them. It is exemplified by using the varying levels of processing load at different WLAN entities particularly WAPs.

[0091]

A simplified representation of a WLAN system 400 embodying this aspect of the present invention is depicted in FIG. 4. It shows WAPs 401 and 403 that are capable of providing services and performing related processing for a number of associated MTs. The WAPs and MTs may maintain a number of associations with each other. However for reasons of simplicity, the WLAN system 400 only shows one association with WAP 401 for the single MT 405. This MT 405 is associated with and receives services from WAP 401 over a wireless connection 427. Also the WAPs 401 and 403 are shown to be connected to a network backbone 407, through which they can communicate with other networks and with each other, either directly or via intermediate switching or routing devices. The WAPs may also connect to the network backbone or with each other through a number of intermediate nodes.

[0092]

During the operation of WLAN system 400, the processing loads at the WAPs may vary due to the dynamic nature of communication. For example, a number of new MTs may choose to associate with a WAP thereby necessitating in additional processing at the WAP. Another example is of a MT choosing to be involved in additional numbers of communication sessions again resulting in extra processing for the WAP with which it is associated. Consequently, the processing load at various WAPs in the WLAN system will vary over time. It is this dynamism that the disclosed invention addresses by requiring WAPs to negotiate with each other for the purpose of distributing processing load from a heavily loaded WAP to a relatively lightly loaded WAP while maintaining existing association relationships with their MTs.

[0093]

From FIG. 4, WAPs 401 and 403 provide services to associated MTs by performing some type of processing on their behalf. The processing may be logically divided by lines 419 and 421 in WAPs 401 and 403, respectively, as being association-specific (ASP) and non-association-specific (nASP) processing. ASP processing 411 and 413 involve those that are directly dependent on the association between MTs and WAPs. Such processing requires interaction with the wireless interface between a WAP and an associated MT. Examples of ASP processing include transmission and reception of data units, power control, coding and modulation.

[0094]

nASP processing 415 and 417 refer to processing that are not directly dependent on the wireless aspects of a connection between WAPs 401 and 403 and associated MT 405. Examples of nASP processing include bridging, filtering, protocol data unit (PDU) processing and PDU delivery.

[0095]

WAP controllers 423 and 425 manage and control the overall processing at WAPs 401 and 403, respectively.

[0096]

The operations involved with this aspect of the present invention are described with reference to FIG. 5. The WAP controller in each of the WAPs in a WLAN system embodying the present invention performs a step 501 of monitoring the nASP processing load at the WAP. This includes monitoring the nASP processing load for each of the communication sessions for all the associated MTs. Examples of how processing load may be monitored include means for monitoring the processor usage or duration of processor activity for a communication session and then aggregating this for all communication sessions. Another example is means for monitoring the amount of memory usage for communication sessions. Similarly, a number of other factors may be monitored, either independently or in any combination, to monitor the overall nASP processing load at a WAP. Furthermore, other means of monitoring may also be used.

[0097]

In one embodiment of the present invention, a WAP controller 423 for a WAP 401 derives a resource characteristic for the WAP based on the various factors of nASP processing load that are monitored for each communication session of the associated MTs. The resource characteristic is a representation of the resources or processing load required for providing services to a communication session.

[0098]

Next, the resource characteristics of all communication sessions for all associated MTs are combined to obtain an aggregate nASP load factor for WAP 401. The aggregate nASP load factor is then compared to a nASP load threshold, in a step 503, to determine impending nASP processing overload conditions that may not be manageable by WAP 401. If the aggregate nASP load factor is determined to be manageable at WAP 401, the monitoring of a step 501 is repeated.

[0099]

If, however, impending nASP processing overload conditions are determined, the WAP controller 423 then determines in a step 505, which parts of the nASP processing load at WAP 401 may be distributed to other WAPs of the WLAN system with the aim of reducing overall processing load at WAP 401 while at the same time maintaining existing association relationships with associated MTs, such as that with MT 405. Such a mechanism is unique from traditional methods of distributing processing load which mandate handovers that may necessitate in a MT physically displacing to a coverage area of another WAP. The step 505 is based on the resource characteristics of the communication sessions of MTs associated with WAP 401. For example, a WAP controller may choose to distribute those parts of processing load with the greatest resource characteristics or those with the least resource characteristics. This choice may also be based on other factors such as the expectation of future changes in resource characteristics.

[0100]

Next, the negotiations phase begins between a first WAP controller and other WAP controllers. This phase involves determining which of the other WAPs are agreeable to accommodate the dynamic differences in processing loads by taking over some parts of the nASP processing load of the overloaded first WAP. In a first stage of negotiations, the WAP controller 423 executes a step 507 of sending solicitation messages to other WAPs of the WLAN system. The solicitation messages include the resource characteristics of those parts of nASP processing load of WAP 401 that have been determined by the WAP controller to be distributed to other WAPs.

[0101]

WAP controllers receiving the solicitation message determine if they are capable of accommodating the additional processing load as specified in the message. These controllers then respond to the WAP controller initiating the solicitation by either accepting to take over the complete specified load or accepting to handle partial amounts of the load. The initiating WAP controller then uses the responses to determine which of the other WAPs are agreeable and to which extent agreeable, to receiving parts of the nASP processing load that it initially specified. The negotiations may also extend beyond the initial solicitation message if such a need is inferred to exist by the initiating WAP controller. As such, a step 507 is used to determine which of the other WAPs in the WLAN system are agreeable to receiving and perform processing of parts of nASP processing load of WAP 401 in order to reduce the processing load at WAP 401.

[0102]

Next, in a step 509, WAP controller 423, of the overloaded or soon to be overloaded WAP, establishes a tunnel connection 409, between WAP 401 and the WAPs determined in a step 507 to be agreeable to receiving and processing the determined parts of nASP processing load of WAP 401. FIG. 4 illustrates one of the agreeable WAPs to be WAP 403. Relevant context information required for processing of the determined parts of nASP processing load is then transmitted over the established tunnel connection to the agreeable WAPs. Then, in a step 511, WAP controller 423 distributes the determined parts of the ASP processing load of WAP 401 to the agreeable WAPs over the tunnel connection. In doing so, WAP controller 423 reduces the overall processing load at WAP 401. All this is achieved while maintaining existing associations with associated MTs and in a fine grained manner so as not to overwhelm the agreeable WAPs.

[0103]

This embodiment illustrates the efficacy of this aspect of the present invention in distributing processing load without the limitations of existing handover-based methods. As such, there are no constraints as to the geographic position or willingness to displace for the associated MTs.

[0104]

In another embodiment of this aspect of the present invention, an overloaded WAP simply relays the processing load required for communication sessions of associated MTs to other agreeable WAPs. This relay may be over wireless, wired or a combination of both types of links. Relevant context information may also be relayed so as to facilitate the processing of the relayed processing load.

[0105]

In one embodiment, the tunnel connection between two WAPs is established over a direct link between WAPs. This direct link may be wireless and similar to the link between WAPs and MTs in which case the WAPs determine a radio channel alternate from the channel used for communication with associated MTs and use this to exchange relevant context information and determined parts of nASP processing load. Alternatively, the link between two WAPs can be wired and directly connected. With this embodiment, the tunnel connection need not traverse the network backbone but rather can be established directly.

[0106]

In another embodiment of the present invention, nASP processing load is defined as the processing required for security algorithms used for the encryption and decryption of MAC PDUs that are transmitted to and received from associated MTs. Processing of security algorithms is a type of non-association-specific processing which is computationally intensive due to the complex characteristic. As such, a significant increase in the number of associated MTs or in the volume of traffic to and from associated MTs will in turn lead to a corresponding increase in the processing of the security algorithms. In this embodiment, WAPs and associated MTs encrypt their respective transmissions over the wireless connection based on an established security algorithm. Upon receipt of transmissions, the WAPs and MTs perform decryption processing based on the same established security algorithm.

[0107]

When the nASP processing load for encryption and decryption becomes significant, as measured by its resource characteristic exceeding a nASP load threshold, a WAP controller 423 of WAP 401 sends a solicitation message to determine which of other WAPs in the WLAN system are agreeable to receiving and processing parts of nASP processing load corresponding to the security algorithms used for transmissions between WAP 401 and MT 405. If WAP 403 is agreeable to processing the nASP processing load, its WAP controller 425 responds to the solicitation message. Upon receipt of the response to the solicitation message, WAP controller 423 establishes a tunnel connection 409 to WAP 403 and then sends relevant security keys and context information to WAP 403 via the established tunnel connection.

[0108]

Next, upon establishment of the tunnel connection 409 and exchange of the security keys and context information, WAP controller 423 sends to WAP 403 encrypted MAC PDUs received from associated MT 405. WAP controller 423 also sends to WAP 403, MAC PDUs that are to be encrypted before transmission to the associated MT 405. WAP 403 then processes the nASP processing load for encryption of MAC PDUs and sends the encrypted MAC PDUs to WAP 401 via the tunnel connection. Having received the encrypted MAC PDUs, WAP 401 then transmits them to the associated MTs. In this embodiment, the computationally intensive processing of security algorithms is distributed across WAPs so as to lower the processing load at a WAP. This is performed without affecting re-associations of MTs and as such this method is not limited by the shortcomings of handover-based methods.

[0109]

In another embodiment, a WAP controller distributes the nASP processing load corresponding to those security algorithms that cannot be processed by the WAP due to reasons of unfamiliarity of the said security algorithms while at the same time maintaining association relationships with associated MTs. Given the growing numbers of MTs and other devices in which WLAN capabilities are incorporated, there may be many security features implemented in such MTs and devices, all of which not being recognizable by all WAPs with which associations are sought. As such this embodiment allows a WAP to maintain associations with MTs and other devices even if some of the required processing are not possible at the said WAP. The embodiment is described using an uncommon security algorithm as example; however it is valid for any other type of processing that is uncommon between WAP and MT.

[0110]

During an association of a MT with a WAP, a security algorithm that is knowledgeable to both entities is negotiated upon for securing transmissions over the wireless connection between the two entities. Traditionally, if the WAP is not knowledgeable of any of the security algorithms used by the MT, the MT cannot be associated with the said WAP. The here forth described embodiment of the present invention transcends this limitation and permits MTs to associate with a WAP even if the WAP is not knowledgeable of any of the security algorithms used by the MTs.

[0111]

In this embodiment, a WAP controller 423 permits a MT 405 to associate with WAP 401 even though there are no common security algorithms that both WAP 401 and MT 405 are knowledgeable of. During the association phase, WAP controller 423 sends a solicitation message to other WAPs in the WLAN system 400 to determine which WAPs are knowledgeable of and agreeable to processing any of the security algorithms familiar to MT 405. If WAP 403 is knowledgeable of and agreeable to processing any of the security algorithms familiar to MT 405, WAP controller 425 responds to the solicitation message from WAP controller 423 with a chosen security algorithm. Upon receipt of the response to solicitation message, WAP controller 423 then establishes a tunnel connection 409 with WAP 403. WAP controller 423 next sends relevant security keys and context information to WAP 403 via the established tunnel connection 409. The chosen security algorithm is then intimated to MT 405 and it is associated with WAP 401.

[0112]

Upon establishment of the tunnel connection 409 and exchange of security keys and context information, WAP controller 423 sends to WAP 403, MAC PDUs received from MT 405 associated with WAP 401, that have been encrypted based on the chosen security algorithm. WAP 403 receives the encrypted MAC PDUs via the tunnel connection and decrypts them based on chosen security algorithm and established security keys and context information. WAP controller 423 also sends to WAP 403, MAC PDUs that are to be encrypted before transmission to the associated MT 405. In this case, WAP 403 receives MAC PDUs via the tunnel connection 409, encrypts them based on chosen security algorithm and sends the encrypted MAC PDUs back to WAP 401. WAP 401 then transmits the encrypted MAC PDUs to the associated MT 405. In this embodiment, the lack of knowledge about a security algorithm does not limit a WAP from allowing a

MT to associate with it. As such it provides greater flexibility in providing services to a great number of MTs with different processing requirements.

[0113]

Another embodiment of the present invention relates to the size of PDUs processed by WAPs. Studies in processor scheduling have shown that processing large PDUs before small PDUs leads to greater average processing time as compared to cases where small PDUs are processed before large PDUs. FIG. 6 illustrates this through example. In a first case, it shows two processing schedules 601 and 603 for processors 613 and 615, respectively. The scheduling order 605 and 607 denote the relative order in which PDUs A, B, C and D are processed. 609 and 611 denote the processing time, in arbitrary time units (tu), required for processing each of the PDUs.

[0114]

In schedule 601, large PDUs A and B are processed before small PDUs C and D. The average processing time for the PDUs is 21.25 tu, while it is only 16.25 tu for the PDUs in schedule 603 where small PDUs C and D are processed before large PDUs A and B. Clearly schedule 603, in which small PDUs are processed before large PDUs, leads to significant reductions in average processing time.

[0115]

In a second case, the aspect of processing overhead for processor scheduling is considered. The processing of each PDU requires some processing overhead which includes memory access time and context transfer time. The overhead is generally independent of the size of the PDU as it is required before the actual processing. FIG. 6 depicts a schedule 617 for small PDUs alone in which processing overhead time and actual processing time is shown by 621 and 625, respectively. Processing overhead time 623 and processing time 627 is for large PDUs in schedule 619. From this, it is seen that the processing overhead takes up 50% of total time in a schedule 617 whereas overhead constitutes only $33^1/_3$% in a schedule 619. This illustrates how processing only small PDUs can lead to a processor handling more overhead than when a processor handles large PDUs.

[0116]

In an embodiment of the present invention related to the size of PDUs, the nASP processing load is defined as the size of PDUs handled by a WAP. A WAP controller 423 of WAP 401 monitors the size of PDUs received over a wireless connection 427 from an associated MT 405. When

WAP controller 423 determines that WAP 401 is processing any of the previous described cases, the controller determines a processing schedule for a subset of the monitored received PDUs. The aim of the processing schedule is to optimize average processing time and processing overhead time at WAP 401.

[0117]

Next, WAP controller 423 derives a resource characteristic for the PDUs that may be distributed to other agreeable WAPs for processing. As such, the resource characteristic represents the processing load required for processing PDUs other than those that are processed by the WAP 401 itself. The resource characteristic is then sent to other WAPs of the WLAN system 400 as part of a solicitation message to determine WAPs agreeable to processing the PDUs described in the message.

[0118]

If WAP 403 is agreeable to the nASP processing of PDUs described in the solicitation message, WAP controller 425 responds accordingly. A WAP in the WLAN system will be agreeable to processing PDUs from another WAP when processing such PDUs would allow it to optimize its own average processing time and processing overhead time. Upon receipt of the response, WAP controller 423 then establishes a tunnel connection 409 with WAP 403 and sends relevant context information to WAP 403 via the established tunnel connection.

[0119]

Having established the tunnel connection and exchanged relevant context information, WAP controller 423 sends to WAP 403, PDUs described by the previously sent resource characteristic with the aim of optimizing average processing time and processing overhead time at WAP 401. So with this embodiment, the nASP processing of PDUs of different sizes may be distributed in a manner so as to optimize processing while at the same time maintaining association relationships between WAPs and MTs.

[0120]

In another embodiment, a WAP controller distributes the nASP processing load based on information comprising the size of the data unit to be processed, the expected average time for processing a data unit, the overhead time for processing a data unit and a weighted sum of said information.

[0121]

Another embodiment of the disclosed method concerns the distribution of processing of ISO-OSI layer 3 and layers above layer 3 from a first WAP to other

WAPs while maintaining association relations between the first WAP and MTs associated with it. Many WAPs are currently capable of processing up to ISO-OSI layer 2, however there are vendors manufacturing WAPs capable of ISO-OSI layer 3 processing. This embodiment refers to such devices and other similar WAPs. Processing for ISO-OSI layer 3 and layers above layer 3 includes quality of service (QoS) provisioning, routing and scheduling. In this embodiment, nASP processing load is defined as the processing concerning ISO-OSI layer 3 and layers above layer 3.

[0122]

In this embodiment, a WAP controller 423 for WAP 401 derives a resource characteristic for the processing of ISO-OSI layer 3 and layers above 3 based on the factors of nASP processing load monitored for each of the communication sessions between WAP 401 and associated MT 405. The resource characteristics of all communication sessions are then combined to derive an aggregate nASP load factor for WAP 401 which is then compared to a nASP load threshold to determine impending nASP processing overload conditions.

[0123]

If impending nASP processing overload conditions are determined, WAP controller 423 then determines parts of nASP processing load of ISO-OSI layer 3 and layers above 3 that may be distributed to other WAPs in the WLAN system with the aim of reducing overall processing load at WAP 401. Next, WAP controller 423 sends a solicitation message, comprising resource characteristics of the determined parts of nASP processing load of ISO-OSI layer 3 and layers above 3, to determine which other WAPs are agreeable to receiving and performing processing of the parts of nASP processing load on behalf of WAP 401.

[0124]

If WAP 403 is agreeable to processing the parts of nASP processing load based on the solicitation message, WAP controller 423 sends a positive response to WAP 401. Upon receiving the response, WAP controller 423 establishes a tunnel connection 409 between WAP 401 and WAP 403 after which relevant context information required for processing of parts of nASP processing load of ISO-OSI layer 3 and layers above 3 is transmitted over tunnel connection to WAP 403. Then WAP controller 423 sends the determined parts of nASP processing load to WAP 403 with the aim of reducing nASP processing load at WAP 401 by distributing parts of processing load to other WAPs while maintaining existing association relations between WAPs and MTs.

[0125]

In yet another embodiment of the aspect of the present invention dealing with negotiations for accommodating dynamic differences among WLAN entities, a central controller entity takes part in the negotiations. Broadly, the central controller entity coordinates how the dynamic differences are to be managed among participating WLAN entities. One particular embodiment involves the central controller coordinating the distribution of nASP processing load across the WAPs under its purview.

[0126]

This is described with reference to FIG. 7 which illustrates a central controller 729 that is capable of monitoring the nASP processing loads at WAPs 701 and 703. When the nASP processing load at WAP 701 exceeds a nASP processing load threshold, the central controller sends a solicitation message to other WAPs in the WLAN system requesting assistance for the processing of parts of processing load of WAP 701. This begins the negotiations phase between the central controller 729 and other WAPs in the WLAN system 700. The solicitation message includes descriptors of the parts of processing load at WAP 701 to be distributed to other WAPs with the aim of reducing overall processing load at WAP 701.

[0127]

If WAP 703 is agreeable to assist with the processing for WAP 701, a WAP controller 725 responds to the solicitation message. The central controller 729 then intimates WAP 701 about the acceptance, after which WAP 701 establishes a tunnel connection 709 with WAP 703. It then sends WAP 703 relevant context information followed by the parts of processing load as specified in the solicitation message. Alternatively, WAP 701 may send the context information and parts of processing load to the central controller 729 which then forwards this to the agreeable WAPs like WAP 703. So with this embodiment, processing load is distributed across WAPs of a WLAN with a central controller coordinating the distribution.

[0128]

In another embodiment, the central controller receives regular information from WAP controllers of the WAPs under its purview regarding their nASP processing loads. As such, the WAP controllers themselves determine overload conditions and the necessity to distribute parts or all of nASP processing load to other WAPs or other WLAN entities. The negotiations phase in this embodiment is thus initiated by the WAP controllers and then further pursued between the central controller and other WAPs.

[0129]

The embodiments presented so far exhibit how negotiations between various WLAN entities based on the disclosed policies which may be used to accommodate the dynamic differences among them. In particular, they describe how processing load may be classified as being association-specific and non-association-specific. They also illustrate how parts of nASP processing load may be distributed to other WAPs of the WLAN system for the purpose of reducing overall processing load at a first WAP. The disclosed invention is unique in that it permits the distribution of processing load while maintaining existing association relationships between WAPs and MTs. As such, the disclosed method for accommodating dynamic differences does not necessitate in the physical displacement of any WLAN entity which is unlike existing methods. This innovation is therefore more flexible than handover-based methods for distributing processing load. It also transcends the limitations of such schemes.

[0130]

The various aspects of the disclosure presented insofar illustrate the novelty of the method for negotiations in accommodating static and dynamic differences among WLAN entities. Whereas, extant methods focus on hard divisions in functionality among WLAN entities, the present invention presents alternate means where functionality divisions may be made in flexible manners. Also, while existing methods require re-associations and the consequent geographical and physical limitations of handovers, this innovation puts forth ways of dealing with imbalances in processing load without the constraints of handover-based methods.

[0131]

It will be clear to anyone skilled in the related art that the disclosed invention may take the form of numerous other embodiments with numerous other policies for the negotiations and handling of differences among WLAN entities without deviating from the essence and scope of this disclosure. As such the present invention will be applicable in all such embodiments and practices.

INDUSTRIAL APPLICABILITY

[0132]

The present invention has the advantage of accommodating differences among WLAN entities. The present invention, thus, can be applied to the technical field of wireless local area networks and in particular to the technical field of a wireless local area network in heterogeneous environments.

CLAIMS

1. A system for providing service in a wireless local area network comprising

i. a single or plurality of wireless access points (WAP) capable of processing a subset of complete functionality defined for the wireless local area network;

ii. a single or plurality of control nodes (CN) capable of providing a subset or complete functionalities defined for the wireless local area network; and

iii. negotiation means for the wireless access points to dynamically negotiate with the control node for a secure connections and function split arrangement;

whereby, in use, the control node would negotiate with the WAPs using the negotiation means and provide same or different complementary functionality for each of the WAPs to form a complete functionality defined for the wireless local area network according to decision of the negotiation means.

2. The system according to claim 1 wherein said wireless access point and control nodes further comprise logically independent functional components of the

functionalities defined for the wireless local area network with predefined interface used between each functional components.

3. The system according to claim 2 wherein interfaces between said functional components could be used over remote connections between said wireless access point and control node.

4. The system according to claim 1 wherein each said control node further comprises a control node controller module and each said wireless access point further comprises a wireless access point controller module.

5. The system according to claim 4 wherein the controller module of control node further comprises a single or plurality of processing schedules composed of sequential lists of descriptors for subsets of functional components used for each wireless access point.

6. The system according to claim 4 wherein the controller module of wireless access point further comprises a single or plurality of processing schedules composed of sequential lists of descriptors for subsets

of functional components used for each associated mobile terminal.

7. The system according to claim 1, wherein the wireless access point further comprises:

i. means for discovering the available control node within a specified domain; and

ii. means for negotiating secure connection with control node that could offer the desired functions;

whereby, in use, the wireless access point is able to locate the control node that provides necessary complementary functionalities with regard to a set of defined complete wireless local area network functions with the means for discovering and establishing secure connection with the control node with the means for negotiating.

8. The system according to claim 1, wherein the controller module of said control node is capable of generating data unit to resemble that from a mobile terminal.

9. A system for load balancing in a wireless local area network (WLAN) without requiring association handover at a mobile terminal comprising:

i. a single or plurality of mobile terminals, each said mobile terminal associated with and receiving services from a single or plurality of wireless access point (WAP);

ii. a single or plurality of wireless access point that are capable of processing data units received from the mobile terminal or other wireless access point using a subset of defined WLAN functions; and

iii. means for the wireless access points to exchange data units processed with a subset or complete defined WLAN functions;

whereby a data unit for a mobile terminal is processed with complete WLAN functions by a single or plurality of WAPs where each WAP processes the data unit with only a subset of complete WLAN functions.

10. The system according to claim 9 wherein the wireless access point further comprises a control module that is capable of negotiating with other wireless access points for a subset of the complete WLAN functions to be carried out at each wireless access point.

11. The system according to claim 9 wherein the wireless access point further comprising a local

database that stores all the associations of the mobile terminals attached to said wireless access point and corresponding subset of the complete WLAN functions to be provided to the mobile terminal.

12. The system according to claim 1, wherein the functionalities of said WAP and CN collocate in a single network element.

13. A method for providing service in a wireless local area network (WLAN) that allows defined WLAN function split between wireless access point (WAP) and a single or plurality of Control Node (CN) comprising the steps in which:

i. a WAP discovers the CN that may provide complementary WLAN functions by sending a single or plurality of messages containing information about its own subset of WLAN functions to all the CN;

ii. a CN after receiving said discover message replies with a single or plurality of messages containing information about a subset of WLAN functions said CN could offer to the WAP; and

iii. said WAP chooses from all the replied CNs a proper CN based on local policy and establishes association with said chosen CN.

14. The method for the WAP to decide which CN to use according to claim 13 using information, the information comprising:

i. the subset of the WLAN functions offered by the CN;

ii. a cost of using the CN;

iii. a vendor of the CN;

iv. a characteristics of the connection to the CN; and

v. a weighted sum of the above factors.

15. A method for providing service in a wireless local area network (WLAN) that allows defined WLAN function split between wireless access point (WAP) and a single or plurality of Control Node (CN) comprising the steps in which:

i. a CN dynamically discovers the capability of a WAP by sending a single or plurality of messages to a WAP containing a section that emulates a data unit sent by a mobile terminal;

ii. a WAP receives said message, processes said section using the same procedure for processing data units received from a mobile terminal and sends data unit back to said CN in a reply message; and

iii. said CN obtains the capability information of said WAP by examining the processed data units in said reply message.

16. A method for providing service in a wireless local area network (WLAN) that allows defined WLAN function split between a wireless access point (WAP) and a single or plurality of Control Node (CN) comprising the steps in which:

i. a CN obtaining capability of the WAP; and

ii. said CN negotiating with another one or a plurality of CNs for the supplementary WLAN functions to be provided to the WAP.

17. A method for carrying out load balancing in a wireless local area network (WLAN) without requiring a mobile terminal to change association relationship with a wireless access point (WAP) comprising the steps in which:

i. the WAP separates the processing function provided to the mobile terminal into an association specific part and a non-association specific part;

ii. said WAP negotiates with another WAP of the non-association specific part and establishes a secure tunnel with said another WAP;

iii. said WAP tunnels the data unit from a mobile terminal to the said another WAP through the tunnel after processing data unit with the association specific part of functions; and

iv. said another WAP receiving the processed data unit through said tunnel and processing it with non-association specific part of functions.

18. The method according to claim 17 further comprising the step in which said WAP uses a wireless channel to establish direct connection with another WAP and sets up secure tunnel over the direct connection.

19. The method according claim 17 further comprising the step in which the WAP decides on whether to tunnel data unit from the mobile terminal to another WAP for non association specific processing by monitoring the load at WAP and comparing it with a preset threshold value.

20. The method according to claim 17 further comprising the step in which said WAP decides on which other WAPs should be used for non association specific processing by monitoring the loads at different WAPs it has connections with and compares them with a preset

threshold value.

21. The method according to claim 17 further comprising the step in which a central control entity monitors the load status on all WAPs within a certain domain and mandates distribution of non-association processing function between different WAPs.

22. The method according to claim 17 for the WAP to determine the distribution of non-association specific function based on information, the information comprising:

i. a size of the data unit to be processed;

ii. an expected average time for the processing of the data unit;

iii. an overhead time for processing the data unit; and

iv. a weighted sum of above factors.

23. A method for providing service in a wireless local area network (WLAN) that allows defined WLAN function split between wireless access point (WAP) and a single or plurality of Control Node (CN) comprising the steps in which:

i. a subset of WAPs processes the total of its subset of functionality defined for the WLAN; and

ii. a CN provides distinct subsets of complementary functionality defined for the WLAN to each of the subset of WAPs.

24. A method for providing service in a wireless local area network (WLAN) that allows defined WLAN function split between wireless access point (WAP) and a single or plurality of Control Node (CN) comprising the steps in which:

i. a CN determines a common subset of functionality required for the WLAN available at a subset of the WAPs;

ii. each WAP of the subset processes the said determined common subset of functionality; and

iii. a CN provides similar subsets of complementary functionality to each of the subset of WAPs.

25. A method for accommodating variances in a wireless network topology comprising the step of dynamically adapting the operations logic of at least one network entity of said wireless network topology to alter processing of one or more functional sub-components.

26. The method according to claim 25 further comprising the step of altering the processing of selected functional sub-components at the at least one network entity by means of bypassing processing of said selected functional sub-components.

27. The method according to claim 25 further comprising the step of altering the processing of a selected functional sub-components at the at one or more network entity by means of selectively processing said selected functional sub-components.

28. A method for compensating variances in latency in a wireless network comprising the steps of;

bypassing processing of selected functional sub-components at a first network entity and;

performing processing of said bypassed functional sub-components at a second network entity.

29. A method for altering local-level functional semantics while maintaining system-wide functional semantics of a wireless network comprising the step of selectively activating functional sub-components of selected network entities such that the sum of activated functional sub-components across said wireless network

corresponds to complete functional sub-components of said wireless network.

30. The method according to claim 29 further comprising the step of shifting the processing of said activated functional sub-components from a first network entity to a second network entity.

31. A method for determining topology of a wireless network, wherein a first network entity alters connectivity association with a second network entity by including one or more third network entities in the communication path of the alternate connectivity association, comprising the steps of;

exchanging information on neighbouring network entities among said network entities of said wireless network;

analyzing communication frames received by said network entities based on pre-established representations of topology of said wireless network;

analyzing association request frames received by said network entities based on pre-established representations of topology of said network.

ABSTRACT

A method for negotiations between various entities of a wireless local area network (WLAN) including negotiations between controlling nodes (CNs) and wireless access points (WAPs) and negotiations between WAPs is disclosed. These negotiations are used for the purpose of establishing the capabilities of the various entities, determining how such capabilities may be optimally divided among the negotiating entities and then dividing the capabilities among the entities based on this determination. The capabilities include those required for the operation, control and management of the WLAN entities and the encompassing WLAN. The disclosed method introduces means for flexibly accommodating the varying degrees of differences in capabilities among the WLAN entities between the WLAN entities including dynamic changes in WLAN topologies.

FIG. 1

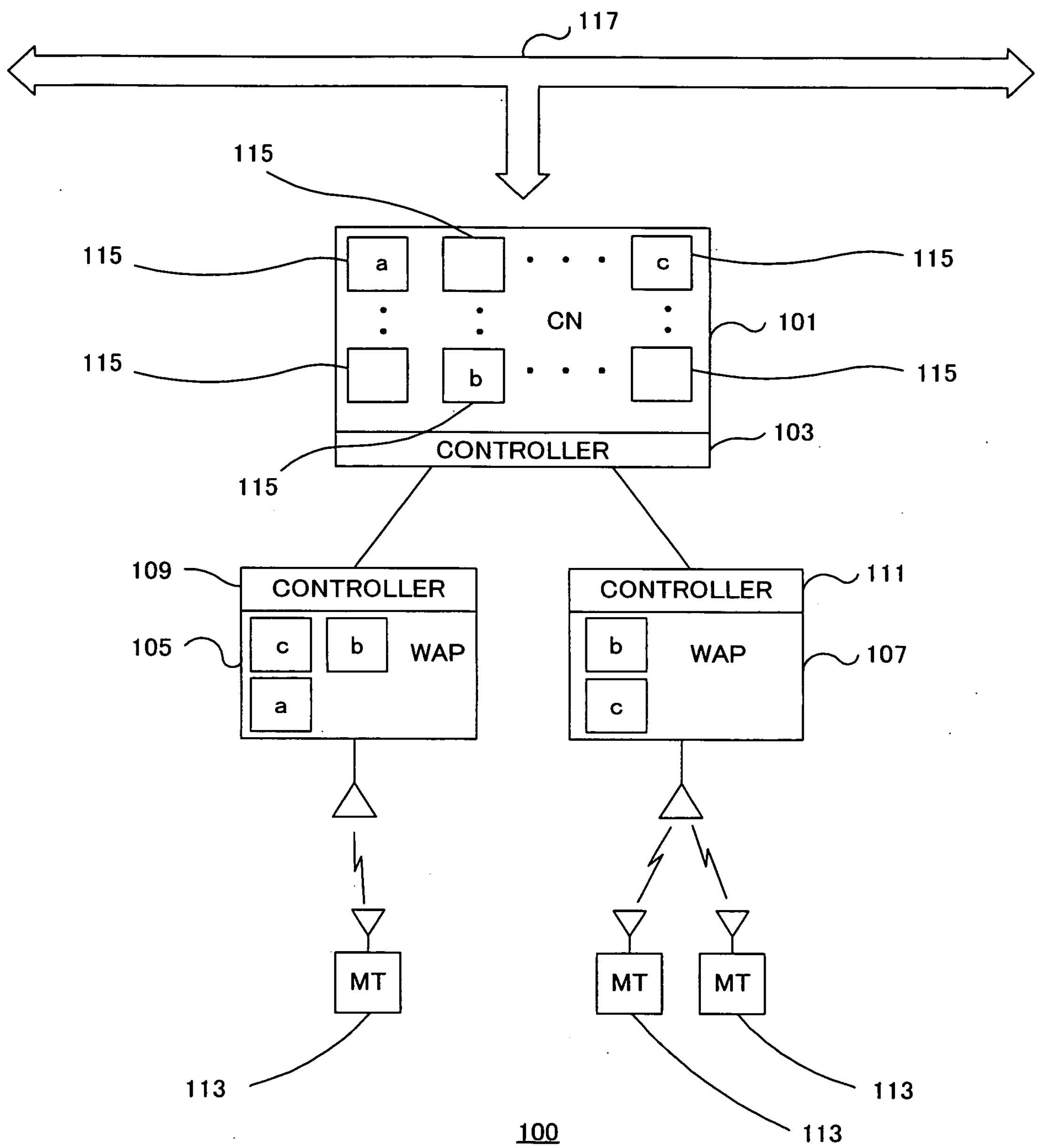

117
115
115
a
c
115
CN
101
115
b
115
CONTROLLER
103
115
109
CONTROLLER
105
c
b
WAP
a
CONTROLLER
111
b
WAP
107
c
MT
MT
MT
113
100
113
113

FIG. 2

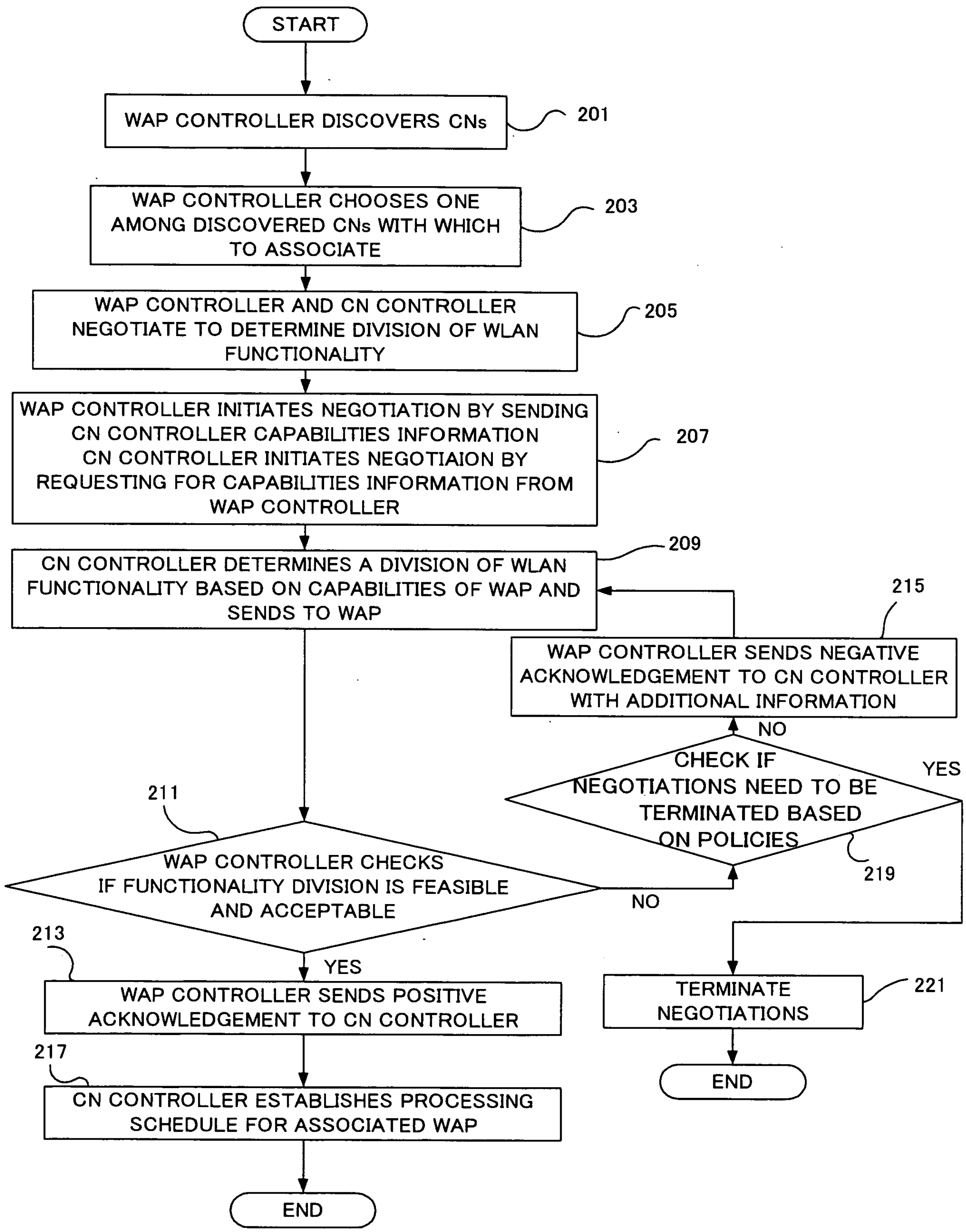

START
WAP CONTROLLER DISCOVERS CNs
201
WAP CONTROLLER CHOOSES ONE AMONG DISCOVERED CNs WITH WHICH TO ASSOCIATE
203
WAP CONTROLLER AND CN CONTROLLER NEGOTIATE TO DETERMINE DIVISION OF WLAN FUNCTIONALITY
205
WAP CONTROLLER INITIATES NEGOTIATION BY SENDING CN CONTROLLER CAPABILITIES INFORMATION CN CONTROLLER INITIATES NEGOTIAION BY REQUESTING FOR CAPABILITIES INFORMATION FROM WAP CONTROLLER
207
CN CONTROLLER DETERMINES A DIVISION OF WLAN FUNCTIONALITY BASED ON CAPABILITIES OF WAP AND SENDS TO WAP
209
215
WAP CONTROLLER SENDS NEGATIVE ACKNOWLEDGEMENT TO CN CONTROLLER WITH ADDITIONAL INFORMATION
NO
CHECK IF NEGOTIATIONS NEED TO BE TERMINATED BASED ON POLICIES
YES
219
211
WAP CONTROLLER CHECKS IF FUNCTIONALITY DIVISION IS FEASIBLE AND ACCEPTABLE
NO
213
YES
WAP CONTROLLER SENDS POSITIVE ACKNOWLEDGEMENT TO CN CONTROLLER
217
CN CONTROLLER ESTABLISHES PROCESSING SCHEDULE FOR ASSOCIATED WAP
END
TERMINATE NEGOTIATIONS
221
END

FIG. 3

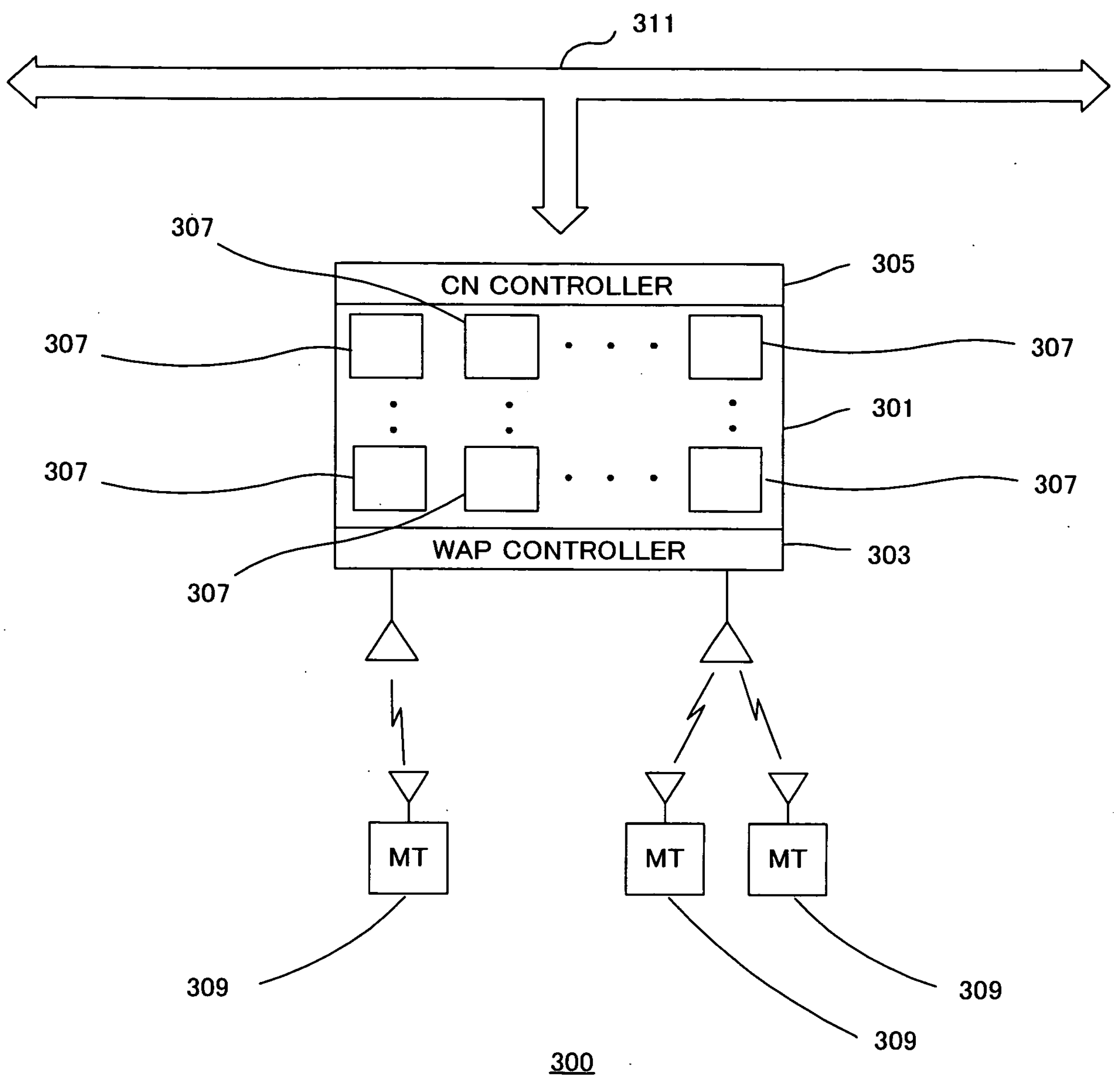

311
307
CN CONTROLLER
305
307
307
301
307
307
WAP CONTROLLER
303
307
MT
MT
MT
309
309
309
300

FIG. 4

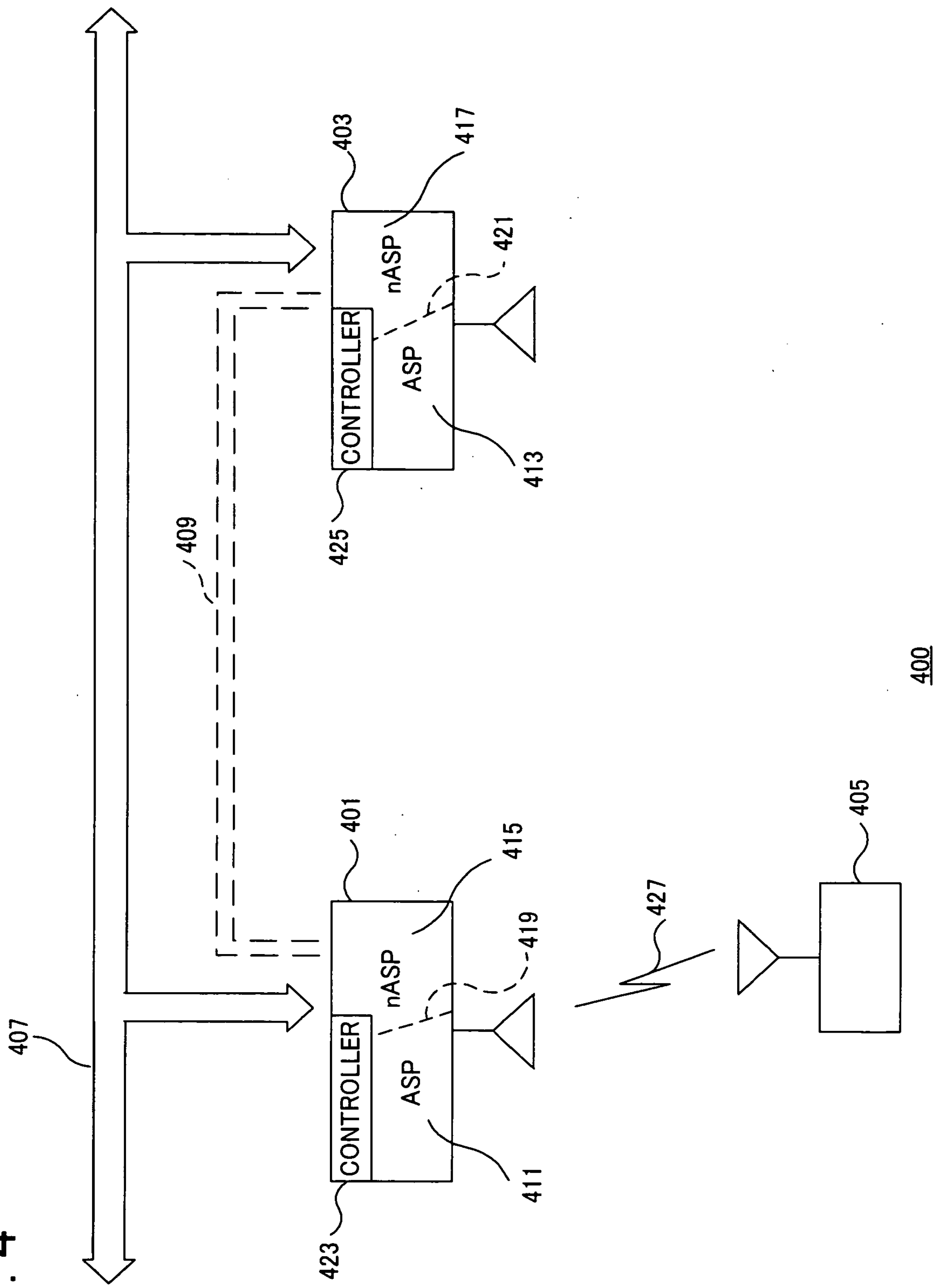

400
401
403
405
407
409
411
413
415
417
419
421
423
425
427
CONTROLLER
ASP
nASP
CONTROLLER
ASP
nASP

FIG. 5

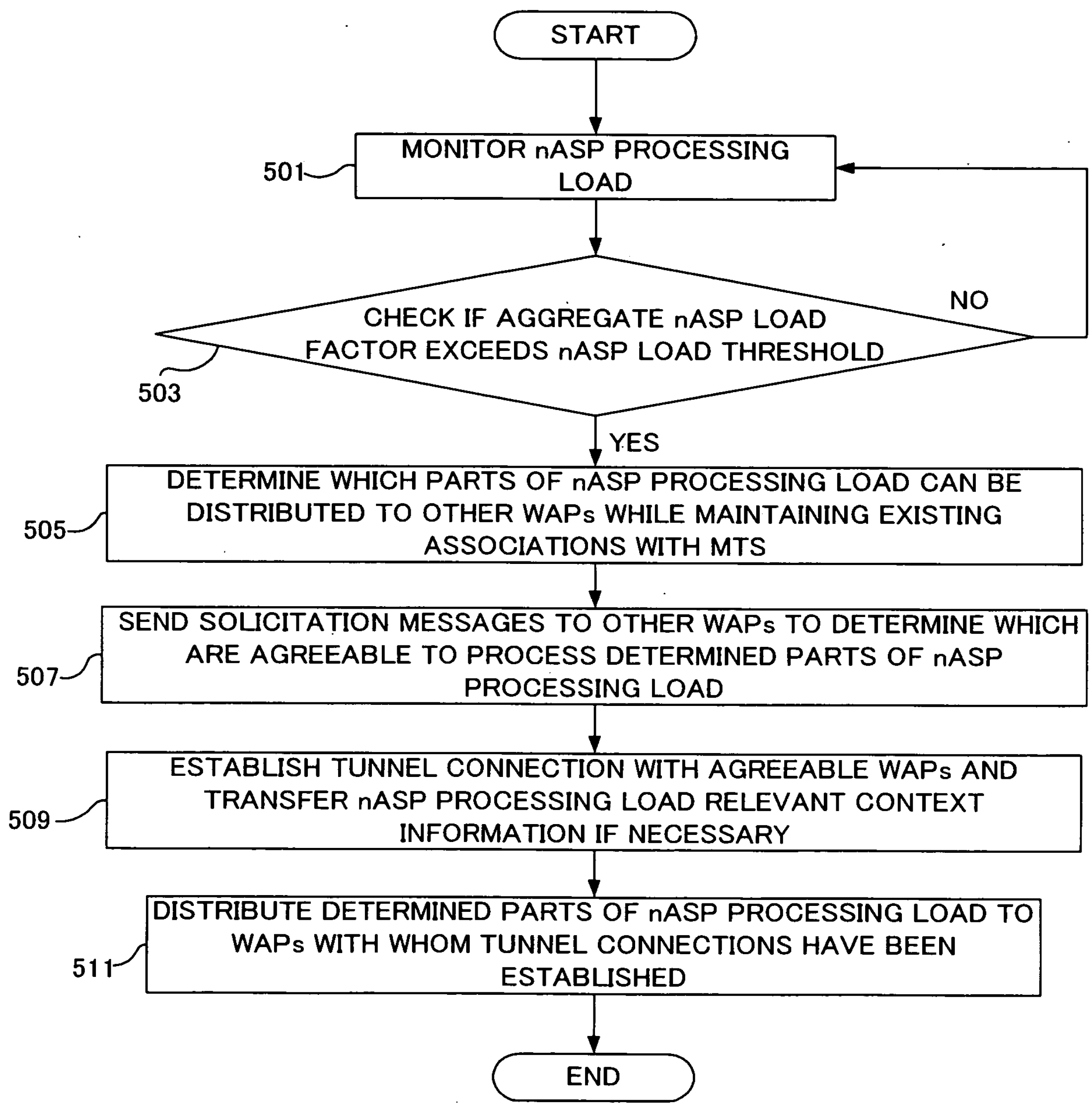
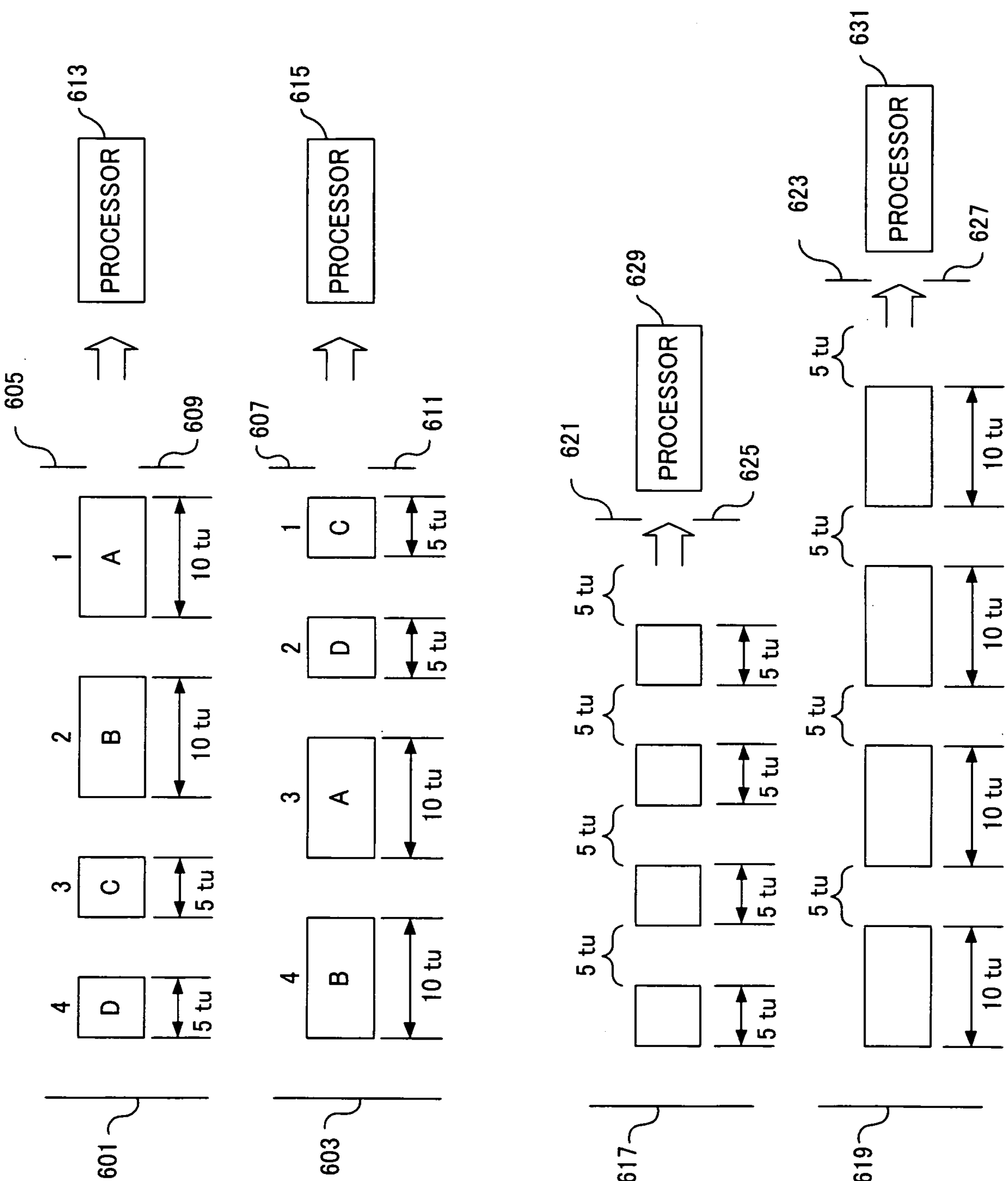
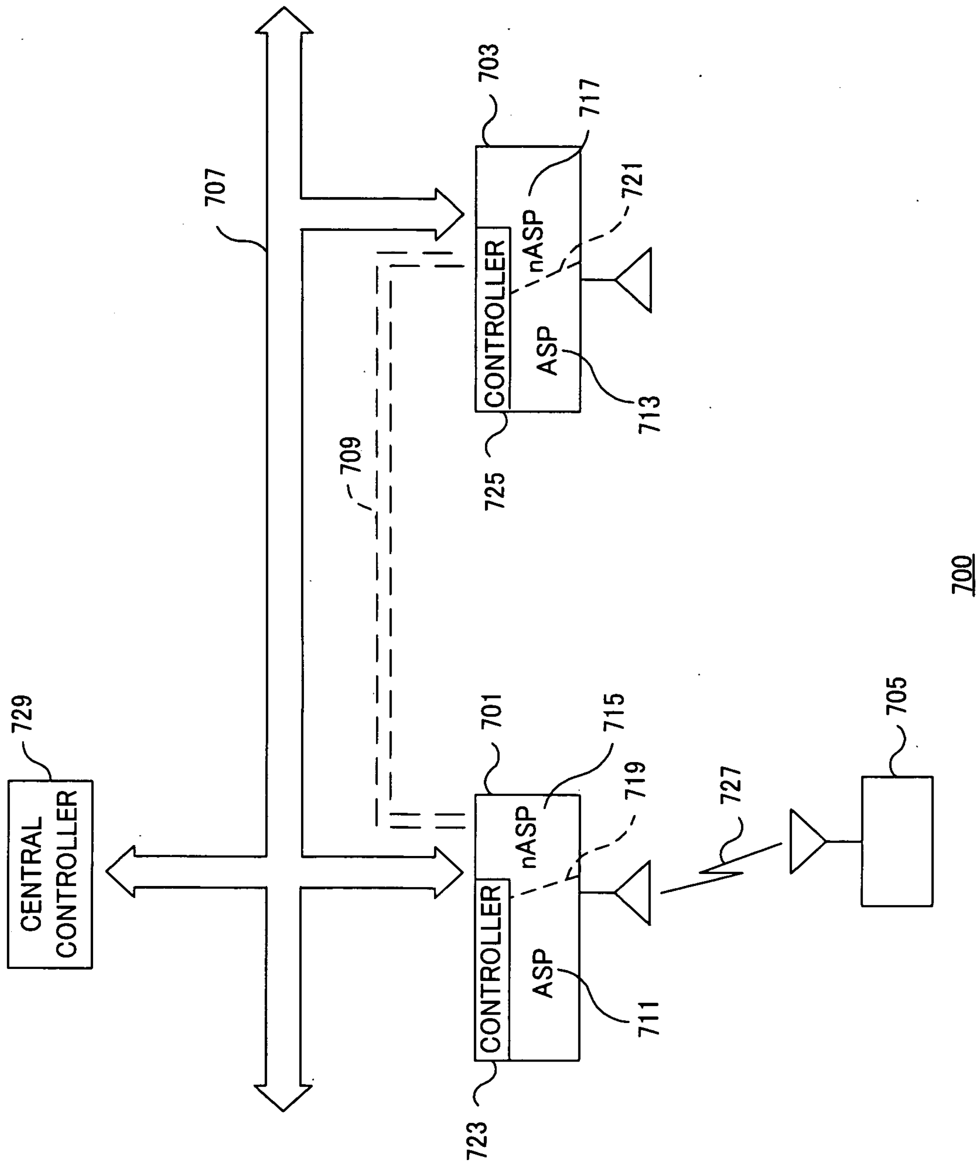

START
MONITOR nASP PROCESSING LOAD
501
CHECK IF AGGREGATE nASP LOAD FACTOR EXCEEDS nASP LOAD THRESHOLD
503
NO
YES
DETERMINE WHICH PARTS OF nASP PROCESSING LOAD CAN BE DISTRIBUTED TO OTHER WAPs WHILE MAINTAINING EXISTING ASSOCIATIONS WITH MTS
505
SEND SOLICITATION MESSAGES TO OTHER WAPs TO DETERMINE WHICH ARE AGREEABLE TO PROCESS DETERMINED PARTS OF nASP PROCESSING LOAD
507
ESTABLISH TUNNEL CONNECTION WITH AGREEABLE WAPs AND TRANSFER nASP PROCESSING LOAD RELEVANT CONTEXT INFORMATION IF NECESSARY
509
DISTRIBUTE DETERMINED PARTS OF nASP PROCESSING LOAD TO WAPs WITH WHOM TUNNEL CONNECTIONS HAVE BEEN ESTABLISHED
511
END

FIG. 6



601
603
605
607
609
611
613
615
617
619
621
623
625
627
629
631
PROCESSOR
PROCESSOR
PROCESSOR
PROCESSOR
1
2
3
4
1
2
3
4
A
B
C
D
C
D
A
B
10 tu
10 tu
5 tu
5 tu
5 tu
5 tu
10 tu
10 tu
5 tu
5 tu
5 tu
5 tu
5 tu
5 tu
5 tu
5 tu
5 tu
5 tu
10 tu
10 tu
10 tu
10 tu



CENTRAL CONTROLLER
729
707
703
717
721
CONTROLLER
nASP
ASP
713
725
709
701
715
719
727
705
CONTROLLER
nASP
ASP
711
723
700

FIG. 7

FIG. 8

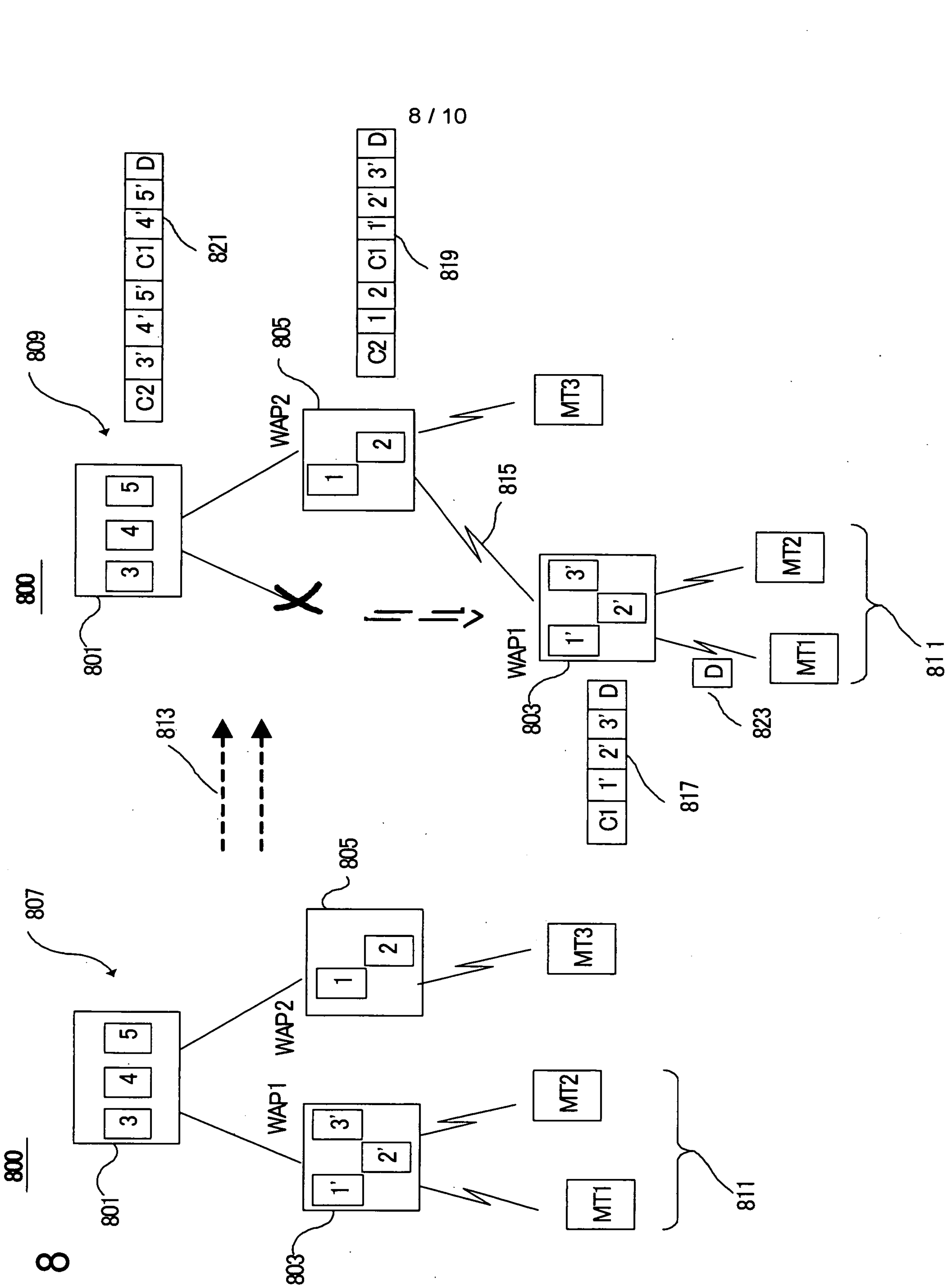
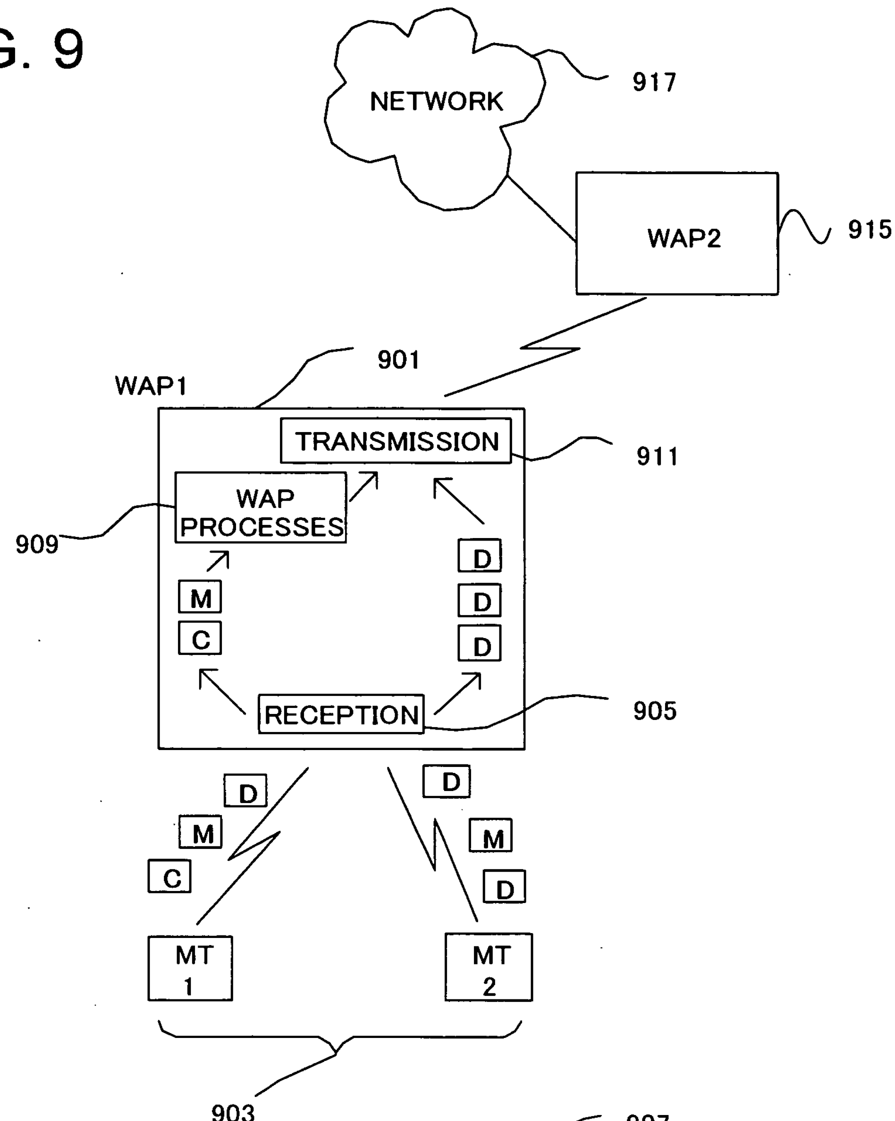

800
801
803
805
807
809
811
813
815
817
819
821
823
WAP1
WAP2
MT1
MT2
MT3
C2 3' 4' 5' C1 4' 5' D
C2 1 2 C1 1' 2' 3' D
C1 1' 2' 3' D
D

FIG. 9



907

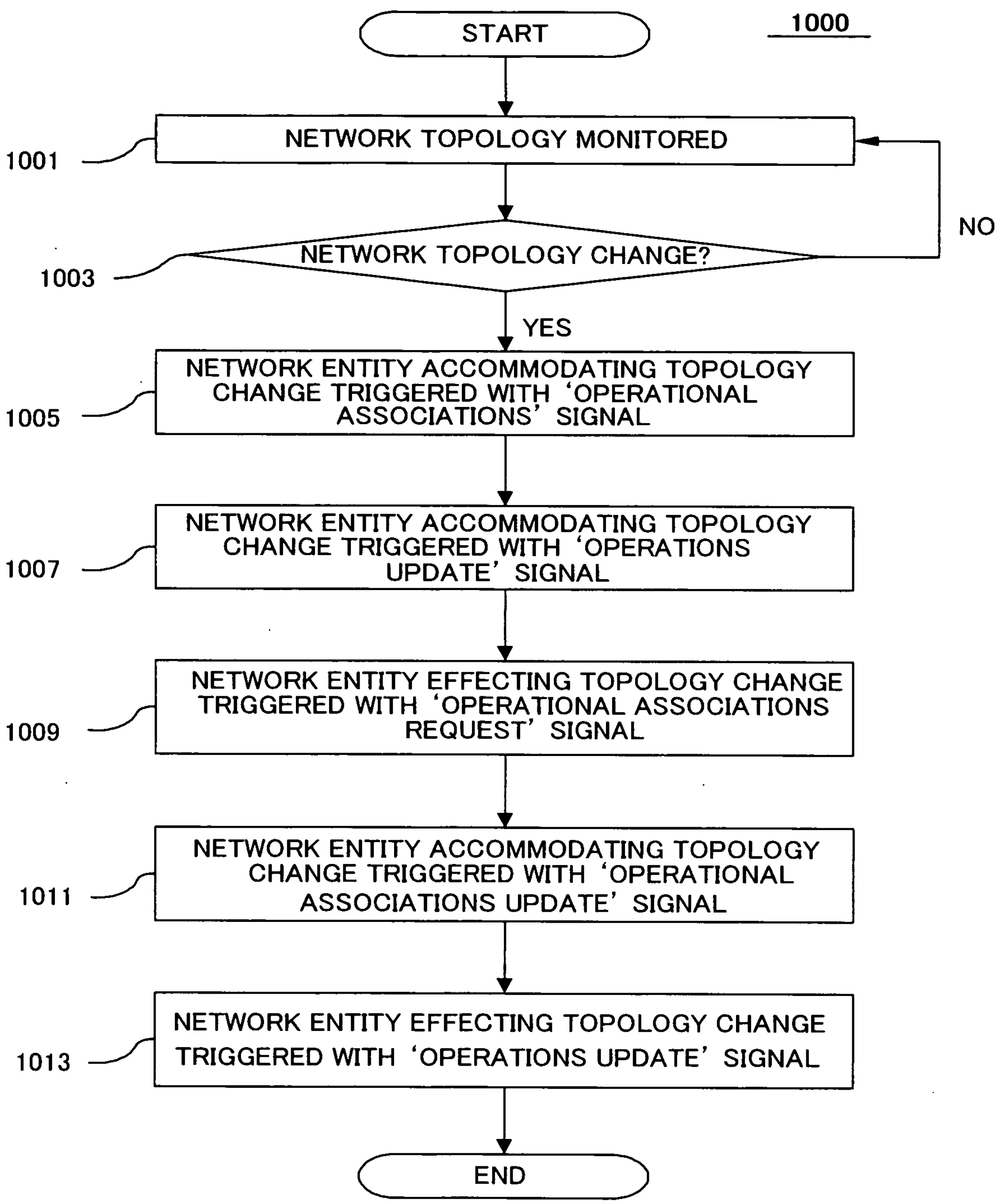
DESTINATION ADDRESS	ACTION
...	...

BSSID	ACTION
...	...

FRAME TYPE	ACTION
FRAME FOR ACK	SIGNAL PROTOCOL_CNTRL
DATA FRAMES	SEND TO TRANSMISSION BLOCK
MANAGEMENT FRAMES	PROCESS LOCALLY
CONTROL FRAMES	PROCESS LOCALLY

913

FIG. 10


START
1000
1001
NETWORK TOPOLOGY MONITORED
1003
NETWORK TOPOLOGY CHANGE?
NO
YES
1005
NETWORK ENTITY ACCOMMODATING TOPOLOGY CHANGE TRIGGERED WITH 'OPERATIONAL ASSOCIATIONS' SIGNAL
1007
NETWORK ENTITY ACCOMMODATING TOPOLOGY CHANGE TRIGGERED WITH 'OPERATIONS UPDATE' SIGNAL
1009
NETWORK ENTITY EFFECTING TOPOLOGY CHANGE TRIGGERED WITH 'OPERATIONAL ASSOCIATIONS REQUEST' SIGNAL
1011
NETWORK ENTITY ACCOMMODATING TOPOLOGY CHANGE TRIGGERED WITH 'OPERATIONAL ASSOCIATIONS UPDATE' SIGNAL
1013
NETWORK ENTITY EFFECTING TOPOLOGY CHANGE TRIGGERED WITH 'OPERATIONS UPDATE' SIGNAL
END

PATENT APPLICATION SERIAL NO. ________________

U.S. DEPARTMENT OF COMMERCE
PATENT AND TRADEMARK OFFICE
FEE RECORD SHEET

09/06/2006 ATRAN1 00000093 10591184

01	FC:1631	300.00 OP
02	FC:1633	200.00 OP
03	FC:1642	400.00 OP
04	FC:1615	550.00 OP
05	FC:1614	2000.00 OP

PTO-1556
(5/87)

*U.S. Government Printing Office: 2002 — 489-267/69033

BEST AVAILABLE COPY

10/591184

IAP5 Rec'd PCT/PTO 30 AUG 2006

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of

Inventors: Hong CHEN, et al.

Application No.: New PCT National Stage Application

Filed: August 30, 2006

For: SYSTEM AND METHOD FOR NEGOTIATION OF WLAN ENTITY

INFORMATION DISCLOSURE STATEMENT

Assistant Commissioner of Patents
Washington, DC 20231

Dear Sir:

Pursuant to Rules 56 and 99, Applicants hereby call the attention of the Patent Office to the art listed on the attached Form PTO 1449. Copies of the art cited in the International Search Report (ISR), which issued by the JPO, are made available to the U.S. examiner in the national stage application, pursuant to MPEP 1893.03(g), and therefore copies of such art are not submitted herewith. The art cited in the ISR is listed on the attached PTO-1449 for an indication of consideration by the examiner. Copies of any other references listed on the PTO-1449, besides those cited in the ISR, are submitted herewith.

Applicants present this art so that the Patent Office may, in the first instance, determine any relevancy thereof to the presently claimed invention, see Beckman Instruments, Inc. v. Chemtronics, Inc., 439 F.2d 1369, 1380, 165 USPQ 355, 364 (5th Cir. 1970). Also see Patent Office Rules 104 and 106.

10/591184

IAP5 Rec'd PCT/PTO 30 AUG 2006

Applicants respectfully request that this art be expressly considered during the prosecution of this application and made of record herein and appear among the "References Cited" on any patent to issue herefrom.

Respectfully submitted,

Date: August 30, 2006

James E. Ledbetter
Registration No. 28,732

JEL/spp

ATTORNEY DOCKET NO. L8638.06115

STEVENS, DAVIS, MILLER & MOSHER, L.L.P.
1615 L STREET, NW, Suite 850
WASHINGTON, DC 20043-4387
Telephone: (202) 785-0100
Facsimile: (202) 408-5200

IAP5 Rec'd PCT/PTO 30 AUG 2006

FORM PTO-1449 (Rev. 4/92) U.S. Department of Commerce Patent and Trademark Office

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use several sheets if necessary)

ATTY. DOCKET NO. L8638.06115	SERIAL NO. New PCT National Stage Application 10/591184
APPLICANT Hong CHENG, et al.	
FILING DATE August 30, 2006	GROUP Unassigned

U.S. PATENT DOCUMENTS

EXAMINER INITIAL		DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE

FOREIGN PATENT DOCUMENTS

		DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO
		2000 0 6 9 0 5 0	03/2000	JP				
		1 0 0 4 1 9 6 9	02/1998	JP				

		OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc.)
		PCT International Search Report dated May 17, 2005.

EXAMINER: Initial if citation is considered, draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

(Form PTO-1449 [6-4])

10/591184

IAP5 Rec'd PCT/PTO 30 AUG 2006

PARTIAL APPLICATION DATA SHEET	
TITLE OF INVENTION	SYSTEM AND METHOD FOR NEGOTIATION OF WLAN ENTITY
APPLICATION TYPE: New PCT National Stage Application of PCT/JP2005/003390 filed March 1, 2005	
CORRESPONDENCE ADDRESS: Customer Number: 52989 *52989*	
PRIORITY DATA: Doc. No.: 2004-058245; Country - JP; Date: 2004-03-02 Doc. No.: 2004-209470; Country - JP; Date: 2004-07-16	
ATTORNEY INFORMATION: Name: James E. Ledbetter Registration No.: 28,732	
ATTORNEY DOCKET NUMBER: L8638.06115	
ASSIGNEE: Organization: MATSUSHITA ELECTRIC INDUSTRIAL CO.,LTD. Address: 1006, Oaza Kadoma, Kadoma-shi City: Osaka Postal Code: 571-8501 Country: JP	

PATENT COOPERATION TREATY PCT/JP05/003390

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION CONCERNING SUBMISSION OR TRANSMITTAL OF PRIORITY DOCUMENT

(PCT Administrative Instructions, Section 411)

To:

NIHEI, Masayuki
Tomin Shinjuku Bldg. 2F
8-8, Shinjuku 2-chome
Shinjuku-ku, Tokyo 160-0022
JAPON

RECEIVED
JUN 1 0. 2005
NIHEI &
ASSOCIATES

Date of mailing *(day/month/year)* 03 June 2005 (03.06.2005)	
Applicant's or agent's file reference P62-0486	**IMPORTANT NOTIFICATION**
International application No. PCT/JP05/003390	International filing date *(day/month/year)* 01 March 2005 (01.03.2005)
International publication date *(day/month/year)*	Priority date *(day/month/year)* 02 March 2004 (02.03.2004)
Applicant MATSUSHITA ELECTRIC INDUSTRIAL CO., LTD. et al	

1. By means of this Form, which replaces any previously issued notification concerning submission or transmittal of priority documents, the applicant is hereby notified of the date of receipt by the International Bureau of the priority document(s) relating to all earlier application(s) whose priority is claimed. Unless otherwise indicated by the letters "NR", in the right-hand column or by an asterisk appearing next to a date of receipt, the priority document concerned was submitted or transmitted to the International Bureau in compliance with Rule 17.1(a) or (b).

2. *(If applicable)* The letters "NR" appearing in the right-hand column denote a **priority document which, on the date of mailing of this Form, had not yet been received by the International Bureau** under Rule 17.1(a) or (b). Where, under Rule 17.1(a), the priority document must be submitted by the applicant to the receiving Office or the International Bureau, but the applicant fails to submit the priority document within the applicable time limit under that Rule, **the attention of the applicant is directed** to Rule 17.1(c) which provides that no designated Office may disregard the priority claim concerned before giving the applicant an opportunity, upon entry into the national phase, to furnish the priority document within a time limit which is reasonable under the circumstances.

3. *(If applicable)* **An asterisk (*)** appearing next to a date of receipt, in the right-hand column, denotes **a priority document submitted or transmitted to the International Bureau but not in compliance with Rule 17.1(a) or (b)** (the priority document was received after the time limit prescribed in Rule 17.1(a) or the request to prepare and transmit the priority document was submitted to the receiving Office after the applicable time limit under Rule 17.1(b)). Even though the priority document was not furnished in compliance with Rule 17.1(a) or (b), the International Bureau will nevertheless transmit a copy of the document to the designated Offices, for their consideration. In case such a copy is not accepted by the designated Office as the priority document, Rule 17.1(c) provides that no designated Office may disregard the priority claim concerned before giving the applicant an opportunity, upon entry into the national phase, to furnish the priority document within a time limit which is reasonable under the circumstances.

Priority date	Priority application No.	Country or regional Office or PCT receiving Office	Date of receipt of priority document
02 March 2004 (02.03.2004)	2004-058245	JP	21 April 2005 (21.04.2005)
16 July 2004 (16.07.2004)	2004-209470	JP	21 April 2005 (21.04.2005)

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No. +41 22 740 14 35	Authorized officer Landicho Remedios Facsimile No. +41 22 338 70 10 Telephone No. +41 22 338 8468

Form PCT/IB/304 (January 2004)

PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

FIRST NOTICE INFORMING THE APPLICANT OF THE COMMUNICATION OF THE INTERNATIONAL APPLICATION (TO DESIGNATED OFFICES WHICH DO NOT APPLY THE 30 MONTH TIME LIMIT UNDER ARTICLE 22(1))

(PCT Rule 47.1(c))

To:

NIHEI, Masayuki
Tomin Shinjuku Bldg. 2F
8-8, Shinjuku 2-chome
Shinjuku-ku, Tokyo 160-0022
JAPON

RECEIVED
OCT 1 3, 2005
NIHEI & ASSOCIATES

Date of mailing *(day/month/year)*
06 October 2005 (06.10.2005)

Applicant's or agent's file reference
P62-0486

IMPORTANT NOTICE

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/JP2005/003390	01 March 2005 (01.03.2005)	02 March 2004 (02.03.2004)

Applicant
MATSUSHITA ELECTRIC INDUSTRIAL CO., LTD. et al

1. **ATTENTION**: For any designated Office(s), for which the time limit under Article 22(1), as in force from 1 April 2002 (30 months from the priority date), **does apply**, please see Form PCT/IB/308(Second and Supplementary Notice) (to be issued promptly after the expiration of 28 months from the priority date).

2. Notice is hereby given that the following designated Office(s), for which the time limit under Article 22(1), as in force from 1 April 2002, **does not apply**, has/have requested that the communication of the international application, as provided for in Article 20, be effected under Rule 93*bis*.1. The International Bureau has effected that communication on the date indicated below:
09 September 2005 (09.09.2005)

   CH

   In accordance with Rule 47.1(c-*bis*)(i), those Offices will accept the present notice as conclusive evidence that the communication of the international application has duly taken place on the date of mailing indicated above and no copy of the international application is required to be furnished by the applicant to the designated Office(s).

3. The following designated Offices, for which the time limit under Article 22(1), as in force from 1 April 2002, **does not apply**, have not requested, as at the time of mailing of the present notice, that the communication of the international application be effected under Rule 93*bis*.1 :

   LU, SE, TZ, UG, ZM

   In accordance with Rule 47.1(c-*bis*)(ii), those Offices accept the present notice as conclusive evidence that the Contracting State for which that Office acts as a designated Office does not require the furnishing, under Article 22, by the applicant of a copy of the international application.

4. **TIME LIMITS for entry into the national phase**

   For the designated Office(s) listed above, and unless a demand for international preliminary examination has been filed before the expiration of **19 months** from the priority date (see Article 39(1)), the applicable time limit for entering the national phase will, **subject to what is said in the following paragraph,** be **20 MONTHS** from the priority date.

   In practice, **time limits other than the 20-month time limit** will continue to apply, for various periods of time, in respect of certain of the designated Offices listed above. For **regular updates on the applicable time limits** (20 or 21 months, or other time limit), Office by Office, refer to the *PCT Gazette*, the *PCT Newsletter* and the *PCT Applicant's Guide*, Volume II, National Chapters, all available from WIPO's Internet site, at http://www.wipo.int/pct/en/index.html.

   It is the applicant's **sole responsibility** to monitor all these time limits.

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No.+41 22 740 14 35	Authorized officer Masashi Honda Facsimile No.+41 22 338 70 10

Form PCT/IB/308(First Notice) (January 2004)

PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

SECOND AND SUPPLEMENTARY NOTICE INFORMING THE APPLICANT OF THE COMMUNICATION OF THE INTERNATIONAL APPLICATION (TO DESIGNATED OFFICES WHICH APPLY THE 30 MONTH TIME LIMIT UNDER ARTICLE 22(1))

(PCT Rule 47.1(c))

To:

NIHEI, Masayuki
Tomin Shinjuku Bldg. 2F
8-8, Shinjuku 2-chome
Shinjuku-ku, Tokyo 160-0022
JAPON

RECEIVED
JUL 12, 2006
NIHEI & ASSOCIATES

Date of mailing *(day/month/year)* 06 July 2006 (06.07.2006)	
Applicant's or agent's file reference P62-0486	**IMPORTANT NOTICE**

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/JP2005/003390	01 March 2005 (01.03.2005)	02 March 2004 (02.03.2004)

Applicant

MATSUSHITA ELECTRIC INDUSTRIAL CO., LTD. et al

1. **ATTENTION**: For any designated Office(s), for which the time limit under Article 22(1), as in force from 1 April 2002 (30 months from the priority date), **does not apply**, please see Form PCT/IB/308(First Notice) issued previously.

2. Notice is hereby given that the following designated Office(s), for which the time limit under Article 22(1), as in force from 1 April 2002, **does apply**, has/have requested that the communication of the international application, as provided for in Article 20, be effected under Rule 93*bis*.1. The International Bureau has effected that communication on the date indicated below:
   09 September 2005 (09.09.2005)

   AU, AZ, BY, CN, CO, DZ, EP, HU, KG, KP, KR, MD, MK, MZ, NA, PG, RU, SY, TM, US

   In accordance with Rule 47.1(c-*bis*)(i), those Offices will accept the present notice as conclusive evidence that the communication of the international application has duly taken place on the date of mailing indicated above and no copy of the international application is required to be furnished by the applicant to the designated Office(s).

3. The following designated Offices, for which the time limit under Article 22(1), as in force from 1 April 2002, **does apply**, have not requested, as at the time of mailing of the present notice, that the communication of the international application be effected under Rule 93*bis*.1 :

   AE, AG, AL, AM, AP, AT, BA, BB, BG, BR, BW, BZ, CA, CR, CU, CZ, DE, DK, DM, EA, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, ID, IL, IN, IS, JP, KE, KZ, LC, LK, LR, LS, LT, LV, MA, MG, MN, MW, MX, NI, NO, NZ, OA, OM, PH, PL, PT, RO, SC, SD, SG, SK, SL, SM, TJ, TN, TR, TT, UA, UZ, VC, VN, YU, ZA, ZW

   In accordance with Rule 47.1(c-*bis*)(ii), those Offices accept the present notice as conclusive evidence that the Contracting State for which that Office acts as a designated Office does not require the furnishing, under Article 22, by the applicant of a copy of the international application.

4. **TIME LIMITS for entry into the national phase**

   For the designated or elected Office(s) listed above, the applicable time limit for entering the national phase will, **subject to what is said in the following paragraph,** be **30 MONTHS** from the priority date.

   In practice, **time limits other than the 30-month time limit** will continue to apply, for various periods of time, in respect of certain of the designated or elected Office(s) listed above. For **regular updates on the applicable time limits** (30 or 31 months, or other time limit), Office by Office, refer to the *PCT Gazette*, the *PCT Newsletter* and the *PCT Applicant's Guide*, Volume II, National Chapters, all available from WIPO's Internet site, at http://www.wipo.int/pct/en/index.html.

   It is the applicant's **sole responsibility** to monitor all these time limits.

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Facsimile No. +41 22 338 82 70

Authorized officer

Masashi Honda

e-mail: pt08@wipo.int

Form PCT/IB/308(Second and Supplementary Notice) (January 2004)

(12)特許協力条約に基づいて公開された国際出願

(19) 世界知的所有権機関
国際事務局

(43) 国際公開日
2005 年9 月9 日 (09.09.2005)

PCT

(10) 国際公開番号
WO 2005/083942 A1

(51) 国際特許分類[7]: H04L 12/28

(21) 国際出願番号: PCT/JP2005/003390

(22) 国際出願日: 2005 年3 月1 日 (01.03.2005)

(25) 国際出願の言語: 日本語

(26) 国際公開の言語: 日本語

(30) 優先権データ:
特願2004-058245 2004 年3 月2 日 (02.03.2004) JP
特願2004-209470 2004 年7 月16 日 (16.07.2004) JP

(71) 出願人 (米国を除く全ての指定国について): 松下電器産業株式会社 (MATSUSHITA ELECTRIC INDUSTRIAL CO., LTD.) [JP/JP]; 〒5718501 大阪府門真市大字門真１００６番地 Osaka (JP).

(72) 発明者; および
(75) 発明者/出願人 (米国についてのみ): チェン ホン (CHENG, Hong). タン ペク ユー (TAN, Pek Yew).

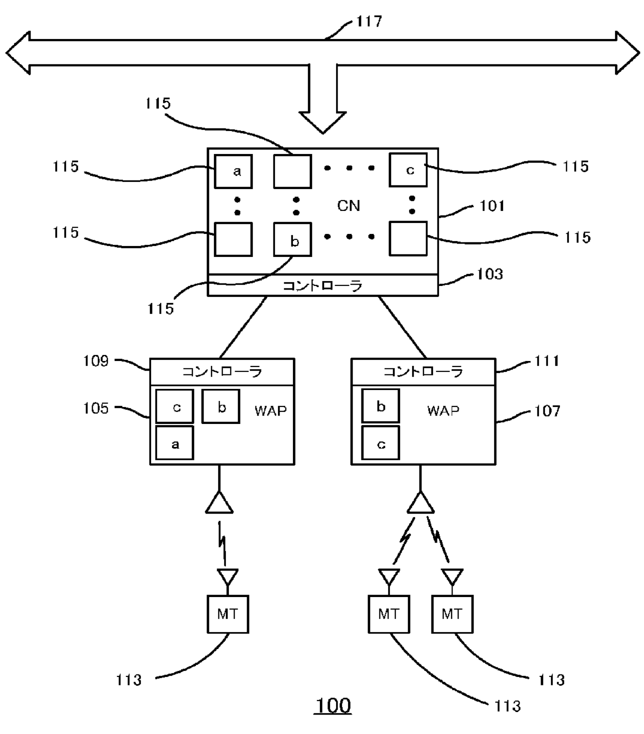
(74) 代理人: 二瓶 正敬 (NIHEI, Masayuki); 〒1600022 東京都新宿区新宿２−８−８ とみん新宿ビル２Ｆ Tokyo (JP).

(81) 指定国 (表示のない限り、全ての種類の国内保護が可能): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR,

[続葉有]

(54) Title: SYSTEM AND METHOD FOR NEGOTIATION OF WLAN ENTITY

(54) 発明の名称: ＷＬＡＮエンティティの折衝のためのシステムと方法



103...CONTROLLER 109...CONTROLLER 111...CONTROLLER

(57) Abstract: There is disclosed a technique for providing a method for negotiation between various entities of wireless local area network (WLAN) such as a negotiation between a control node (CN) and a wireless access point (WAP) and a negotiation between WAPS. According to the technique, capabilities of various entities are set and it is decided how to divide the capabilities between the negotiation entities optimally. The aforementioned negotiation is used to divide the capabilities between the entities according to the decision. The aforementioned capabilities are required for WLAN entity and operation, control, and management of the WLAN. The disclosed technique employs means for flexibly adjusting the difference in capabilities of various degrees between the WLAN entities and a dynamic change of the WLAN topology between the WLAN entities.

(57) 要約: 例えば、制御ノード（ＣＮ）とワイアレス・アクセス・ポイント（ＷＡＰ）との間の折衝や、ＷＡＰ間の折衝などの、ワイアレス・ローカル・エリア・ネットワーク（ＷＬＡＮ）の種々のエンティティ間における折衝のための方法を提供する技術が開示され、その技術によれば種々のエンティティの能力を設定し、どのようにして、この能力を折衝エンティティ間で最適に分割

[続葉有]

WO 2005/083942 A1

BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SM, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) 指定国 (表示のない限り、全ての種類の広域保護が可能): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), ユーラシア (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), ヨーロッパ (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

添付公開書類:
— 国際調査報告書

２文字コード及び他の略語については、 定期発行される各*PCT*ガゼットの巻頭に掲載されている「コードと略語のガイダンスノート」を参照。

するかについて決定し、この決定に基づいてエンティティ間で能力を分割するために、上述の折衝が利用される。上記の能力は、ＷＬＡＮエンティティ及び対象となるＷＬＡＮの動作、制御、管理のために必要とされるものである。開示される方法では、ＷＬＡＮエンティティ間の様々な程度の能力の違いや、ＷＬＡＮトポロジの動的な変化を、ＷＬＡＮエンティティ間において柔軟に調整するための手段が導入される。

明 細 書

WLANエンティティの折衝のためのシステムと方法

技術分野

[0001] 本発明は、ワイアレス・ローカル・エリア・ネットワークの技術分野に関し、特に、ヘテロジニアスな環境(heterogeneous environment)におけるワイアレス・ローカル・エリア・ネットワークの動作に関する。

背景技術

[0002] ワイアレス・ローカル・エリア・ネットワーク(WLAN)は、消費者と産業界の両方から多大な関心を得てきた。現在最も一般的なWLANは、[非特許文献1]による標準化に基づいている。こうした標準化は、WLANの初期の導入段階では役に立つものの、大規模な環境下では、WLANエンティティのコスト及び制御が複雑になってしまうため、現在の形式では、大規模ワイアレス・ネットワークへの適用には適していない。

[0003] 現在、WLAN装置の製造者は、新たな分割構成を導入することによって、大規模な環境への適用を模索している。[非特許文献1]に詳述されているWLANの制御の態様は、制御ノード(CN)への集中化である一方、多数のワイアレス・アクセス・ポイント(WAP)への分散化という他の態様も存在している。そして、様々な製造者が存在し、分散構成が実施される中で、異なる製造者によるWLANエンティティ間における相互接続が不可能になる。

[0004] 現在、IETF(Internet Engineering Task Force)のCAPWAP(Control And Provisioning of Wireless Access Points)ワーキンググループにおいて、大規模なWLANを管理するための標準化手段を提供しようとする努力が行われており、[非特許文献2]には、CAPWAPワーキングにおける成果が記載されている。しかしながら、これらの成果では、異なる機能に係る能力(functionality capability)を有するWAPが単一のWLANに存在する場合の調整に係る問題点は考慮されていない。このような問題点は、WLANのマーケットの発展を妨げるものである。

[0005] さらに、将来的には、WLANは、動的なワイアレス・ネットワークとして展開されることが期待されている。このような適用では、優れたアプリケーションやサービスの使用

が許可されるように、WLANが運用されている間にネットワーク・トポロジが変化することが予想される。このようなネットワークにおけるWLAN構成要素には、有線又は無線による接続性が提供され、動的なトポロジの変化が許可されることとなる。しかしながら、WLAN(及びCAPWAP)における現在の前提条件としては、静的なネットワーク・トポロジしか考慮されていない。現在のWLANは、無線媒体との動的な接続を調節する機能はあるものの、動的なトポロジの変化による影響を調整することはできない。

[0006] 例えば、現在のWLANシステムは、信号送信電力を増加させることによって、無線媒体のSIR(Signal-to-Interference Ratio:信号対干渉雑音比)の低下を調節することができない。しかしながら、このような些細な補正は、WLANトポロジの変化によって発生する遅延やオーバヘッドの変動の調整に、十分に対応できるものではない。さらに、分散された動作の性質上、分散構成は遅延に敏感であり、これらの遅延やオーバヘッドの変動によって、CAPWAPの分散構成における動作が妨げられることになる。また、動的なCAPWAPトポロジにおける中間的なWAPによって実行されるWLANやCAPWAPの処理は、物理的なオーバヘッドと共に、CAPWAPの分散動作に対して悪影響を及ぼすものである。

[0007] このようなシナリオにおいて、様々な製造者による現在のWLANエンティティは、単一のWLAN内で相互動作を行うことはできず、さらに、動的なトポロジを持つWLAN内で動作することも不可能である。

[0008] これらの問題点は、基本的な設計の違いによるものであり、WLANエンティティ間の静的な違いであると言える。また、さらに、WLANエンティティ間の動的な違いに関連した問題点も存在する。

[0009] 特に、WLANの機能に関して、実質的に、WAPの処理負荷が、WAPの処理能力を超えるほど高くなってきている。これは、例えば、モバイル端末(MT)の接続数の増加や、接続するMTからのトラフィック量の増加によるものである。こうした時間当たりに処理できる負荷の違いは、MTの動きに依存するものであり、動的な要因の1つとなっている。

[0010] このような、WLANを構成するWAP間における負荷の処理に係る動的な違いは、

MTが、接続している処理負荷の高いWAPから、処理負荷の相対的に低いWAPに再接続するようなMTのハンドオーバにおける影響などによって、以前から言及されてきたものである。

[0011] ［特許文献1］には、接続しているMTの積極的なハンドオーバによって、WAP間における処理負荷レベルの動的な違いを処理するための手段が開示されている。

また、［特許文献1］では、WAP間における処理負荷の動的な違いに関する問題点が言及されている。しかしながら、この方法では、あるWAPに接続されているMTが、ハンドオーバ及び再接続を実施可能とするように、さらに、他のWAPのカバー・エリア内に存在する必要がある。MTが、他の1つ以上のWAPのカバー・エリア内に存在していない場合には、ある処理負荷を有する最初のWAPの負荷低下のために、このようなカバー・エリアに物理的に移動することが望まれる。これらの制約は厳しいものであり、［特許文献1］に開示された方法の効果は制限されている。なお、こうした制限は、すべてのハンドオーバ・ベースの方法に共通して存在している。

[0012] また、［特許文献2］には、WAPが、主な処理負荷レベルに基づいて、MTの接続を誘引又は解離するために送信するビーコン信号間のインターバルを変更する方法が提案されている。しかしながら、この方法も、MTが処理負荷の低い別のWAPのカバー・エリア内に存在することや、このようなエリアに移動できることが要求されるという制約を伴っている。

[0013] また、［特許文献3］は、MTが積極的に接続の決定を行うMTに焦点が置かれている。しかしながら、この方法も前述の要因に制約を受けている。

[0014] このような方法は、負荷の処理に係る動的な違いの問題点の解決を図っているが、厳しい必要条件の導入や、こうした必要条件の導入による更なる問題点によるものである。

また、［特許文献1］、［特許文献2］、［特許文献3］の別の欠点や、WAPの動的な違いに対処する別のハンドオーバ・ベースの方法は、通信セッションの大量シフトに関係している。実際に、MTは、接続しているWAPと多数の通信セッションを維持している。その結果、ただ1つのMT又は数台のMTの通信セッションによって、WAPに、かなりの量の処理負荷が作られる可能性が高い。WAPが、前記MTに対して、ハン

ドオーバ及び別のWAPとの再接続を促した場合には、最初のWAPの処理負荷は減少するが、逆に、他のWAPに影響を与える。このとき、他のWAPは過剰負荷になり、逆に、最初のWAPへのハンドオーバを促す。これは、WLAN全体の利益をもたらさずに連続して行われるかもしれない。すなわち、ハンドオーバの方法では、処理負荷が精密に分散されないことが分かる。言い換えれば、動的な違いが精密に管理されていない。

非特許文献1:Institute of Electrical and Electronics Engineers Standard 802.11 - 1999 (R2003)

非特許文献2:"CAPWAP Problem Statement", draft-ietf-capwap-problem-statement-02.txt

特許文献1:"Method and apparatus for facilitating handoff in a wireless local area network", US 2003/0035464 A1

特許文献2:"Dynamically configurable beacon intervals for wireless LAN access points", US 2003/0163579 A1

特許文献3:"Method and apparatus for selecting an access point in a wireless network", US 6,522,881 B1

発明の開示

[0015] 上述の問題点に鑑み、本発明は、例えば、単一のLAN内におけるWLANトポロジの動的な変化などのような、WLANエンティティ間における静的及び動的な違いを調整できるようにするためのポリシーに基づいて、WLANの制御ノード(CN)とワイアレス・アクセス・ポイント(WAP)との間で折衝を行うための装置及び方法を提供することを目的とする。

[0016] また、本発明は、システム設計、処理負荷、ネットワーク・トポロジの変化を調整するために、WLANエンティティのそれぞれにおいて処理されるべき、選択された機能のサブセット、負荷や、他のコンポーネントを決定することを図り、WLANエンティティ間で折衝を行う方法及びポリシーを提供することを別の目的とする。

[0017] また、本発明は、単一のLAN内における様々なWLANエンティティの処理負荷レベルの違いなどのような、WLANエンティティ間の動的な違いを調整できるようにす

るためのポリシーに基づいて、WLANエンティティ間で折衝を行う装置及び方法を提供することを別の目的とする。

[0018] さらに、本発明は、ネットワーク・トポロジの動的な変化が起こる分割構成のWLANの動作を調整するための手段を提供することを別の目的とする。

[0019] 開示された発明は、ワイアレス・ローカル・エリア・ネットワーク(WLAN)、特に、WLANエンティティ間の静的及び動的な違いに係る課題を解決するための手段に関連している。本発明では、これらの違いを調節するために、WLANエンティティ間における折衝のためのポリシーが導入される。

[0020] 本発明のある態様では、WAP間の静的な違いの調節を可能にするポリシーに基づいて、WLANの制御ノード(CN)とワイアレス・アクセス・ポイント(WAP)との間の折衝が取り扱われる。特に、折衝を行うエンティティ間において、WLAN機能の柔軟な分割を決定する手段が提示される。本発明では、WLANエンティティの機能に係る能力の分類が、まず行われる。そして、エンティティは、他のエンティティの能力を決定して、エンティティ間の機能分割の最良の方法について折衝を行う。WLANエンティティの更なる動作は、機能に関して決定された分割に基づいて行われる。本発明の本態様では、WLANエンティティの相互動作性が向上される。

[0021] また、本発明の別の態様では、WLANエンティティ間の動的な違いの調節を可能にするポリシーに基づくWLANエンティティ間の折衝が取り扱われる。特に、接続されているモバイル端末(MT)の物理的な移動を要求せずに、WAP間で処理負荷を配分する課題が意図されている。ここでは、あるWAPにおける処理負荷の部分を分散する必要性が、まず決定される。この後、MTとWAPとの間の既存の接続関係を維持しながら、同時に、処理負荷のどの部分を分散するかについての決定が行われる。次に、過剰負荷のWAPは、どのようにして、処理負荷の決定部分をWAP間で配分するかについて決定するために、他のWAPとの折衝に入る。本発明の本態様によれば、WLANエンティティ間の動的な違いを管理するハンドオーバ・ベースの方法の限界が克服される。

[0022] また、本発明の最も広い態様によれば、制御ノードがWAPと折衝を行い、各WAPに対して同様又は異なる補完機能を提供して、WLANで定義される完全な機能を

実現することによって、WLANでサービスを提供するシステムが提供される。

[0023] また、本発明の好ましい形式によれば、制御ノードが、各ワイアレス・アクセス・ポイントで使用される機能コンポーネントのサブセットを記述する記述子の連続したリストによって構成される単一又は複数の処理スケジュールを持てるようにするためのコントローラ・モジュールが提供される。

[0024] また、本発明の別の好ましい形式によれば、制御ノードが、WAPに対して、モバイル端末から送信されるデータ・ユニットをエミュレートするセクションを有する単一又は複数のメッセージを送信することによって、WAPの能力を動的に探索し、前記メッセージを受信したWAPが、モバイル端末から受信するデータ・ユニットの処理手順と同一のものを用いて、前記セクションの処理を行って、前記制御ノードに回答メッセージによって送り返し、制御ノードが、この回答メッセージ内の処理後のデータ・ユニットを調べることによって、前記WAPの機能に係る情報を取得する、WLANでサービスを提供する方法が提供される。

[0025] また、本発明の別の好ましい形式によれば、WAPのサブセットが、WLANで定義される機能のサブセット全体の処理を行い、制御ノードが、WAPのサブセットごとに、それぞれ異なる補完機能のサブセットを提供することにより、WAP及び1つ以上の制御ノード間で、所定のWLAN機能の分割を可能とするWLANでサービスを提供する方法が提供される。

[0026] さらに、本発明の別の好ましい形式によれば、折衝エンティティ間でWLAN機能の柔軟な分割を決定する手段が許容される。まず、本発明では、WLANエンティティの機能に係る能力の分類が行われる。続いて、これらのエンティティは、それぞれの間において、どのような機能分割が最良かに関する折衝を行って、他のエンティティの機能を決定する。さらに、WLANエンティティは、決定された機能分割に基づいて動作を行う。

[0027] また、本発明の別の態様によれば、モバイル端末に関するデータ・ユニットは、完全なWLAN機能を用いて処理されるが、この完全なWLAN機能は単一又は複数のWAPから構成されており、各WAPは、このデータ・ユニットを完全なWLAN機能のサブセットのみを用いて処理する。これにより、モバイル端末における接続ハンドオーバ

を必要とすることなく、WLANにおける負荷分散を図るシステムが提供される。

[0028] また、本発明の好ましい形式によれば、WAPがモバイル端末に提供する処理機能を、接続固有部分と非接続固有部分とに分けて、WLANにおいて、モバイル端末がWAPとの接続関係を変えることなく負荷分散を図る手段が提供される。WAPは、非接続固有部分で処理を行うために、別のWAPと折衝を行い、別のWAPとの間にセキュアなトンネルを確立し、機能の接続固有部分によるデータ・ユニットの処理後に、このトンネルを通じて、モバイル端末からのデータ・ユニットを別のWAPにトンネリングする。別のWAPは、このトンネルを通じて、処理後のデータ・ユニットを受信し、非接続固有部分によって、そのデータ・ユニットの処理を行う。

[0029] また、本発明の別の好ましい形式によれば、処理されるデータ・ユニットのサイズや、データ・ユニットの処理について予想される平均時間や、データ・ユニットを処理するためのオーバヘッド時間や、上記の情報に関して重み付けされた総計を含む情報に基づいて、非接続固有機能の分配を決定する方法が提供される。

[0030] また、本発明の別の態様によれば、ワイアレス・ネットワーク・トポロジの少なくとも1つのネットワーク・エンティティの処理ロジックを動的に調節して、1つ以上の機能サブ・コンポーネントを変更するステップを有し、ワイアレス・ネットワーク・トポロジの変化に対応する方法が提供される。

[0031] また、本発明の好ましい形式によれば、選択された機能サブ・コンポーネントをバイパスして処理する手段を用いて、少なくとも1つのネットワーク・エンティティに、選択された機能サブ・コンポーネントの処理を変更することによって、WLANにおける変化に対応する方法が許可される。

[0032] また、本発明の好ましい形式によれば、選択された機能サブ・コンポーネントを選択的に処理する手段を用いて、少なくとも1つのネットワーク・エンティティに、選択された機能サブ・コンポーネントの処理を変更することによって、WLANにおける変化に対応する方法が許可される。

[0033] また、本発明の別の好ましい形式によれば、ワイアレス・ネットワーク全体において、動作させる機能サブ・コンポーネントの和集合がワイアレス・ネットワークの完全な機能サブ・コンポーネントに対応するように、選択されたネットワーク・エンティティの機能

サブ・コンポーネントを選択的に動作させることによって、ローカル・レベル機能のセマンティックス(semantics)を変更しながら、ワイアレス・ネットワークのシステム全体の機能のセマンティックスを維持する方法が提供される。

[0034] また、さらに、動作させる機能サブ・コンポーネントの処理を第1のネットワーク・エンティティから第2のネットワーク・エンティティに移すことによって、本発明の別の好ましい形式によれば、ローカル・レベル機能のセマンティックスを変更しながら、ワイアレス・ネットワークのシステム全体の機能のセマンティックスを維持する方法が提供される。

[0035] 本発明の態様及び好ましい形式に基づいて、異なる機能に係る能力のWAPによる、相互接続不可の問題点は解決される。また、本発明によれば、動的なトポロジ環境におけるWLANの動作に関する問題点も解決される。さらに、本発明の別の態様によれば、時間当たりに処理される負荷が異なる量の場合に、この調整に関する問題点が解決される。

図面の簡単な説明

[0036] [図1]WLANエンティティ間、特に制御ノード(CN)とワイアレス・アクセス・ポイント(WAP)との間で、折衝のためのポリシーを取り扱う本発明の第1の態様を説明するために用いられるワイアレス・ローカル・エリア・ネットワーク(WLAN)の動作を示す図

[図2]CNとWAPとの間の折衝のためのポリシーを取り扱う本発明の第1の態様に含まれる主要な動作ステップを示す図

[図3]CN及びWAPの能力が1つのエンティティに統合されている、本発明の第1の態様の一実施例を示す統合化されたWLANエンティティを示す図

[図4]WLANエンティティ間、特にWAP間の動的な違いを調節するために、折衝のためのポリシーを取り扱う本発明の第2の態様を単純化したフレームワークを示す図

[図5]WLANエンティティ間の動的な違いを調節する折衝のためのポリシーを取り扱う本発明の第2の態様に含まれる主要な動作ステップを示し、特に、種々のエンティティに係る負荷の処理が行われることを示す図

[図6]本発明の第2の態様の一実施例に係る、WAPが、接続されているMTから受信するプロトコル・データ・ユニット(PDU)のサイズを負荷処理の定義とする根拠を説明

するための図

[図7]セントラル・コントローラがWLANエンティティ間の動的な違いを調節する折衝の監視機能を担っている、本発明の第2の態様の一実施例を示す図

[図8]動的なWLANトポロジにおけるCAPWAPの分配動作を可能とする折衝方法に係る本発明の第1の実施の形態の一例を示す図

[図9]IEEE802．11WLAN仕様に関する本発明の第1の実施の形態の詳細な一例を示す図

[図10]動的なWLANトポロジを可能とする本発明の第1の実施の形態の処理シーケンスを示す図

発明を実施するための最良の形態

[0037] ワイアレス・ローカル・エリア・ネットワーク(WLAN)のエンティティ間の折衝のためのポリシーに関する本発明は、2つの主な態様で記述される。第1の態様では、WLANエンティティ間における静的な違いを調節し、更にWLANトポロジの変化を調整する折衝に焦点が置かれ、第2の態様では、特に処理負荷のレベルにおいて、動的な違いに対処する手段が示されている。

[0038] 下記において、説明のために、指定番号、時間、構造、他のパラメータが、本発明を十分に理解するために記されている。しかし、本発明は、これらの特定の詳細事項なしに実施可能であることは、当業者には自明のことである。

[0039] 静的な違いを調節する折衝：

[0040] 図1には、WLANエンティティの静的な違いの調節に対処する、本発明の第1の態様を具体化するWLANシステムが例示されている。この図では、コントローラ・ノード(CN)101、多数のワイアレス・アクセス・ポイント(WAP)105、107、複数のモバイル端末(MT)113、ネットワーク・バックボーン117を具備するWLANシステム100が示されている。単純化のために、単一のCNを有するWLANシステム100が図示されている。また、本発明を具体化するシステムは、任意の数のCNを含むことができる。また、図では、CN101とWAP105、107との間の直接的な接続が示されているが、代わりに、それらの間に多くの中間ノードがあってもよい。同様に、CN101とネットワーク・バックボーン117との間の接続も、多くの中間ノードを含むことができる。このような

ケースのすべてにおいて、開示された発明の趣旨は保たれている。

[0041] CN101は、接続するWAP105、107のサポート及び制御を行う。WLANシステム100の新規WAPは、1つ又は複数のCNからのサポート及び制御を受ける前に、1つ又は複数のCNとの接続関係を最初に選択して設定しなければならない。このように、WAPは、1つ又は複数のCNと2つ以上の接続関係を同時に保持することができる。同様に、MT113は、MTにサービスを順に提供するWAPとの接続を選択して維持する。これらのサービスには、無線送受信、セキュアな搬送、移動性が含まれる。MTは、1つ又は複数のWAPと多数の接続を維持することができるが、図1では、各MTが1つのWAPと、1つの接続のみを行っている状態に単純化されている。

[0042] WAPがCN101を経由してネットワーク・バックボーン117に接続されていることが、WLANシステム100から分かる。この代わりに、他の中間ノードを経由する可能性のある他の手段でネットワーク・バックボーンに接続するWAPもある。このようなケースでは、CNは、接続するWAPの制御及び管理を担うだけであるが、外部ネットワークとの接続は他のエンティティでも扱うことができる。

[0043] 図1には、ある確立されたWLANスタンダードで指定されるような、WLANの機能に係る動作の完全なセットを実施できるCN101が示されている。それは、他の制御及び管理の機能動作も可能である。各機能の動作は、機能コンポーネント115の1つによって論理的に表される。機能コンポーネントのそれぞれによって示される動作には、暗号化、復号、媒体アクセス制御プロトコル・データ・ユニット（MAC PDU）処理、認証、接続、サービス品質（QoS）の処理、インターネット・プロトコル（IP）処理などが含まれる。

[0044] 各機能コンポーネントは、機能コンポーネント・コードで表される。図解のために、図1の機能コンポーネントの一部は、機能コンポーネント・コード‘a’、‘b’、‘c’で表される。例えば、機能コンポーネント‘a’は、あるタイプの暗号化に必要な処理、例えば、Wi−Fi保護アクセス（WPA）又は高度暗号化基準（AES）を示しており、機能コンポーネント‘b’はQoS処理、例えば、優先順位の取り扱いを示しており、機能コンポーネント‘c’は無線送受信の最中のパワー制御を示している。機能コンポーネントは、論理ユニットであり、異なる機能コンポーネントのための命令及びコンテキストの異な

るセットを用いる単一のプロセッサで構成されてもよい。また、代わりに、各機能コンポーネントは、異種のエンティティにおいて可能な個々の処理エンティティで構成されてもよい。機能コンポーネントの実際の構成は、製造者及びそれらの構成において様々であると考えられるが、あるWLANエンティティから別のWLANエンティティに対して、コントロール又はデータ・ユニットのシームレス処理を可能とするように、異なるコンポーネントとリンクするインタフェースは共通であるか、又は互換性を有している。

[0045] WAPは、異なる製造者によって製造されたもの、又は異なる構成のものなので、様々な程度のWLAN機能コンポーネントを有することになる。これらは、CNとWAPとの間で機能の分割が異なっていることに対応している。例えば、WAP105は機能コンポーネント'a'、'b'、'c'の処理が可能であるよう図示されているが、WAP107は機能コンポーネント'b'、'c'を処理できるだけである。それらのWLAN動作及び制御に必要な残りの機能コンポーネントは切り離されて、CN101で処理される。これらのWAPとCNとのエンティティ間の違いは、開示された折衝のための方法を用いて、WLANエンティティが相互に調整を行うべき静的な違いを表している。

[0046] 本発明の適切な動作のために、異なる製造者によるCN及びWAPは、包含及び認識する機能コンポーネントに対して、あらかじめ定められた命名規定に準じる必要がある。これにより、折衝しているエンティティが、どの機能コンポーネントが同じエンティティ構成であるかを正確に区別できることが保証される。そのために、機能コンポーネント・コードは、種々の機能コンポーネントを表す際に一致している必要がある。この規定は、しかし、厳密に文字に準じる必要はない。例えば、この規定によって、折衝しているエンティティがそれらの特性を見分けることができる種々の機能コンポーネントの標準記述子が提供されてもよい。一例として、"IEEE802.11i"はセキュリティ機能を有するIEEE WLANスタンダードを記している。このような記述子に基づいて、記述子が表す機能コンポーネントの特質が推定可能となるように、折衝しているCN及びWAPは、名前の一部又はすべてを他の記述子に一致させてもよい。

[0047] 前述のように、機能コンポーネント間のインタフェースもWLANエンティティで一致する必要がある。これにより、コントロール又はデータ・ユニットの処理が、あるWLAN

エンティティから別のWLANエンティティに対して、シームレスに実施できることが保証される。例えば、WAPは、適切な機能コンポーネントでデコードし、デコードしたデータ・ユニットを更なる処理に適したフォーム、すなわち、CNの復号機能コンポーネントが容易に復号可能なフォームでCNに送ることができる。異なるWLANエンティティに異なる機能コンポーネントがある場合でも、それらの間のインタフェースは、シームレスな処理が提供されるように相互に認識することができる。

[0048] 各WLANエンティティは、通常、コントローラ・エンティティによって制御される。したがって、CNコントローラ103及びWAPコントローラ109、111は、それぞれ、CN101及びWAP105、107の全体的な運用を担っている。WLANシステム100は、コントローラがWLANエンティティに統合されて図示されているが、コントローラは別のエンティティでもよい。このように、コントローラは、各WLANエンティティに対して異種のままでも、又は多数のWLANエンティティと組み合わされていてもよい。また、特殊化したコントローラが、各タイプのエンティティに対して存在することも考えられる。

[0049] コントローラは、特に、コントローラが管理するエンティティと接続するエンティティのそれぞれに対して、処理スケジュールを設定することを担っている。これに合わせて、CNコントローラ103はWAP105、107用の処理スケジュールを保持するのに対し、WAPコントローラ109、111は、それぞれに接続するMT113用の処理スケジュールを順に保持する。

[0050] 処理スケジュールは、前述のコントローラが管理するエンティティによって接続されたデバイスから受信したコントロール及びデータ・ユニットに関して処理されるべき機能コンポーネントのシーケンスである。例えば、WAP105のWAPコントローラ109は、その機能コンポーネント・コード‘a’、‘b’、‘c’のシーケンスを具備する処理スケジュールを維持する。コントロール又はデータ・ユニットが、接続されているMT113から到着すると、WAP105は、設定された処理スケジュールに基づいて機能コンポーネント・コード‘a’、‘b’、‘c’の処理を行う。すべてのMTが同一の機能を含む場合には、WAPの処理スケジュールは、すべての接続されているMTに対して同一となる。しかし、MTに異なる程度の機能が構成されている場合には、WAPは、異なるMTからのコントロール及びデータ・ユニットを処理するための別の処理スケジュールも保持で

きる。

[0051] 本発明に係るこの第1の態様における実施例では、WAP105、107のWAPコントローラ109、111は、それぞれCNを探索する、図中のステップ201を行う。探索すべきCNはWAPと同一の管轄ドメイン内にあってもよく、CNは異なる管轄ドメインに属していてもよい。この探索ステップは、任意のノード探索プロトコルに基づいて実施されてもよく、利用可能なCNからの応答を呼び出す特定の相互認識可能なメッセージのブロードキャスト／マルチキャスト／エニキャストによって実施されてもよい。

[0052] 次に、WAPコントローラは、ステップ203において、探索されたCNの中から、接続すべきCNを選択する。この選択のために考えられる判断基準の1つは、WAPとCNとの間の往復時間（round-trip latency）である。この判断基準は、WLANエンティティ間の制御メッセージの迅速な交換を可能にするという長所を有している。CN選択に使用できる他の判断基準として、ネットワーク状態、輻輳、CNが呈するWLAN機能のサブセット、CNを使用した場合のコスト、CNのベンダ、CNへの接続に係る特徴、リンク状態、ランダム選択、リンクの使用コスト、製造者の識別情報、これらの判断基準が重み付けされた総計がある。接続すべきCN101を選択すると、WAPコントローラ109、111は、CNとの接続段階に入る。この段階には、相互認証、セキュリティ情報の交換、更なる交換のための通信プロトコルの設定が含まれている。

[0053] そして、ステップ205において、WAPコントローラ109、111は、それぞれの機能に係る能力に起こり得る違いを調節する手段を設定するために、CNコントローラ103との折衝段階に入る。特に、折衝は、折衝を行うエンティティの能力に見合ったWLAN機能の分割を設定するものであり、WLAN全体の動作および管理を最適化するものである。

[0054] ステップ207に示すように、折衝は、WAPコントローラ又はCNコントローラのいずれかが始動できる。WAPコントローラは、選択したCNに対して、接続されているWAPの機能に係る能力に関する情報を送って始動する。この情報には、WAPが処理できる機能コンポーネントに対応する適切なコードと、それらの処理スケジュールとが含まれている。CNコントローラは、接続されているWAPからの機能に係る能力に関する情報をリクエストして折衝を開始する。

[0055] 接続されているWAPから能力に関する情報を受信すると、設定ポリシーに基づいて、CNコントローラ103は、WLAN機能の初期分割を決定する。この分割は、ステップ209において、接続されているWAP105、107とCN101との間で行われる。機能分割では、WAPが処理できる機能コンポーネントのうちのどれが、WAPが自ら処理するために作動(active)する必要があるか、及び、CNが処理するために非作動(inactive)とする必要があるかについて特定される。

[0056] ある実施例では、機能の初期分割は、それぞれ接続されたWAPが、可能なすべての機能コンポーネントを処理できるようにするというポリシーに基づいている。このような分割により、接続されたWAPがもともと処理できない機能コンポーネントだけが、CNに残され、このような機能コンポーネントが、CNコントローラの処理スケジュールに含められる。WAPは同等程度の機能に係る能力を有していないかもしれず、CNコントローラは、接続されているWAPごとに別の処理スケジュールを設定するように要求される。このように、本実施例は、各WAPに完全な能力が搭載されるようにするポリシーを提示する。しかし、これは、異なるWAPに対してCNコントローラが異なる処理スケジュールを実行するという犠牲が払われて行われる。

[0057] 別の実施例では、機能の初期分割は、CNコントローラが、接続されたすべてのWAPに共通する機能コンポーネントのサブセットを最初に決定するというポリシーに基づいている。接続されたWAPは、他の機能コンポーネントを処理できても、機能コンポーネントに関して決定されたサブセットのみを処理しなければならない。したがって、接続された各WAP用に処理されるべき機能コンポーネントの残りのセットは、すべてのWAPに共通になる。このとき、この共通セットがCNで処理され得る。本実施例は、CNコントローラが、接続されたすべてのWAPに対して単一の処理スケジュールを維持できるというポリシーを提示する。従来の処理スケジュールで特定されるものと適合しないか、又は少ない機能コンポーネントを含んでいる新しいWAPがCNと接続する場合に、CNコントローラは、現在接続されているすべてのWAPに共通の機能コンポーネントのサブセットを決定するステップを繰り返す。なお、新しいWAPが、単一の既に設定済みの処理スケジュールで特定されるものより多くの機能コンポーネントを有する場合には、このステップを実施する必要がないことに注意すべきである。

[0058] 代わりに、CNに新しいWAPが接続すると、2つの処理スケジュールが同時に維持される猶予期間(grace period)が実施されることになる。第1のものは、新しいWAPの接続前に設定されていた従来の処理スケジュールに対応し、第2のものは、新たに接続したWAPの機能を考慮した処理スケジュールに対応している。このとき、猶予期間中に処理されたデータ・ユニットは、最適の処理スケジュールに基づいて行われる。本実施例は、CNに新しいWAPが接続した場合でも、既存のMTに対するサービスが中断されないようにする。

[0059] 別の実施例では、機能の初期分割は、ポリシーの組み合わせに基づいており、接続したWAPのサブセットが、可能なすべての機能コンポーネントを処理できるようにする。また、接続されたWAPの別のサブセットは、より大きな能力を有する場合でも、WAPが処理可能な機能コンポーネントの共通サブセットのみに関する処理を行う。CNコントローラは、接続されているWAPのサブセットのすべてに共通する機能コンポーネントのサブセットを決定する。接続されているWAPごとに処理が要求される機能コンポーネントの残りのセットは、CNで処理される。したがって、機能コンポーネントの残りのセットは、接続されているWAPのあるサブセットに関しては、WAPのそれぞれに対して独自のものとなり、接続されているWAPの他のサブセットに関しては、WAPのそれぞれに対して同一のものとなる。

[0060] 次に、WLAN機能の初期分割が決まると、ステップ209において、確認のために接続されたWAPに対して、その分割が通知される。WAPコントローラは、分割が実行可能なことを順に検証し、検証した場合には、ステップ211と213において、肯定的な承認(ACK)をCNに返す。

[0061] 例えば、ハードワイア・システムのように、あるWAPが非分割状態で機能コンポーネントを構成した場合、このようなWAPは、特定の初期機能分割を実行することができない。これらのケースでは、ステップ215において、WAPは、機能コンポーネント間の動作上の依存関係を示す更新された処理スケジュールと共に、否定的な承認(NACK)をCNに対して送る。このとき、CNコントローラは、この新しい処理スケジュールを考慮して、WAPに適合可能な別の機能分割を定める。新たな分割が可能な場合には、WAPはACKを返すが、そうでない場合には、同様のやり方で折衝が継続

される。ある所定の回数だけ非成功の折衝が交換された場合には、CNは、WAPがすべての機能コンポーネントを処理することが可能となるようにする。

[0062] 初期折衝段階中に、CN又は接続されたWAPは、折衝段階完了前でも所定のポリシー及びルールに基づいて、更なる折衝を強制的に終了することを選択できる。これらのポリシーは、ステップ219、221において、更なる折衝が未定であることが推定されるときに、CN又はWAPによって実行される。例えば、WLAN機能の初期分割間の違いがWAPの能力と大きく異なっている場合に、WAPは、更に処理を進めることが無駄かもしれず、WAPは折衝の終了を選択することができる。また、いずれかのエンティティが、他者が不正であると決定した場合に、折衝が終了となってもよい。さらに他の多数のポリシーを用いて、折衝を強制終了することもできる。

[0063] いったん機能分割が、関与するすべてのWLANエンティティに受け入れられるようになった場合には、CNコントローラ103は、ステップ217において、接続されたWAP105、107に適切な処理スケジュールを設定する。これらのスケジュールによって、接続されたWAP105、107から受信したコントロール及びデータ・ユニットに対して、CN101が処理する機能コンポーネントのシーケンスが定められる。そして、CNコントローラ103は、処理スケジュールに矛盾のない方法で、接続されたWAPのそれぞれを管理する。

[0064] ある実施例では、WLAN機能は、機能コンポーネント・コード1、2、3、4で表される4つの機能コンポーネント・コードに分割できる。コード1に対応する機能コンポーネントは、無線の態様に関するWLAN機能の一部に関連している。これは、無線送受信、コーディング、変調、パワー制御、ビーコン信号制御を含んでいる。無線インタフェースに関する態様の組み合わせを分割することによって、より単純な設計が可能となる。コード2の機能コンポーネントは、認証、接続、暗号化、復号を含むセキュリティ態様に関連している。この分割の基本は、セキュリティの処理が、統合や最適化のために数学的な計算を伴うことにある。続いて、コード3の機能コンポーネントは、コントロール及びデータのプロトコル・データ・ユニット(PDU)に必要な処理を扱う。これは、ブリッジング、ルーティング、再送信、及び特殊化ネットワーク・プロセッサが開発されたインターネット・プロトコル(IP)レイヤ処理を含んでいる。次に、コード4の機能コン

ポーネントは、WLANの一般的な制御及び管理に関連している。サービス品質(QoS)コントロール、構成、ポリシー管理が、この機能コンポーネントの態様の一部である。本実施例では、WLAN機能に対して、単純、かつ実践的な区分けが提示される。種々のWLANエンティティ間の折衝は、これらの区分けに基づいて行われてもよく、さらに、区分けは、異なるエンティティを記載するために使用可能である。例えば、WLANの無線の態様のみを構成するWAPは、タイプ1エンティティと呼ばれ、残りの機能コンポーネント2、3、4が可能となるCNを必要とする。

[0065] 第1の態様の別の実施例では、WAPコントローラは、その機能に係る能力に関する情報をCNコントローラに明示的に送る必要がなく、CNコントローラが、接続されたWAPの能力を推定する。このような自動化された能力探索手段によれば、接続されたWAPとCNとの間の機能コンポーネント・コードの明示的な交換を要求せずに、機能コンポーネントを容易に決定することが可能となる。本実施例では、CNコントローラが、WAPに対して特別なコマンドを送信する。WAPは、データ・ユニットを生成して、それをその機能コンポーネントに基づいて処理することによって、この特別なコマンドに対して応答を行う。エミュレートされたデータ・ユニットは、WAPで処理された後にCNに送られる。CNコントローラは、エミュレートされた受信データ・ユニットに基づいて、接続されたWAPの機能に係る能力を推定する。この後の動作は図2のステップ209から始まる。本実施例では、接続されたWAPが、CNコントローラによって発せられた特別なコマンドを認識して応答できることが要求される。

[0066] 実施例の代替形態では、CNコントローラが、モバイル端末のように、データ・ユニットを擬似化し、擬似データ・ユニットを接続されたWAPに送る。擬似データ・ユニットの宛先アドレスは、CN自体に設定される。データ・ユニットを受信すると、WAPは、その能力に基づいて処理を実施し、処理されたデータ・ユニットをCNに送り返す。CNコントローラは、処理されたデータ・ユニットから、接続されたWAPの機能に係る能力を推定する。この後、CNコントローラは、WLAN機能の初期分割を行って、これを接続されたWAPに送る。後の動作は図2のステップ209から始まる。

[0067] 本発明の別の実施例では、WLANの動作機能と制御及び管理機能との両方を統合する単一のエンティティが提示されている。図3には、このように統合化されたWL

ANエンティティ301が図示された本実施例が例示されている。統合化されたWLANエンティティ301は、WAPコントローラ303とCNコントローラ305とがそれぞれ存在することによって、WAP動作及びCN制御管理動作の両方を行うことができる。WAP及びCNの各機能動作が、各機能コンポーネント・コードで示される機能コンポーネント307の1つによって論理的に表されている。これらの機能コンポーネントは、WLAN監視や構成管理のようなCN動作に加えて、無線送受信のようなWLAN動作を含んでいる。

[0068] 機能コンポーネント307のセットはWAP及びCNの両方のコントローラに共通なので、各コントローラの処理スケジュールは任意の機能コンポーネントを含んでいる。各コントローラは、機能コンポーネントの完全なセットがそのスケジュールのために利用できることを把握して、それぞれ独立した方法で動作する。このように、WAPコントローラ303とCNコントローラ305との間の折衝段階において、WAPコントローラは、機能コンポーネント307のすべてに対応するコードの完全なセットが含まれるように、その能力に関する情報を送る。

[0069] 統合化されたWLANエンティティ301には、多数のMT309が接続されている。WLANシステム300では、MT309が、統合化されたWLANエンティティ301を介してネットワーク・バックボーン311に接続する様子が示されている。この接続は、他の中間ノードを介するように、代替手段を介しても実施できる。しかしながら、接続されたMTにとっては、本来のWAPと統合化されたWLANエンティティとの間に違いはない。

[0070] 本実施例では、動作上、まず、統合化されたWLANエンティティのWAPコントローラが、CNの探索を行う。基本的に、この探索結果は、自らをCNとみなすものになる。探索では、接続段階に続いて、CNコントローラ及びWAPコントローラが折衝段階に入る。探索及び接続は、WAP及びCNが共に単一エンティティ内に存在するので、内部動作である。

[0071] 次に、WAPコントローラ及びCNコントローラは、それらの間で機能の適正な分割を定めるために折衝を始める。WAPコントローラは、まず、その能力に関する情報をCNコントローラに送る。この情報は、統合化されたWLANエンティティ内で利用可能

な機能コンポーネントのすべてに対応する機能コンポーネント・コードと、全コードを伴う処理スケジュールとを含むことになる。能力に関する情報に応じて、CNコントローラは、機能分割のために設定されたポリシーに基づいて、機能の初期分割を行い、これをWAPコントローラに送る。機能の初期分割は、分割を順に定めるCNコントローラによって実行可能であり、WAPコントローラにとっても実行可能、かつ受け入れ可能となる。その結果、WAPコントローラは、ACKをCNコントローラに送る。両方のコントローラは、承諾された機能の分割に基づいて処理スケジュールを設定し、これに基づいて動作を行う。本実施例では、どのように折衝のプロセスが統合化されたWLANエンティティ内で行われるかについて示されている。このように、開示された発明は、これらのエンティティのための種々のデザインと調和することになる。

[0072] 本発明の第1の態様の別の実施例では、別のCNが、異なる程度の機能を含んでいる。このように、CN及び接続されたWAPは、接続されたCN及び自らの両方で使用できない機能の処理を要求する。本実施例では、WLANの種々のCNが、それらの機能に係る能力の違いを調節するために、CN間で折衝することを可能として、このような状態を解決する。CNは、図2で述べたステップに基づいて、それらの機能の静的な違いをどのように管理するかについて定める。例えば、第1のCNは、機能コンポーネントのうちの2つのタイプを含んでいるだけであり、不可能ではあるが、第3のコンポーネントにおいて、接続されたWAPにサービスを提供することが要求されている。このようなケースでは、第1のCNは、WLANの第2のWAPを発見して折衝する。この折衝は、CN間において機能を分割するためのものである。その結果、第1のCNでは、第3の機能コンポーネントの処理が第2のCNにおいて行われるようになる。

[0073] また、本発明の第1の態様の更に別の実施例では、WLANトポロジの動的変化について言及される。図8には、動的なWLANシステム800に基づくCAPWAPの一般的な態様が図示されている。ここでは、WLAN機能(機能コンポーネント1ー5で表される)が、セントラル・コントロール・ノード801と、ワイアレス・アクセス・ポイント(WAP1 803、WAP2 805)の組との間で分割されている。なお、セントラル・コントロール・ノード801は、異なる能力を有するWAP(WAP1 803、WAP2 805)を管理することが可能である。

[0074] トポロジに係る第1の例807では、動作が静的な場合を表している。ここでは、WLANシステム800において、WAP1 803及びWAP2 805の接続が固定されている。続いて、WLANシステム800がトポロジに係る第2の例809に変形する遷移813が起こる。この例では、WAP1 803が別の位置に移動し、WAP2 805を通じて、制御ノード801への新たな接続815を確立する。遷移813は、動的な変化を表しており、第2の例809は、依然としてWAP1 803からモバイル・クライアント811に対してサービスが提供される新たなWLANトポロジを表している。また、同時に、WAP1 803は、WAP2 805にとって、別のモバイル・クライアントとして動作する。

[0075] トポロジに係る第2の例809では、通信ユニット823によって、モバイル・クライアント811からの通信トラフィックが例示されている。通信ユニット823は、まず、ステップ817に示すように、WAP1 803によって処理される。ここでは、3つすべてのWLAN機能コンポーネントとCAPWAP制御コンポーネントの処理が行われる。なお、このステップ817では、WAP2 805への送信に必要なヘッダを加えたCAPWAPプロトコル・ヘッダの形式で物理的なオーバヘッドが付加されている。これは、ステップ817の‘C1’サブ・フィールドによって例示されている。次に、WAP2 805において、ステップ819が実行され、再び、別のセットのWLAN機能及びCAPWAP制御コンポーネントの処理が行われる。次に、ステップ821において、セントラル・コントローラ801が、ステップ817及び819のそれぞれの補完機能を実行する。ステップ821のサブ・フィールドに基づけば、セントラル・コントローラ801が、いくつかの補完機能を重複させてしまうことは明白であり、本発明は、こうした処理の重複や送信オーバヘッドを避けることを目的としている。

[0076] また、図10には、各ステップに関する本発明の動作が記載されている。ステップ1001及び1003において、ネットワーク構成のあらゆる変化を確定できるように、ワイアレス・ネットワークのトポロジの監視が行われる。これらのステップを実現する手段は、受信した通信ユニットのヘッダフィールドを分析して、それらと、あらかじめ設定されているネットワーク・トポロジの表現との比較を行うことである。例えば、WLANに基づくIEEE802. 11の仕様では、制御ノード801が、WAP1 803に対応した信頼のあるモバイル・クライアントに関して、WAP2 805から接続要求(Association Request)を受

信する場合に、制御ノード801とWAP1 803との間の現在のトポロジにWAP2 805が含まれていることが推測される。また、トポロジの変化を確立する別の手段は、隣接ネットワーク・エンティティに関する情報を周期的に交換することによる。これらの交換される情報の変化は、トポロジの変化を意味する。

[0077] ネットワーク・トポロジの変化が決まった場合、その変化を調整するネットワークエンティティ(WAP2 805)は、ステップ1005に示すように、'オペレーショナル・アソシエーション'信号によるトリガを受ける。この信号は、トポロジの変化に影響を受けるネットワーク・エンティティ(WAP1 803、WAP1 803によって管理されているモバイル・クライアント811)に関する予備状態情報を有している。IEEE802.11の仕様に基づく一例では、予備状態情報は、WAP1 803によって管理されているモバイル・クライアント811の数、モバイル・クライアント811の接続に係る識別情報、モバイル・クライアント811の送信元MACアドレスを含んでいる。また、さらに、予備状態情報は、トポロジの変化をもたらすネットワーク・エンティティ(WAP1 803)のMACアドレスなどの付加的な状態情報を含んでいてもよい。次に、ステップ1007において、トポロジの変化を調整するネットワーク・エンティティ (WAP2 805)は'オペレーション・アップデート'信号によるトリガを受け、トポロジの変化に係る処理を行うために、その機能の調節を行う。IEEE802.11の仕様に基づく一例では、'オペレーション・アップデート'信号は、'送信ブロックへのフレーム転送'動作に対応するコード値と、前述の動作が取られる'データ・フレーム'のタイプに対応するコード値とを含んでいる。また、さらに、'オペレーション・アップデート'信号は、'BSSID(Basic Service Set Identification)'、'送信元MACアドレス'、'送信先MACアドレス'などの追加パラメータを有していてもよい。IEEE802.11の仕様に基づく別の一例では、'オペレーショナル・アップデート'信号は、WAP2 805の媒体アクセス制御(MAC)管理と制御ロジックに影響を与える。特に、トポロジの変化をもたらすネットワーク・エンティティ(WAP1 803)によって管理されるモバイル・クライアント811からの通信フレームが、通常の接続及び認証のフェーズを実行することなく、WAP2 805によって管理されるように、ロジックの変更が行われてもよい。さらに、別の一例では、このロジック変更は、モバイル・クライアント811から受信するすべての通信フレームを、通常の一連の処理に渡すように

、WAP2 805の‘受信’ブロックの‘Filter#MPDU’処理を変更することによって実現される。その代わりに、接続及び認証の処理は、制御ノード801において、あらかじめ確立されている可能性がある。

[0078] トポロジの変化を調整するネットワーク・エンティティ(WAP2 805)がアップデートされた後、トポロジの変化をもたらすネットワーク・エンティティ(WAP1 803)は、ステップ1009に示すように、‘オペレーショナル・アソシエーション・リクエスト’信号によるトリガを受ける。IEEE802.11の仕様に基づく一例では、‘オペレーショナル・アソシエーション・リクエスト’信号は、どの対応する情報の値がリクエストされたかに応じて、‘セキュリティ・アルゴリズム・タイプ’、‘セキュリティ・キー’、‘セッション識別情報’、又は‘アソシエーション識別情報’のパラメータに対応するコード値を有している。リクエスト信号は、管理するWAP1 803と、モバイル・クライアント811に関する特定の状態情報を得るためのものである。このとき、ステップ1011に示すように、WAP2 805は、‘オペレーショナル・アソシエーション・アップデート’信号を受け取ることにより、この状態情報を認識し、今後使われる機能に関する準備を行う。IEEE802.11の仕様に基づく一例では、‘オペレーショナル・アソシエーション・アップデート’信号は‘セキュリティ・アルゴリズム・タイプ’、‘セキュリティ・キー’、‘セッション識別情報’又は‘アソシエーション・識別情報’のパラメータに対応する情報の値を含んでいる。

[0079] 次に、ステップ1013において、トポロジの変化をもたらすネットワーク・エンティティ(WAP1 803)が、その機能ロジックを変更するように‘オペレーション・アップデート’信号によるトリガを受ける。特に、この信号は、WAP2 805で重複してしまう可能性のある任意の処理をWAP2 805にバイパス(WAP1 803での処理を無視し、WAP2 805でのみ処理を行わせる)するように、WAP1 803に指示するものである。ステップ1013の意図は、WAP1 803及びWAP2 805の両方で、WLAN及びCAPWAP処理が重複してしまうことを防ぐことにある。さらに、WAP1 803における処理のバイパスによって、新たに確立された無線接続815上において、送信に係る物理的なオーバヘッドが減少し、その結果、伝送の遅延が減少する。なお、これら2つの態様の組み合わせることによって、確実に、WAP1 803と制御ノード801との間のタイミングの制約が、初期のトポロジ状態に応じて維持されるようにすることができる。

[0080] IEEE802.11の仕様及びCAPWAPのフレームワークに基づく一例では、オペレーショナル・アソシエーション状態情報が、セントラル・コントロール・ノードを通じて、トポロジの変化や、トポロジの変化をもたらすネットワーク・エンティティを調整するネットワーク・エンティティ間で交換される。

[0081] なお、上述のオペレーショナル・アソシエーション状態情報の交換の一例の代わりに、トポロジの変化や、トポロジの変化をもたらすネットワーク・エンティティを調整するネットワーク・エンティティ間で、明示的なオペレーショナル・アソシエーションが設定されることなく、上述の交換が実施されるようにすることも可能である。トポロジの変化をもたらすネットワーク・エンティティ(WAP1 803)は、状態情報を含む通信フレームに、特定の'フレームタイプ'コードを使用するように指示されている。次に、トポロジの変化を調整するネットワーク・エンティティ(WAP2 805)が、'オペレーション・アップデート'信号によるトリガを受け、これにより、交換手段を用いて、特定の'フレームタイプ'コードを用いた通信フレームの処理が可能となる。例えば'サブタイプ'や'持続時間／ID'コードが代わりに使用される。特に、交換手段は、前述の通信フレームのデカプセル機能を有しており、状態情報として、ペイロードを使用する。一具体例としては、制御ノード801によって様々なトリガ信号が管理される。

[0082] 動的なCAPWAPのフレームワークでは、トポロジの変化をもたらすネットワーク・エンティティ(WAP1 803)は、トポロジの変化を調整するネットワーク・エンティティ(WAP2 805)を通じて、制御ノード801との通信を行う。

[0083] ステップ1007、1013において、WLANのローカル・レベルやCAPWAPの機能セマンティックス(機能セマンティックスは、WLAN動作において必要とされる処理のセットやシーケンスに対応している)が壊れ、その結果、上述の処理のうちの選択されたサブ・コンポーネントは、選択されたネットワーク・エンティティ、トポロジの変化を調整するネットワーク・エンティティや、トポロジの変化をもたらすネットワーク・エンティティでバイパスされる。しかしながら、各ステップの組み合わせ1000において、本発明によれば、制御ノード801、WAP1 803、WAP2 805の中で、選択された処理に係るサブ・コンポーネントを分割することによって、WLANのシステム全体のセマンティックスや、CAPWAPの機能における処理が達成される。したがって、各ステップ1000

は、選択的にサブ・コンポーネントの様々な処理を動作させて、これによって、システム全体の機能セマンティックスを達成する。なお、各ステップ1000が組み合わされたり、分けられたり、本発明の本質から逸脱せずに、最適化、実施、他の目的のために変更が加えられたりすることは、当業者にとっては明白である。このように、本発明の範囲は、特定の各ステップ1000に制限されるものではない。

[0084] また、図9には、WAP1 901における各ステップ1000に関する動作の一実施例が示されている。WAP1 901のロジック動作は、IEEE802. 11のWLAN仕様に基づいているが、他の無線に係る仕様に関しても容易に示すことが可能である。WAP1 901は、一般的な動作に加えて、様々なデータ(D)、管理(M)、コントロール(C)フレームを処理することによって、モバイル・クライアント903の管理を行う。また、処理としては、'受信'905、'WAP処理'909、'送信'911のブロックが論理的に含まれている。さらに、'受信'ブロック905には、論理がフィルタ907に基づくロジックを有する'Filter#MPDU'処理を有している。フィルタ907は、フレームが様々な判断基準に基づいて、到着フレームの比較を行い、適切な処理を行うために使用される。

[0085] ステップ1013の'オペレーション・アップデート'信号に応じて、フィルタ・ロジックは、フィルタ・ロジック・アップデート913の変更が含まれるように、アップデートされる。具体的には、データ・フレームは直接'送信'ブロック911に送られて、'WAP処理'ブロック909は完全にバイパスされる。その結果、大部分のデータ・フレームに関する処理時間はWAP1 901において、かなり短縮される。そして、これらのデータ・フレームは、ステップ1007に従って、動作がアップデートされたWAP2 915によって処理される。管理及び制御フレームは、WAP1 901とモバイル・クライアント903との間の接続に直接関連しており、WAP1 901で局所的に処理される。このように、本発明では、WAP1 901の受信ロジックに影響を与えることによって、選択的に処理を動作させる。

[0086] ある具体例では、トポロジの変化を調整するネットワーク・エンティティと、トポロジの変化をもたらすネットワーク・エンティティが、異なった無線の仕様に従って動作する。図8に関しては、IEEE802. 11の仕様に従って、WAP1 803が動作しており、IEEE802. 16に従って、WAP2 805が動作している。そして、ローカル・レベルの機能

セマンティックスを適用する一方で、システム全体の機能セマンティックスを維持するという原則が、異なった無線の仕様に従って動作するネットワーク・エンティティに対して適用される。なお、ブルートゥースの接続性、IEEE802．20、携帯電話や、その他の無線の仕様では、動作における相違点が含まれる可能性がある。

[0087] なお、動的なWLANトポロジに係る本発明には、数多くのシナリオや応用が含まれている。例えば、将来のホーム・ネットワークは、即座にカバー・エリアを拡張することができるようになる可能性がある。また、輸送システムが、送信コンポーネント及び受信コンポーネントを有しており、一時的な停止場所、駅、港などで、ネットワーク・トポロジが変化する可能性もある。また、製造が容易となることによって、様々な時間の様々な位置に対して接続性を提供する通信ネットワークが提供されることになる。以上に説明した本発明によれば、動的なトポロジ環境における遅延やオーバヘッドに係る課題に取り組むために、これらのシナリオを具体化することが可能である。

[0088] 以上、説明された本発明の第1の態様の実施例では、WLANエンティティが、各エンティティに含まれる様々な程度の静的な違いを調節するために互いに折衝を行う際のポリシーが示されている。さらに、この実施例では、ローカル・レベルの機能セマンティックスを破ることによって、システム全体の機能セマンティックスを維持しながら、WLANトポロジにおける動的な変化を可能にするという、本発明の第1の態様の応用が示されている。そこでは、様々な程度のWLAN機能を有するWAPを制御ノードがどのように統合的に管理するかについて記載されている。折衝のための開示された方法によれば、異なる製造者によるエンティティ又は異なる構成のエンティティを有するWLANを設ける際の柔軟性が提供される。従来の技術ではWLANエンティティ間において機能を分割する適切な手段の配備に焦点が置かれているが、本発明では、異なる程度の機能のエンティティの調整を行っている。その結果、制御ノードとワイアレス・アクセス・ポイントとの間のWLAN機能の分割を柔軟に実施することができる。

[0089] 動的な違いを調節する折衝

[0090] 本発明に係るこの態様では、開示された発明を具体化するWLANエンティティが、動的な違いを調節するために互いに折衝する際のポリシーについて記載されている

。ここでは、異なるWLANエンティティ、特にWAPにおける処理負荷の変動レベルを利用することによって例示が行われる。

[0091] 本発明の本態様を具体化するWLANシステム400が、図4に単純化して図示されている。ここでは、サービスを提供するとともに多数の接続されたWAPに関連した処理を実施できるWAP401、403が図示されている。WAP及びMTは、互いに多数の接続を維持しているが、単純化のために、WLANシステム400は、単一のMT405がWAP401との間で1つの接続を有している状態のみが図示されている。MT405は、WAP401に接続して、ワイアレス・コネクション427上でWAP401からのサービスを受ける。また、WAP401、403は、ネットワーク・バックボーン407に接続している様子が図示されているが、直接又は中間スイッチング又はルーティング・デバイスを経由して他のネットワーク及び相互に通信することが可能である。さらに、WAPは、多数の中間ノードを経由してネットワーク・バックボーン又は相互に接続している。

[0092] WLANシステム400の動作中に、WAPの処理負荷は、通信の動的特性のために変動する。例えば、多数の新しいMTが、WAPとの接続を選択して、WAPでの更なる処理の際に折衝を行う。また、別の例では、MTが更に多数の通信セッションを選択し、接続されているWAPにとっては過剰な処理となる。そして、結果的に、WLANシステムの種々のWAPの処理負荷は、時間と共に変動する。開示された発明では、MTとの既存の接続関係を維持しながら、比較的軽負荷のWAPに重負荷のWAPから処理負荷を移すために、互いに折衝することをWAPに要求することによって、この動的な構成の問題を取り扱う。

[0093] 図4では、WAP401、403は、あるタイプの処理を自ら実施して、接続されているMTにサービスを提供する。この処理は、接続固有(ASP:Association Specific)及び非接続固有(nASP:non-Association Specific)処理のように、WAP401、403のそれぞれにおいて、ライン419、421により論理的に分割できる。ASP処理411、413は、MTとWAPとの間の接続に直接依存するものを伴っている。このような処理は、WAP及び接続されているMTの間において、ワイアレス・インタフェースの相互作用を要求する。ASP処理の例としては、データ・ユニットの送受信、パワー制御、コーディング、変調がある。

[0094] nASP処理415、417は、WAP401、403及び接続されているMT405の間の接続の無線の態様に直接依存しない処理を意味する。nASP処理の例としては、ブリッジング、フィルタリング、プロトコル・データ・ユニット(PDU)処理、PDU伝送がある。

[0095] WAPコントローラ423、425は、それぞれ、WAP401、403における全体的な処理を管理して制御する。

[0096] 本発明の本態様に関連する動作を、図5を参照しながら説明する。WLANシステムのWAPのそれぞれにおけるWAPコントローラは、WAPのnASP処理負荷をモニタリング(監視)するステップ501を行う。これは、接続されたMTのすべてに対して通信セッションごとにnASP処理負荷を監視することを含んでいる。処理負荷を監視する方式の例として、通信セッションに対してプロセッサの活動期間又はプロセッサの利用状態を監視して、これを全通信セッションに対して合計する手段を含んでいる。別の例は、通信セッションに対してメモリの使用量を監視する手段である。同様に、WAPにおける全体的なnASP処理負荷を監視するために、他の多数の要因を、個別に又は任意の組み合わせで監視することができる。さらに、他の監視手段を使用することも可能である。

[0097] 本発明のある実施例では、WAP401のWAPコントローラ423は、接続されているMTの通信セッションごとに監視したnASP処理負荷の種々の要因に基づいて、WAPのリソース特性を導く。リソース特性は、通信セッションにサービスを提供するために必要なリソース又は処理負荷の表現形態である。

[0098] 次に、接続されたすべてのMTの全通信セッションのリソース特性を組み合わせて、WAP401の総計のnASP負荷ファクタを得る。ステップ503において、総計のnASP負荷ファクタがnASP負荷閾値と比較されて、WAP401で管理できないおそれがある切迫したnASP処理過剰負荷条件の見極めが行われる。なお、総計のnASP負荷ファクタがWAP401で管理可能であることが決定された場合には、ステップ501のモニタリングが繰り返し行われる。

[0099] しかし、nASP処理過剰負荷条件が切迫していることが決定された場合には、ステップ505において、WAPコントローラ423は、例えばMT405のような接続されているMTとの既存の接続関係を維持しながら、同時に、WAP401の全体的な処理負荷を

低減するために、WAP401のnASP処理負荷のどの部分が、WLANシステムの他のWAPに分散可能であるかについて決定する。このようなメカニズムは、MTが別のWAPのカバー・エリアに物理的に移ることが必要なハンドオーバを指示して、処理負荷を分散する従来の方法と比べて独自のものである。ステップ505は、WAP401及び接続されているMTの通信セッションのリソース特性に基づいている。例えば、WAPコントローラは、最大のリソース特性を持つ処理負荷の部分、又は最小のリソース特性を持つ部分を分散するように選択できる。この選択は、リソース特性の将来の変化予測のような他のファクタに基づいてもよい。

[0100] 次に、折衝段階が、第1のWAPコントローラと他のWAPコントローラとの間で開始される。この段階では、他のWAPのどれが、過剰負荷の第1のWAPのnASP処理負荷の一部を引き継いで、処理負荷における動的な違いの調節に同意できるかが決定される。折衝の最初の段階において、WAPコントローラ423は、WLANシステムの他のWAPに要請メッセージを送るステップ507を実行する。要請メッセージは、WAPコントローラによって定められた他のWAPに配分すべきWAP401のnASP処理負荷の部分に係るリソース特性を含んでいる。

[0101] 要請メッセージを受け取ったWAPコントローラは、メッセージで指定された付加的な処理負荷を調節できるかどうかを決定する。これらのコントローラは、指定されたすべての負荷の引き継ぎを許諾するか又は負荷量の一部の取扱を許諾することにより、その要請を始動したWAPコントローラに対して、応答を行う。始動したWAPコントローラは、応答を用いて、初期に指定済みのnASP処理負荷の部分の受け入れに関して、他のWAPのどれが、どの程度同意しているかを決定する。なお、この折衝では、始動するWAPコントローラによって、このようなニーズが存在すると推定された場合には、初期の要請メッセージを省略することも可能である。このように、ステップ507を用いると、WLANシステムの他のWAPのどれが、WAP401の処理負荷を低減するために、WAP401のnASP処理負荷の部分に係る処理を受け入れて実行することに同意しているかどうかを見極めることができる。

[0102] 次に、ステップ509において、過剰負荷の、又はまもなく過剰負荷になるWAPのWAPコントローラ423は、WAP401と、WAP401のnASP処理負荷の決定部分の受

け入れ及び処理に同意しているWAP（ステップ507で決定されたWAP）との間にトンネル・コネクション409を設定する。図4では、同意しているWAPの1つがWAP403であるように図示されている。nASP処理負荷の決定部分の処理に必要な関連コンテキスト情報が、同意しているWAPに対して設定されたトンネル・コネクション409を介して送信される。次に、ステップ511において、WAPコントローラ423は、トンネル・コネクション409を介して同意しているWAPに対して、WAP401のASP処理負荷の決定部分を送って、WAPコントローラ423は、WAP401の全体的な処理負荷を低減する。これはすべて、接続されているMTとの既存の接続を維持しながら、かつ同意しているWAPとの調和を図る巧みな方式で実施可能である。

[0103] 本実施例では、従来のハンドオーバ・ベースの方法における制限なしに、処理負荷の分散における本発明の本態様の効果が示される。このように、地理的位置やMT移動に関する制約はない。

[0104] また、本発明の本態様の別の実施例では、過剰負荷のWAPが、接続されているMTの通信セッションに必要な処理負荷を、同意する他のWAPに単純に中継する。この中継は、無線、有線、又は両方のタイプのリンクの組み合わせによって行われる。また、中継される処理負荷の処理を促すように、関連コンテキスト情報が中継される必要性もある。

[0105] ある実施例では、2つのWAP間のトンネル・コネクションが、WAP間の直接的なリンク上で設定される。この直接的なリンクは、ワイアレスでよく、WAPとMTとの間のリンクと似ている。このケースでは、WAPは、接続されているMTとの通信用チャネルから代用できる無線チャネルを決定し、これを用いて、nASP処理負荷の決定部分及び関連コンテキスト情報を交換する。また、代わりに、2つのWAP間のリンクを有線にして直接的に接続することもできる。本実施例では、トンネル・コネクションは、ネットワーク・バックボーンを経由する必要がなく、むしろ直接的に設定できる。

[0106] 本発明の別の実施例では、nASP処理負荷は、接続されているMTとの間で送受信されるMAC　PDUの暗復号化に用いられるセキュリティ・アルゴリズムのために必要な処理と定められる。セキュリティ・アルゴリズムの処理は、複雑な特性のためにコンピュータ計算の負荷が高くなる非接続固有処理のタイプである。このように、接続さ

れているMTの数又は接続されているMTに出入りするトラフィック量の大幅な増加によって、セキュリティ・アルゴリズムの処理が対応して増加することになる。本実施例では、WAP及び接続されているMTは、設定されたセキュリティ・アルゴリズムに基づいて、ワイアレス・コネクション上の送信情報を暗号化する。送信情報を受信すると、WAP及びMTは、設定された同一のセキュリティ・アルゴリズムに基づいて復号処理を行う。

[0107] 暗復号化のためのnASP処理負荷が大きくなり、そのリソース特性がnASP負荷閾値を超えて測定された場合、WAP401のWAPコントローラ423は、要請メッセージを送って、WLANシステム400における他のWAPのどれが、WAP401とMT405との間の送信に用いられるセキュリティ・アルゴリズムに対応するnASP処理負荷の部分の受け入れ及び処理に同意できるかを決定する。WAP403がnASP処理負荷の処理に同意可能な場合、そのWAPコントローラ425が要請メッセージに応答する。要請メッセージに対する応答を受信すると、WAPコントローラ423は、トンネル・コネクション409をWAP403に設定し、関連するセキュリティ・キーとコンテキスト情報とをWAP403に設定したトンネル・コネクションを介して送る。

[0108] 次に、トンネル・コネクション409を設定し、セキュリティ・キー及びコンテキスト情報を交換すると、WAPコントローラ423は、接続されているMT405から受信した暗号化MAC PDUをWAP403に送る。WAPコントローラ423は、結合したMT405に送信する前に暗号化すべきMAC PDUをWAP403にも送る。WAP403は、MAC PDUの暗号化のためにnASP処理負荷を処理し、WAP401に対してトンネル・コネクションを介して暗号化MAC PDUを送る。暗号化MAC PDUを受信すると、WAP401は、接続されているMTにそれらを送信する。本実施例では、セキュリティ・アルゴリズムに関してコンピュータ計算の負荷が高くなる処理を、他のWAPに分散して、WAPの処理負荷を減らす。これはMTの再結合に関与せずに行われるので、この方法は、ハンドオーバ・ベースの方法によって制限されるものではない。

[0109] また、別の実施例では、WAPコントローラは、接続されているMTとの接続関係を維持しながら、同時に、前述のセキュリティ・アルゴリズムを把握できないためにWAPが処理できない、セキュリティ・アルゴリズムに対応するnASP処理負荷を分散する。

WLANに係る能力を含むMT及び他のデバイスの数が増えており、このようなMT及びデバイスに組み込まれるセキュリティの特徴も多数存在している。接続が求められるすべてのWAPが、あらゆるセキュリティ・アルゴリズムを認識できるわけでない。このように、本実施例では、WAPに要求された処理の一部がこのWAPで不可能な場合でも、MTと他のデバイスとの接続が維持されるようにする。本実施例では、非共通のセキュリティ・アルゴリズムを利用する例が説明されているが、WAPとMTとの間で共通ではない任意の他のタイプの処理に対しても有効である。

[0110] WAPにMTが接続している状態で、2つのエンティティ間のワイアレス・コネクション上での送信を保証するために両方のエンティティが把握できるセキュリティ・アルゴリズムが折衝される。従来、MTによって利用される任意のセキュリティ・アルゴリズムをWAPが把握できない場合には、MTは、前述のWAPと接続することは不可能である。本発明の実施例では、MTによって利用される任意のセキュリティ・アルゴリズムを把握することができない場合でも、この制限を超えて、MTがWAPと接続することを可能とする。

[0111] また、本実施例では、WAPコントローラ423は、WAP401及びMT405の両方が把握できない非共通のセキュリティ・アルゴリズムが存在しても、MT405がWAP401に接続することを可能にする。折衝段階中に、WAPコントローラ423は、要請メッセージをWLANシステム400の他のWAPに送り、どのWAPが、MT405が熟知している任意のセキュリティ・アルゴリズムを把握しており、その処理に同意できるかどうかを決定する。WAP403が、MT405が熟知している任意のセキュリティ・アルゴリズムを把握して、その処理に同意可能な場合には、WAPコントローラ425は、選択されたセキュリティ・アルゴリズムを用いて、WAPコントローラ423からの要請メッセージに応答する。要請メッセージの応答を受信すると、WAPコントローラ423は、WAP403とのトンネル・コネクション409を設定する。次に、WAPコントローラ423は、設定されたトンネル・コネクション409を介してWAP403に関連するセキュリティ・キー及びコンテキスト情報を送る。そして、選択されたセキュリティ・アルゴリズムがMT405に通知されるとともに、MT405が、WAP401に接続される。

[0112] トンネル・コネクション409を設定し、セキュリティ・キー及びコンテキスト情報を交換

すると、WAPコントローラ423は、選択されたセキュリティ・アルゴリズムに基づいて暗号化されている、WAP401と接続するMT405から受信したMAC　PDUを、WAP403に送る。WAP403は、暗号化されたMAC　PDUをトンネル・コネクション409を介して受信し、選択されたセキュリティ・アルゴリズムと設定したセキュリティ・キー及びコンテキスト情報に基づいて、それらの暗号を解読する。さらに、WAPコントローラ423は、接続されているMT405に送信する前に暗号化すべきMAC　PDUを、WAP403に送る。このケースでは、WAP403は、MAC　PDUをトンネル・コネクション409を介して受信し、それらを選択されたセキュリティ・アルゴリズムに基づいて暗号化し、暗号化されたMAC　PDUをWAP401に送り返す。WAP401は、暗号化されたMAC　PDUを、接続されているMT405に送る。本実施例では、セキュリティ・アルゴリズムについての知識に欠けていても、WAPが、MTの接続を制限しない。このように、異なる処理要求を有する数多くのMTに対してサービスを提供する際に、より大きな柔軟性が提供される。

[0113]　本発明の別の実施例は、WAPが処理するPDUのサイズに関連している。プロセッサ・スケジューリングの研究から、小さなPDUの前に大きなPDUを処理することは、小さなPDUが大きなPDUの前に処理されるケースと比べると、平均処理時間が長くなることが分かっている。図6は、例を用いてこれを示すものである。第1のケースでは、プロセッサ613、615のそれぞれに対して、2つの処理スケジュール601、603が示されている。スケジュール順序605、607は、PDUのA、B、C、Dが処理される相対的な順序を示す。また、609、611は、任意の時間単位（tu）で、各PDUの処理のために必要な処理時間を示している。

[0114]　スケジュール601において、大きなPDUのAとBは、小さなPDUのCとDの前に処理される。PDUの平均処理時間は21．25tuであるが、小さなPDUのCとDが大きなPDUのAとBの前に処理されるスケジュール603のPDUの場合には、わずか16．25tuである。スケジュール603では、小さなPDUが大きなPDUの前に処理されるので、明らかに、平均処理時間が大幅に短縮している。

[0115]　第2のケースでは、プロセッサ・スケジューリングの処理のオーバヘッドの態様が考慮されている。各PDUの処理には、メモリ・アクセス時間及びコンテキスト転送時間が

含む処理のオーバヘッドが必要になる。オーバヘッドは、実際の処理の前に必要になるので、一般的に、PDUのサイズには依存しない。図6は、小さなPDUだけのスケジュール617を示し、処理オーバヘッド時間及び実際の処理時間がそれぞれ、621、625で示されている。処理オーバヘッド時間623及び処理時間627は、スケジュール619の大きなPDUのためのものである。この図によれば、スケジュール617では、処理オーバヘッドが総時間の50%までになるが、スケジュール619では、オーバヘッドは33・1／3%を占めているにすぎないことが分かる。これは、小さなPDUのみの処理が、プロセッサが大きなPDUを扱う場合に比べて、プロセッサが、どのくらい多くのオーバヘッドを扱うことになるかを示している。

[0116] PDUのサイズに関連する本発明の実施例では、nASP処理負荷が、WAPで処理されるPDUのサイズによって定められる。WAP401のWAPコントローラ423は、接続されているMT405からワイアレス・コネクション427上で受信したPDUのサイズを監視する。WAPコントローラ423が、WAP401が任意の前述のケースのいずれかの処理を行っていると決定した場合には、コントローラは、監視した受信PDUのサブセットの処理スケジュールを決定する。この処理スケジュールの目的は、WAP401における平均処理時間及び処理オーバヘッド時間を最適化することにある。

[0117] 次に、WAPコントローラ423は、処理に対して同意可能な他のWAPに分散することができるPDUのリソース特性を取得する。このように、リソース特性は、WAP401自らが処理するもの以外のPDUの処理に必要な処理負荷を表している。このとき、リソース特性は、PDUの処理に同意可能なWAPを決定するための要請メッセージの一部に記載されて、WLANシステム400の他のWAPに送られる。

[0118] WAP403が要請メッセージに記載されているPDUのnASP処理に同意可能な場合に、WAPコントローラ425は、これに応じた応答を行う。WLANシステム400のWAPは、このようなPDUの処理が自らの平均処理時間及び処理オーバヘッド時間の最適化を可能にする場合に、別のWAPからのPDUの処理に同意可能となる。応答を受信すると、WAPコントローラ423は、WAP403とのトンネル・コネクション409を設定し、関連するコンテキスト情報をWAP403に設定されたトンネル・コネクションを介して送る。

[0119] トンネル・コネクションを設定し、関連するコンテキスト情報を交換すると、WAPコントローラ423は、WAP401の処理オーバヘッド時間と平均処理時間とを最適化するために、既に送られてきているリソース特性が示すPDUを、WAP403に送る。本実施例によれば、異なるサイズのPDUに係るnASP処理は、MTとWAPとの間の接続関係を同時に維持しながら、処理の最適化を行うように分散することができる。

[0120] また、別の実施例では、処理されるデータ・ユニットのサイズ、データ・ユニットの処理について予想される平均時間、データ・ユニットを処理するためのオーバヘッド時間、上記の情報に関して重み付けされた総計を含む情報に基づいて、WAPコントローラによって、nASP処理の負荷の分配が行われる。

[0121] 開示される方法の別の実施例は、第1のWAP及びそれに接続されているMTとの間の接続関係を維持しながら、第1のWAPから他のWAPに、ISO―OSIレイヤ3及びレイヤ3上のレイヤの処理の配分に関連している。WAPの多くはISO―OSIレイヤ2まで処理できるが、ISO―OSIレイヤ3を処理できるWAPを製造するベンダもいる。本実施例では、このようなデバイス及び他の同様のWAPが示唆されている。ISO―OSIレイヤ3及びレイヤ3上のレイヤの処理には、サービス品質(QoS)の提供、ルーティング、スケジューリングが含まれている。本実施例では、nASP処理負荷は、ISO―OSIレイヤ3及びレイヤ3上のレイヤに関する処理として定められる。

[0122] 本実施例では、WAP401のWAPコントローラ423は、WAP401及び接続されているMT405の間の各通信セッションに対して監視されたnASP処理負荷のファクタに基づいて、ISO―OSIレイヤ3及びレイヤ3より上のリソース特性が求められる。すべての通信セッションのリソース特性は、WAP401の集計したnASP負荷ファクタが得られるように組み合わされており、切迫したnASP処理過剰負荷条件を決定するために、nASP負荷閾値と比較される。

[0123] 切迫したnASP処理過剰負荷条件が決まると、WAPコントローラ423は、WAP401の全体的な処理負荷を低減するために、WLANシステム400の他のWAPに配分されるISO―OSIレイヤ3及びレイヤ3上のレイヤのnASP処理負荷の部分を決定する。次に、WAPコントローラ423は、ISO―OSIレイヤ3及びレイヤ3より上のnASP処理負荷の決定された部分に関するリソース特性を含む要請メッセージを送り、他のW

APのどれが、WAP401のためにnASP処理負荷の部分の処理を受け入れて実施することに同意可能であるかを決定する。

[0124] WAP403が要請メッセージに基づくnASP処理負荷の部分の処理に同意可能な場合、WAPコントローラ423は、肯定的な応答をWAP401に送る。応答を受信すると、WAPコントローラ423は、トンネル・コネクション409をWAP401とWAP403の間に設定し、その後、ISO—OSIレイヤ3及びレイヤ3より上のnASP処理負荷の部分の処理に必要な関連コンテキスト情報が、WAP403にトンネル・コネクション上を介して送信される。WAPコントローラ423は、コントロール・マネージャの権限の下で、MTとWAPとの間の既存の接続関係を維持しながら、他のWAPに処理負荷の部分を分散することによって、WAP401のnASP処理負荷を低減することを目的とし、WAP403に対してnASP処理負荷の決定部分を分配する。

[0125] WLANエンティティ間の動的な違いを調節する折衝を取り扱う本発明の態様の更に別の実施例では、コントローラ・エンティティが折衝を行う。概して、セントラル・コントローラ・エンティティは、関与しているWLANエンティティ間において、動的な違いの管理方法の調整を行う。ある特定の実施例では、セントラル・コントローラ・エンティティの権限の下、セントラル・コントローラ・エンティティが、WAPのnASP処理負荷の配分を調整する。

[0126] これに関して、図7を参照しながら、WAP701、703のnASP処理負荷を監視できるセントラル・コントローラ729について説明する。WAP701のnASP処理負荷がnASP処理負荷閾値を超えると、セントラル・コントローラ729は、WLANシステム700の他のWAPに対して、WAP701の処理負荷の部分の処理のサポートを要請する要請メッセージを送る。これによって、WLANシステム700のセントラル・コントローラ729と他のWAPとの間の折衝段階が始まる。要請メッセージは、WAP701の全体的な処理負荷を低減するために、他のWAPに送られるWAP701の処理負荷の部分の記述子を含んでいる。

[0127] WAP703がWAP701の処理のサポートに同意可能な場合、WAPコントローラ725が要請メッセージに応答する。セントラル・コントローラ729は、認可についてWAP701に通知し、その後、WAP701はWAP703とのトンネル・コネクション709を設定

する。そして、WAP703に対して、関連コンテキスト情報と、続いて、要請メッセージで指定された処理負荷の部分とを送る。なお、代わりに、WAP701が、コンテキスト情報及び処理負荷の部分をセントラル・コントローラ729に送り、セントラル・コントローラ729が、例えば、WAP703などのような同意可能なWAPに対して、これを送ってもよい。このように、本実施例によれば、配分を調整するセントラル・コントローラによって、処理負荷が、WLANのWAPに配分される。

[0128] 別の実施例では、セントラル・コントローラが、その権限の下で、WAPのWAPコントローラから、WAPのnASP処理負荷に関する定期的な情報を受信する。このように、WAPコントローラは、他のWAP又は他のWLANエンティティにnASP処理負荷の一部又はすべてを配分する必要性と過剰負荷条件とを自ら決定する。したがって、本実施例の折衝段階は、WAPコントローラによって始動され、セントラル・コントローラと他のWAPとの間で更に処理が進められる。

[0129] 以上に提示した実施例では、種々のWLANエンティティ間において、開示されたポリシーに基づいて、動的な違いを調節するための折衝の利用方法が示されている。ここでは、特に、処理負荷を接続固有と非接続固有として区分けする方法が説明されている。また、ここでは、どのようにしてnASP処理負荷の部分が、第1のWAPの全体的な処理負荷を低減するためにWLANシステムの他のWAPに配分されるかについて図示されている。開示された本発明は、MTとWAPとの間の既存の接続関係を維持しながら、処理負荷の配分を可能にする点で独自のものである。このように、動的な違いを調節するための開示された方法は、従来の方法と異なり、任意のWLANエンティティの物理的な移動を必要としない。したがって、この革新的な技術は、処理負荷を配分するハンドオーバ・ベースの方法より柔軟性に富んでおり、このような方式の限界を克服するものである。

[0130] また、以上に開示された種々の態様では、WLANエンティティ間における静的及び動的な違いを調節する際に折衝する新規な方法が示されている。従来の方法ではWLANエンティティにおけるハードの機能による分割に焦点を置いているが、本発明では、機能分割を柔軟に実施できる代替手段が提示される。また、従来の方法では、再接続とハンドオーバで生じる地理的制約及び物理的制約が必要とされるが

、この革新的な技術によれば、ハンドオーバ・ベースの方法の制約を伴わずに、処理負荷のアンバランスに対処する方式が提案されている。

[0131] また、開示された発明は、この開示の本質及び趣旨から逸脱せずに、WLANエンティティ間の違いを折衝して対処するための他のポリシーが、様々な多数の他の実施の形態を作ることは、当業者には自明のことである。以上のように、本発明は、このような実施例及び具体例のすべてにおいて適用可能である。

産業上の利用可能性

[0132] 本発明は、WLANエンティティ間における違いを調整することを可能にするという効果を有しており、ワイアレス・ローカル・エリア・ネットワークの技術分野に適用可能であり、特に、ヘテロジニアスな環境におけるワイアレス・ローカル・エリア・ネットワークの技術分野に適用可能である。

請求の範囲

[1] ワイアレス・ローカル・エリア・ネットワークでサービスを提供するシステムであって、

(1)前記ワイアレス・ローカル・エリア・ネットワーク用の所定の完全な機能のサブセットを処理することが可能な、単一又は複数のワイアレス・アクセス・ポイント(WAP)と、

(2)前記ワイアレス・ローカル・エリア・ネットワーク用の所定のサブセット又は完全な機能を処理することが可能な、単一又は複数の制御ノード(CN)と、

(3)ワイアレス・アクセス・ポイントが、セキュアな接続及び機能分割の構成を行うために、前記制御ノードと動的に折衝を行うための折衝手段とを有し、

前記制御ノードが、前記折衝手段を用いて前記WAPと折衝を行い、前記WAPのそれぞれに対して、前記折衝手段の決定に基づいて、前記ワイアレス・ローカル・エリア・ネットワーク用の所定の完全な機能を構成するための同一又は異なる補完機能を提供するシステム。

[2] 前記ワイアレス・アクセス・ポイント及び制御ノードが、各機能コンポーネント間で用いられる所定のインタフェースを備え、前記ワイアレス・ローカル・エリア・ネットワーク用の所定の前記機能に関して論理的に独立した機能コンポーネントを更に有する請求項1に記載のシステム。

[3] 前記機能コンポーネント間のインタフェースが、前記ワイアレス・アクセス・ポイントと制御ノードとの間のリモート・コネクション上において使用可能である請求項2に記載のシステム。

[4] 前記制御ノードのそれぞれが、制御ノード・コントローラ・モジュールを更に有し、前記ワイアレス・アクセス・ポイントのそれぞれが、ワイアレス・アクセス・ポイント・コントローラ・モジュールを更に有する請求項1に記載のシステム。

[5] 制御ノードの前記コントローラ・モジュールが、各ワイアレス・アクセス・ポイントで用いられる、機能コンポーネントのサブセット用の記述子の配列リストにより構成された単一又は複数の処理スケジュールを更に有する請求項4に記載のシステム。

[6] ワイアレス・アクセス・ポイントの前記コントローラ・モジュールが、接続されている各モバイル端末に対して用いられる機能コンポーネントのサブセット用の記述子の配列

リストにより構成された単一又は複数の処理スケジュールを更に有する請求項4に記載のシステム。

[7] 前記ワイアレス・アクセス・ポイントが、

（1）特定のドメイン内で使用可能な前記制御ノードを探索する手段と、

（2）所望の機能を提供できる制御ノードとのセキュアな接続を折衝する手段とを更に有し、

これによって、前記ワイアレス・アクセス・ポイントが、前記探索する手段を用いて、所定の完全なワイアレス・ローカル・エリア・ネットワーク機能のセットに関して必要な補完機能を提供する前記制御ノードの位置を定め、前記折衝する手段を用いて、前記制御ノードとの間にセキュアな通信を確立することができる請求項1に記載のシステム。

[8] 前記制御ノードの前記コントローラ・モジュールが、モバイル端末に由来するものに類似したデータ・ユニットを生成することができる請求項1に記載のシステム。

[9] モバイル端末における接続のハンドオーバを要求することなく、ワイアレス・ローカル・エリア・ネットワーク（WLAN）における負荷のバランスをとるためのシステムであって、

（1）単一又は複数のワイアレス・アクセス・ポイント（WAP）に接続され、サービスを受けている単一又は複数のモバイル端末と、

（2）前記モバイル端末又は所定のWLAN機能のサブセットを用いる他のワイアレス・アクセス・ポイントから受信したデータ・ユニットを処理することが可能な単一又は複数の前記ワイアレス・アクセス・ポイントと、

（3）ワイアレス・アクセス・ポイントが、サブセット又は所定の完全なWLAN機能によって処理されたデータ・ユニットを交換するための手段とを有し、

これによって、モバイル端末用のデータ・ユニットが、単一又は複数のWAPによる完全なWLAN機能によって処理される一方、各WAPは、完全なWLAN機能のサブセットのみを用いて、前記データ・ユニットの処理を行うシステム。

[10] 前記ワイアレス・アクセス・ポイントが、各ワイアレス・アクセス・ポイントにおいて実行される完全なWLAN機能のサブセットに関して、他のワイアレス・アクセス・ポイントと

の折衝を行うことができる制御モジュールを更に有する請求項9に記載のシステム。

[11] 前記ワイアレス・アクセス・ポイントが、前記ワイアレス・アクセス・ポイントに接続されているる前記モバイル端末とのすべての接続関係と、前記モバイル端末に提供される完全なWLAN機能に関して対応するサブネットとを格納するローカル・データベースを更に有する請求項9に記載のシステム。

[12] 前記WAP及びCNの機能が、単一のネットワーク・エレメント内に共存している請求項1に記載のシステム。

[13] ワイアレス・アクセス・ポイント（WAP）と、単一又は複数の制御ノード（CN）との間で所定のWLAN機能の分割を可能にする、ワイアレス・ローカル・エリア・ネットワーク（WLAN）でサービスを提供するための方法であって、

（1）WAPが、すべての前記CNに対して、自らのWLAN機能のサブセットに関する情報を含むメッセージを送ることによって、補完的なWLAN機能を提供できる前記CNを探索するステップと、

（2）CNが、前記探索に係るメッセージの受信後、WAPに提供できるWLAN機能のサブセットに関する情報を含むメッセージによって返答するステップと、

（3）前記WAPが、ローカルポリシーに基づいて、返答を受けたすべてのCNから適切なCNを選択し、選択された前記CNとの接続を確立するステップとを、

有する方法。

[14] （1）CNが提供したWLAN機能のサブセットと、

（2）CNを用いるコストと、

（3）CNのベンダと、

（4）CNへの接続の特性と、

（5）上記のファクタに関して重み付けされた総計とを、

有する情報を利用して、前記WAPが、どのCNを使用するかの決定を行う請求項13に記載の方法。

[15] ワイアレス・アクセス・ポイント（WAP）と、単一又は複数の制御ノード（CN）との間で所定のWLAN機能の分割を可能にする、ワイアレス・ローカル・エリア・ネットワーク（WLAN）でサービスを提供するための方法であって、

（1）CNが、モバイル端末から送られるデータ・ユニットをエミュレートするセクションを含むメッセージをWAPに送ることによって、WAPの能力を動的に探索するステップと、

（2）WAPが前記メッセージを受信し、モバイル端末から受信したデータ・ユニットの処理と同一の手順を用いて、前記セクションを処理し、回答メッセージによって前記CNにデータ・ユニットを送り返すステップと、

（3）前記CNが、前記回答メッセージ内に存在する処理されたデータ・ユニットを調べることによって、前記WAPの能力に関する情報を取得するステップとを、

有する方法。

[16] ワイアレス・アクセス・ポイント（WAP）と、単一又は複数の制御ノード（CN）との間で所定のWLAN機能の分割を可能にする、ワイアレス・ローカル・エリア・ネットワーク（WLAN）でサービスを提供するための方法であって、

（1）CNが前記WAPの能力を取得するステップと、

（2）前記CNが、前記WAPに提供される補完的なWLAN機能について、別の単一又は複数のCNと折衝を行うステップとを、

有する方法。

[17] モバイル端末における接続のハンドオーバを要求することなく、ワイアレス・ローカル・エリア・ネットワーク（WLAN）における負荷のバランスをとる方法であって、

（1）前記WAPが、前記モバイル端末に提供される処理機能を、接続固有処理機能及び非接続固有処理機能に分離するステップと、

（2）前記WAPが、前記非接続固有処理機能について別のWAPと折衝を行い、前記別のWAPとの間にセキュアなトンネルを設定するステップと、

（3）前記WAPが、前記接続固有機能を用いてデータ・ユニットの処理を行った後に、モバイル端末からの前記データ・ユニットを、前記トンネルを介して前記別のWAPにトンネリングするステップと、

（4）前記別のWAPが、前記処理されたデータ・ユニットを前記トンネルを介して受信し、前記非接続固有機能による処理を行うステップとを、

有する方法。

[18] 前記WAPが、ワイアレス・チャネルを用いて前記別のWAPとの直接の接続を確立し、前記直接の接続を介してセキュアなトンネルをセットアップするステップを更に有する請求項17に記載の方法。

[19] 前記WAPが、WAPにおける負荷の監視及び所定の閾値との比較によって、前記モバイル端末から別のWAPに対して、非接続固有処理用のデータ・ユニットをトンネリングするかどうかを決定するステップを更に有する請求項17に記載の方法。

[20] 前記WAPが、接続している異なるWAPにおける負荷の監視及び所定の閾値との比較によって、他のWAPのどれを非接続固有処理のために用いるかを決定するステップを更に有する請求項17に記載の方法。

[21] セントラル・コントロール・エンティティが、あるドメイン内のすべてのWAPの負荷状態を監視し、異なるWAP間の非接続固有処理機能の配分の指示を行うステップを更に有する請求項17に記載の方法。

[22] (1)処理される前記データ・ユニットのサイズと、

(2)前記データ・ユニットの処理について予想される平均時間と、

(3)前記データ・ユニットを処理するためのオーバヘッド時間と、

(4)上記のファクタに関して重み付けされた総計とを、

有する情報に基づいて、前記非接続固有機能の配分を決定する請求項17に記載の方法。

[23] ワイアレス・アクセス・ポイント(WAP)と、単一又は複数の制御ノード(CN)との間で所定のWLAN機能の分割を可能にする、ワイアレス・ローカル・エリア・ネットワーク(WLAN)でサービスを提供するための方法であって、

(1)WAPのサブセットが、前記WLAN用の所定の機能のサブセット全体の処理を行うステップと、

(2)前記CNが、前記WAPの各サブセットとは異なる前記WLAN用の所定の補完機能のサブセットを提供するステップとを、

有する方法。

[24] ワイアレス・アクセス・ポイント(WAP)と、単一又は複数の制御ノード(CN)との間で所定のWLAN機能の分割を可能にする、ワイアレス・ローカル・エリア・ネットワーク(

WLAN)でサービスを提供するための方法であって、

(1)前記CNが、前記WAPのサブセットで使用可能であり、前記WLANに必要な機能の共通サブセットを決定するステップと、

(2)前記サブセットを有する各WAPが、前記決定された機能の共通サブセットを処理するステップと、

(3)前記CNが、前記WAPの各サブセットと同一の補完機能のサブセットを提供するステップとを、

有する方法。

[25] ワイアレス・ネットワーク・トポロジの変化に対応するための方法であって、

前記ワイアレス・ネットワーク・トポロジのうち、少なくとも1つのネットワーク・エンティティの処理ロジックを動的に調節して、1つ以上の機能サブ・コンポーネントの処理に変更するステップを有する方法。

[26] 前記選択された機能サブ・コンポーネントの処理をバイパスすることによって、少なくとも1つのネットワーク・エンティティの選択された機能サブ・コンポーネントの処理を変更するステップを更に有する請求項25に記載の方法。

[27] 前記選択された機能サブ・コンポーネントを選択的に処理することによって、1つ以上のネットワーク・エンティティの選択された機能サブ・コンポーネントの処理を変更するステップを更に有する請求項25に記載の方法。

[28] ワイアレス・ネットワークにおける遅延の変動を調整するための方法であって、

第1のネットワーク・エンティティにおいて、選択された機能サブ・コンポーネントの処理をバイパスするステップと、

第2のネットワーク・エンティティにおいて、上述のバイパスされた機能サブ・コンポーネントの処理を行うステップとを、

有する方法。

[29] ワイアレス・ネットワークのシステム全体の機能のセマンティックスを保持しながら、ローカル・レベルにおける機能のセマンティックスを変更するための方法であって、

前記ワイアレス・ネットワーク全体における機能サブ・コンポーネントの和集合が、前記ワイアレス・ネットワークの完全な機能サブ・コンポーネントに対応するように、選択

したネットワーク・エンティティの機能サブ・コンポーネントを選択的に動作させるステップを有する方法。

[30] 第1のネットワーク・エンティティから第2のネットワーク・エンティティに、動作させる機能サブ・コンポーネントの処理を移すステップを更に有する請求項29に記載の方法。

[31] 第1のネットワーク・エンティティが第2のネットワーク・エンティティとの接続関係を変更して、前記変更された接続関係の通信経路上に、1つ以上の第3のネットワーク・エンティティが含まれるようになる場合におけるワイアレス・ネットワークのトポロジを決定する方法であって、

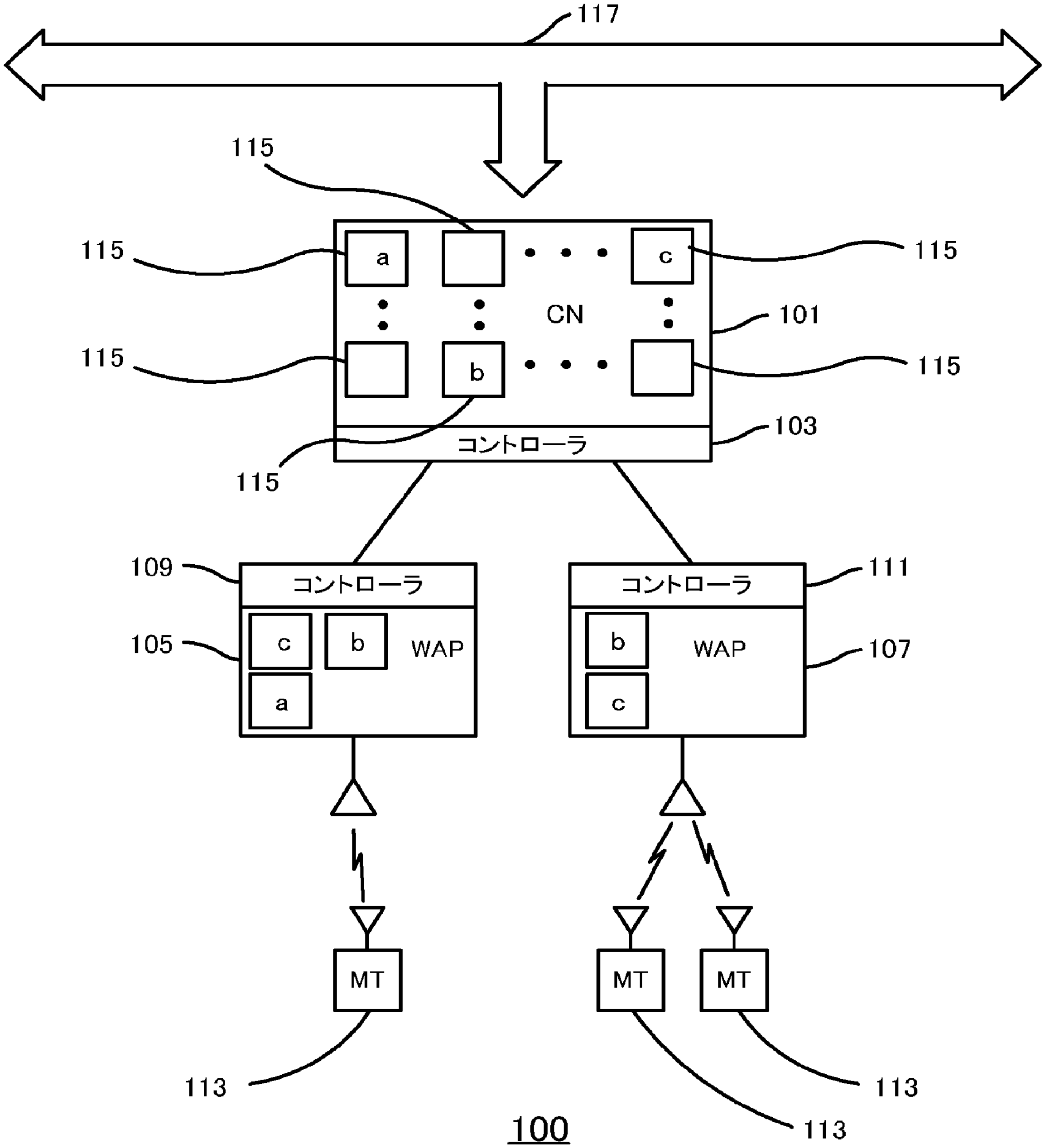
前記ワイアレス・ネットワークの前記ワイアレス・エンティティ間で、隣接するネットワーク・エンティティに関する情報を交換するステップと、

前記ワイアレス・ネットワークのトポロジに関して、あらかじめ設定された情報に基づいて、前記ネットワーク・エンティティによって受信された通信フレームの解析を行うステップと、

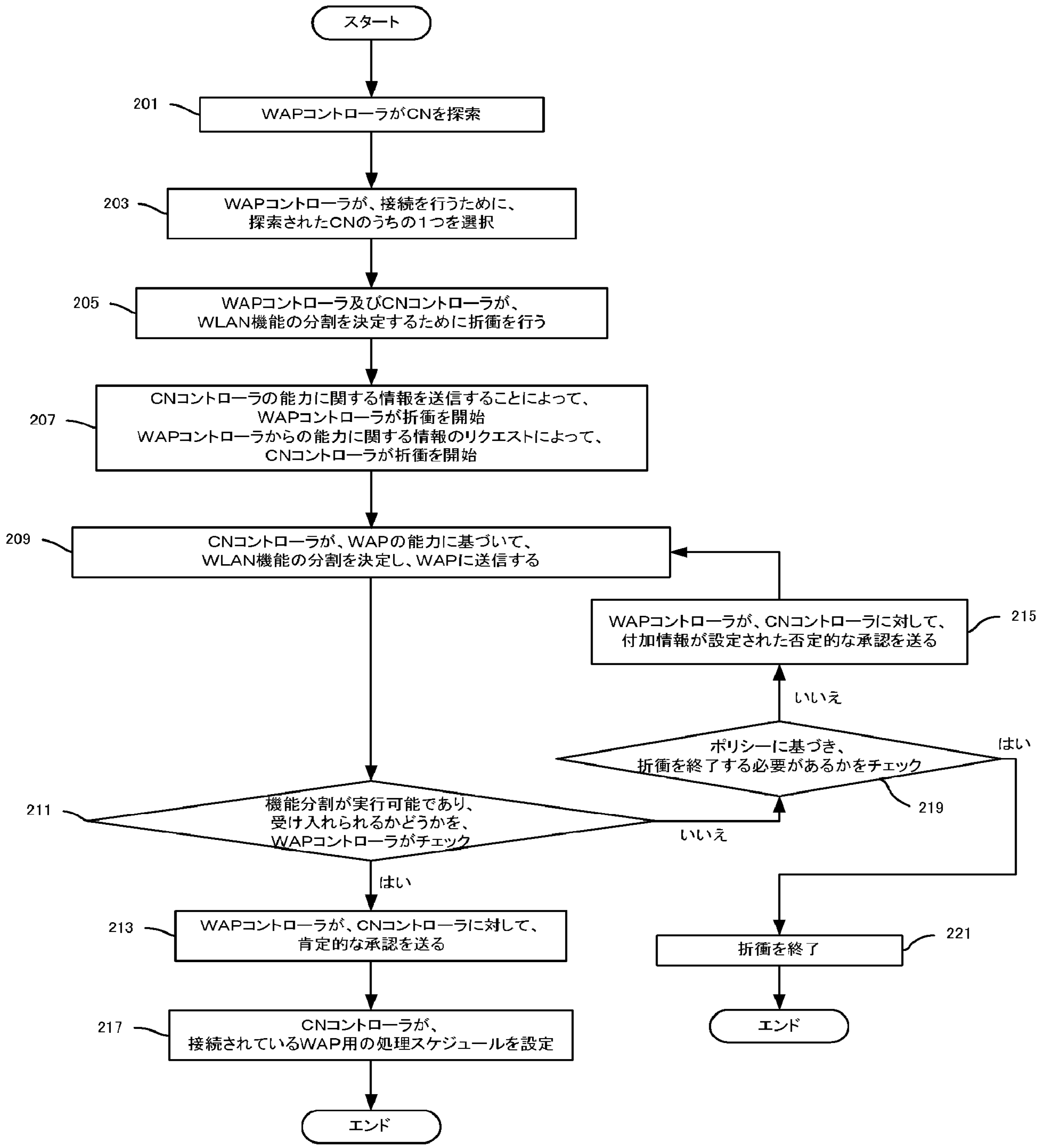
前記ワイアレス・ネットワークのトポロジに関して、あらかじめ設定された情報に基づいて、前記ネットワーク・エンティティによって受信された接続要求フレームの解析を行うステップとを、

有する方法。

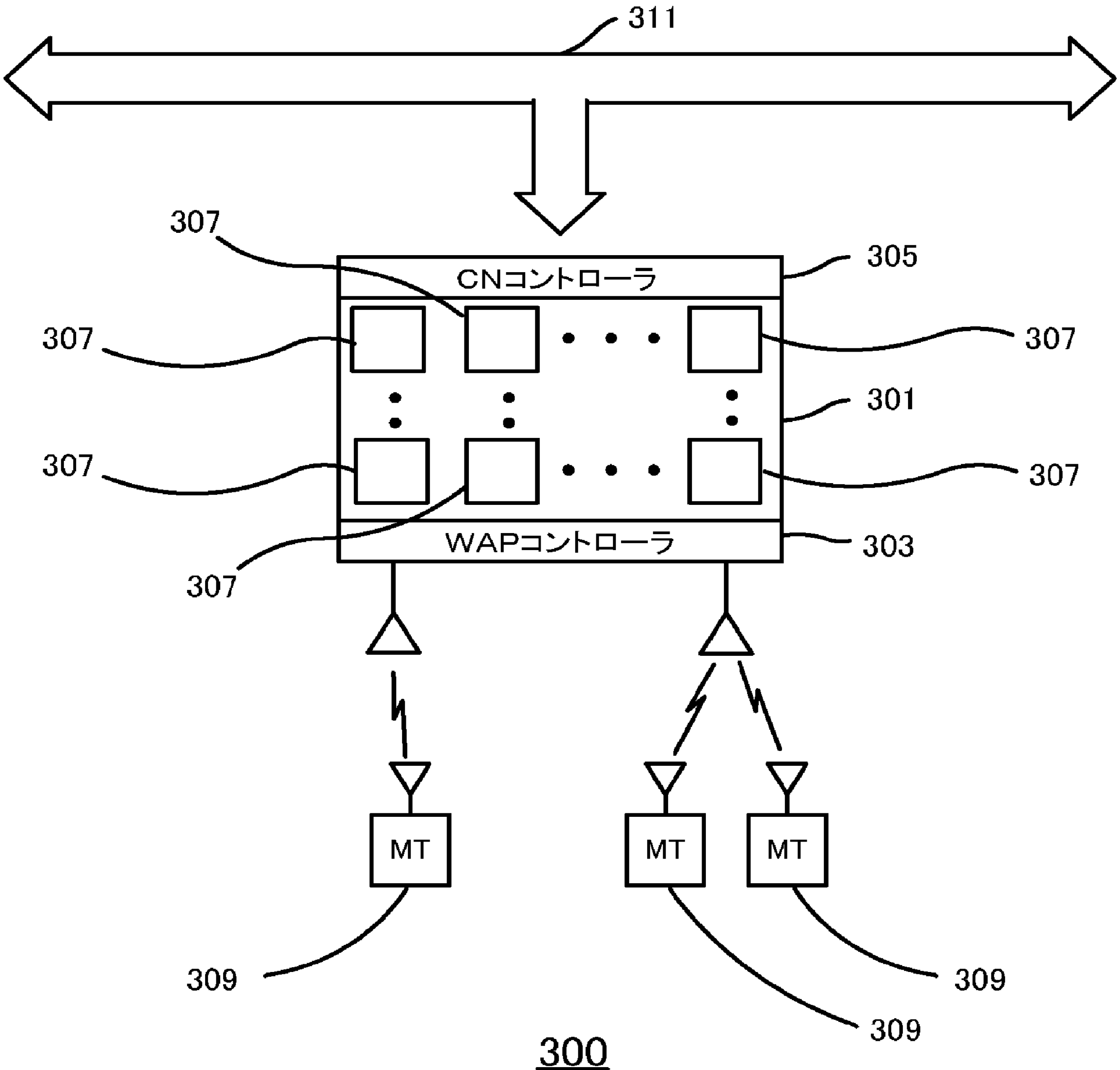
［図1］


117
115
115
a
c
115
CN
101
115
b
115
コントローラ
103
115
109
コントローラ
111
コントローラ
105
c
b
WAP
a
b
WAP
107
c
MT
MT
MT
113
113
113
100

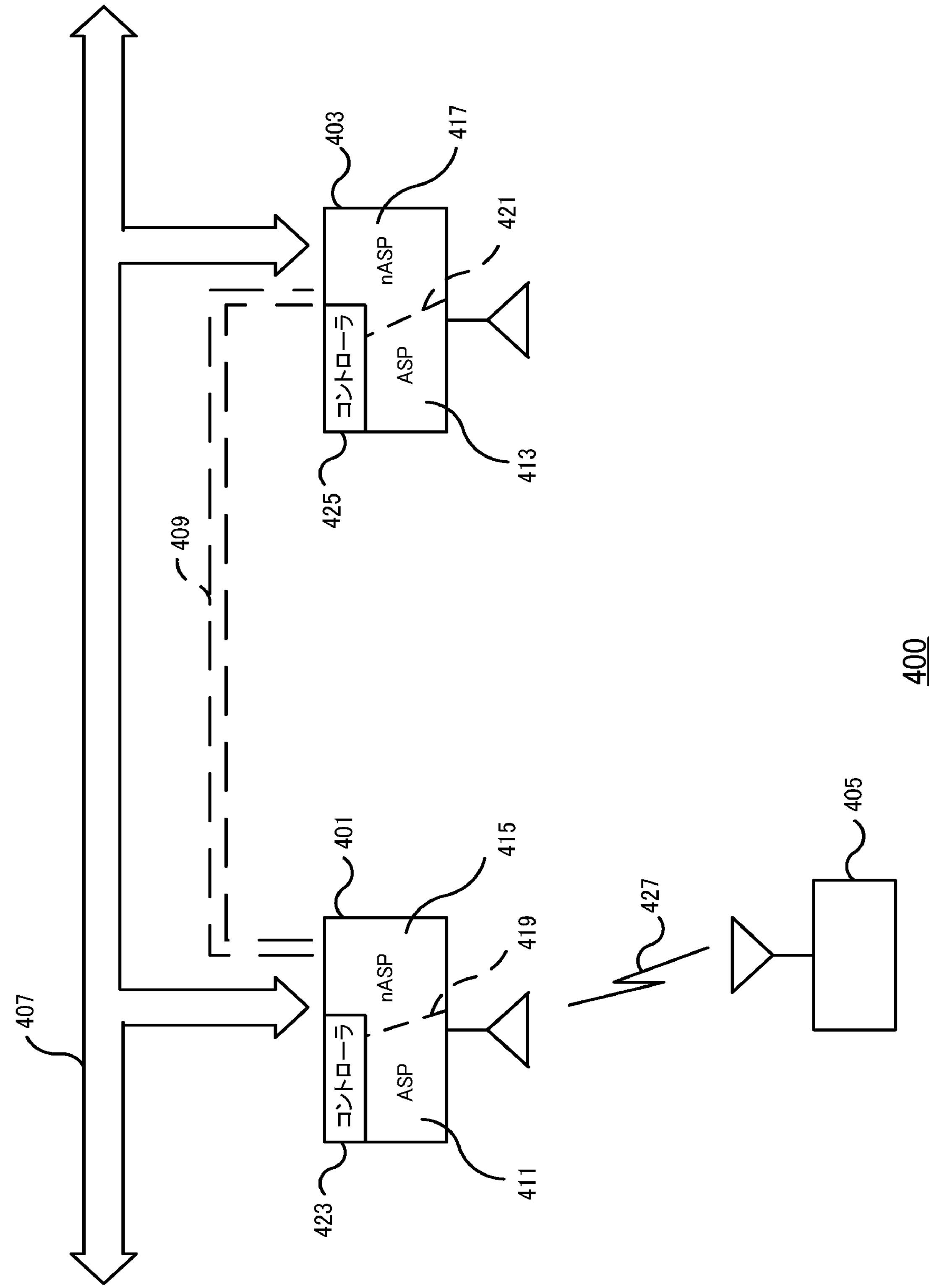
[図2]


スタート
201
WAPコントローラがCNを探索
203
WAPコントローラが、接続を行うために、
探索されたCNのうちの1つを選択
205
WAPコントローラ及びCNコントローラが、
WLAN機能の分割を決定するために折衝を行う
207
CNコントローラの能力に関する情報を送信することによって、
WAPコントローラが折衝を開始
WAPコントローラからの能力に関する情報のリクエストによって、
CNコントローラが折衝を開始
209
CNコントローラが、WAPの能力に基づいて、
WLAN機能の分割を決定し、WAPに送信する
215
WAPコントローラが、CNコントローラに対して、
付加情報が設定された否定的な承認を送る
いいえ
ポリシーに基づき、
折衝を終了する必要があるかをチェック
はい
219
211
機能分割が実行可能であり、
受け入れられるかどうかを、
WAPコントローラがチェック
いいえ
はい
213
WAPコントローラが、CNコントローラに対して、
肯定的な承認を送る
221
折衝を終了
217
CNコントローラが、
接続されているWAP用の処理スケジュールを設定
エンド
エンド

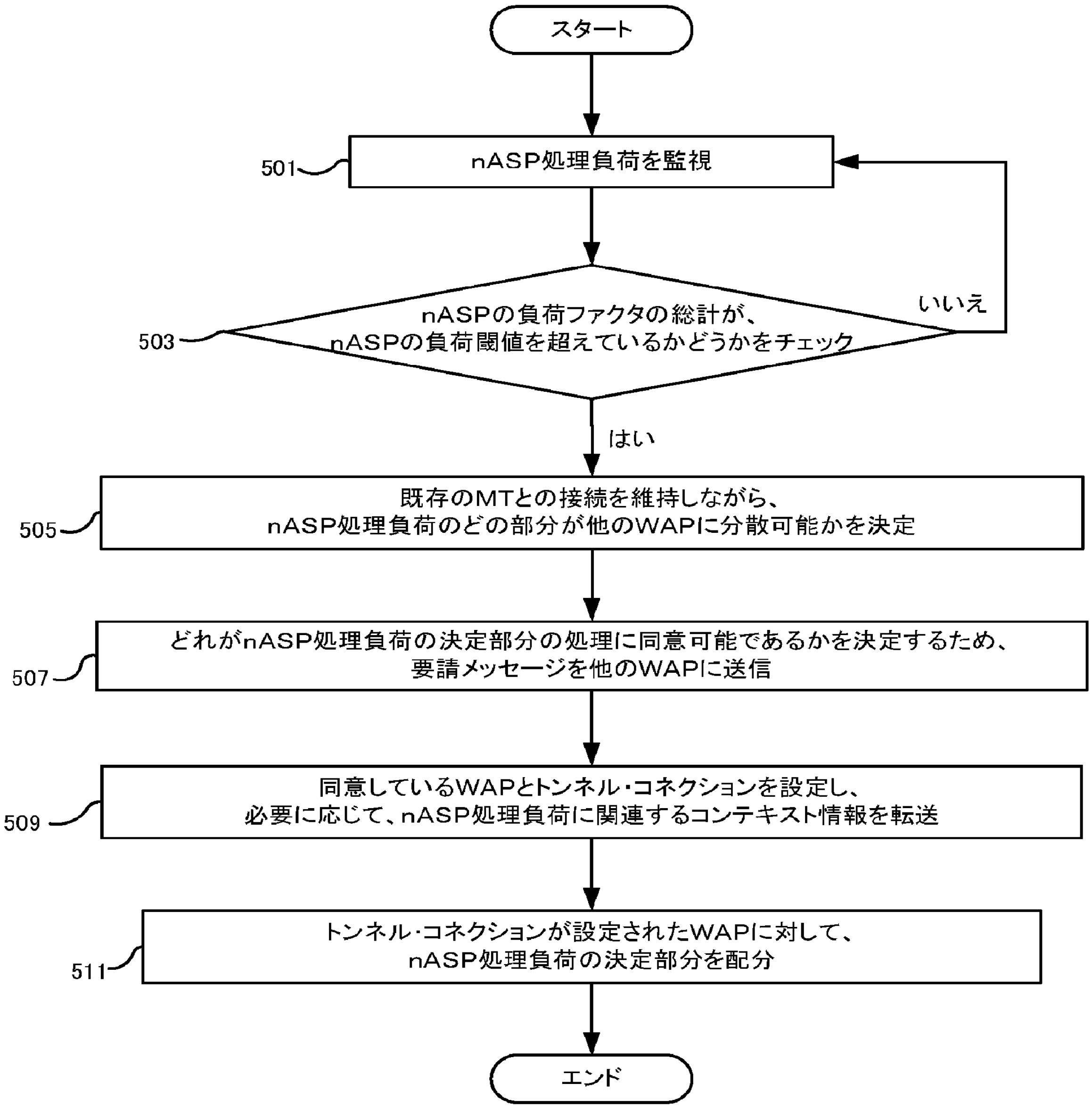
[図3]


311
307
305
CNコントローラ
307
307
301
307
307
WAPコントローラ
303
307
MT
MT
MT
309
309
309
300

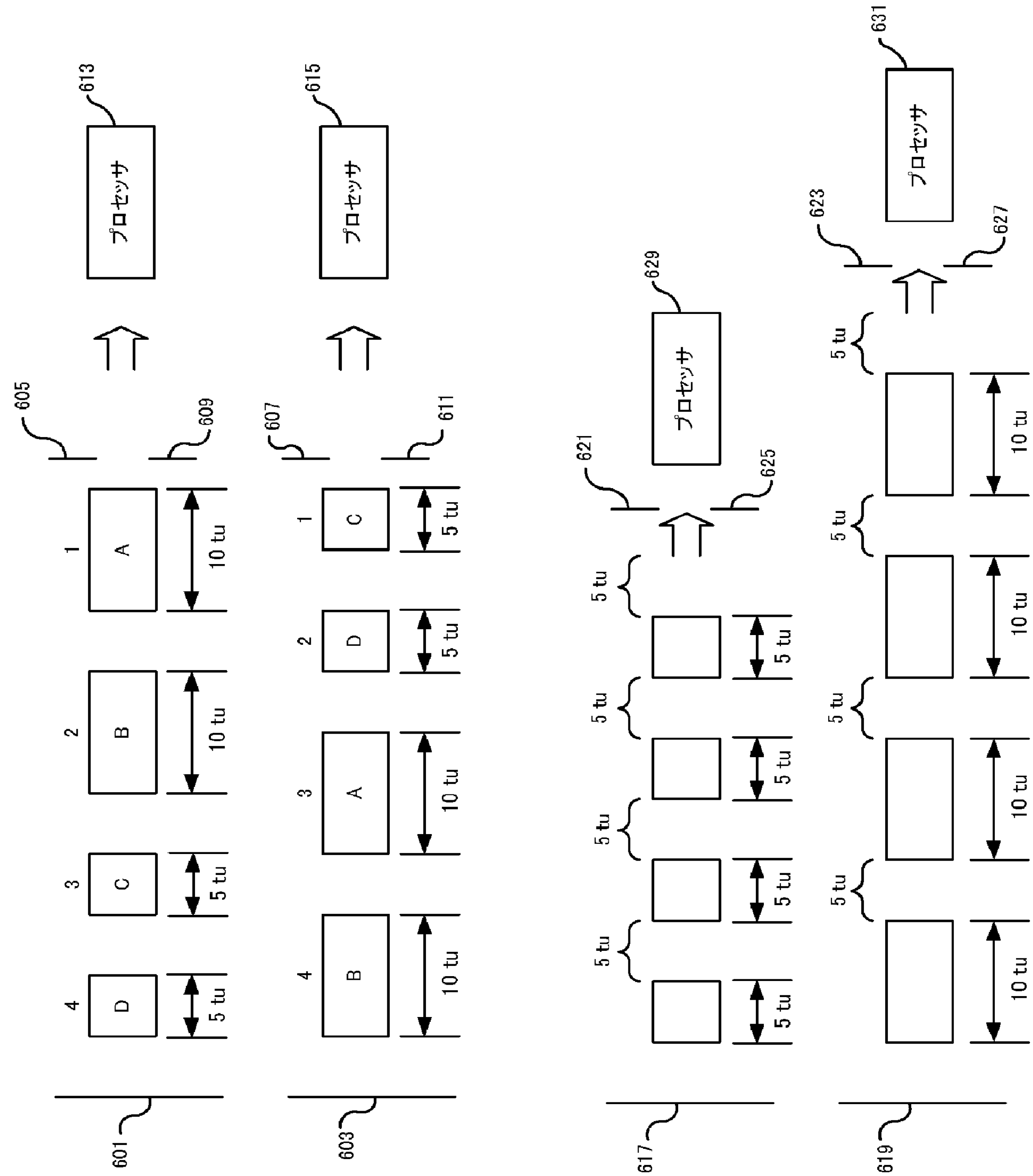
[図4]


407
403
417
421
nASP
コントローラ
ASP
413
425
409
401
415
419
nASP
コントローラ
ASP
411
423
427
405
400

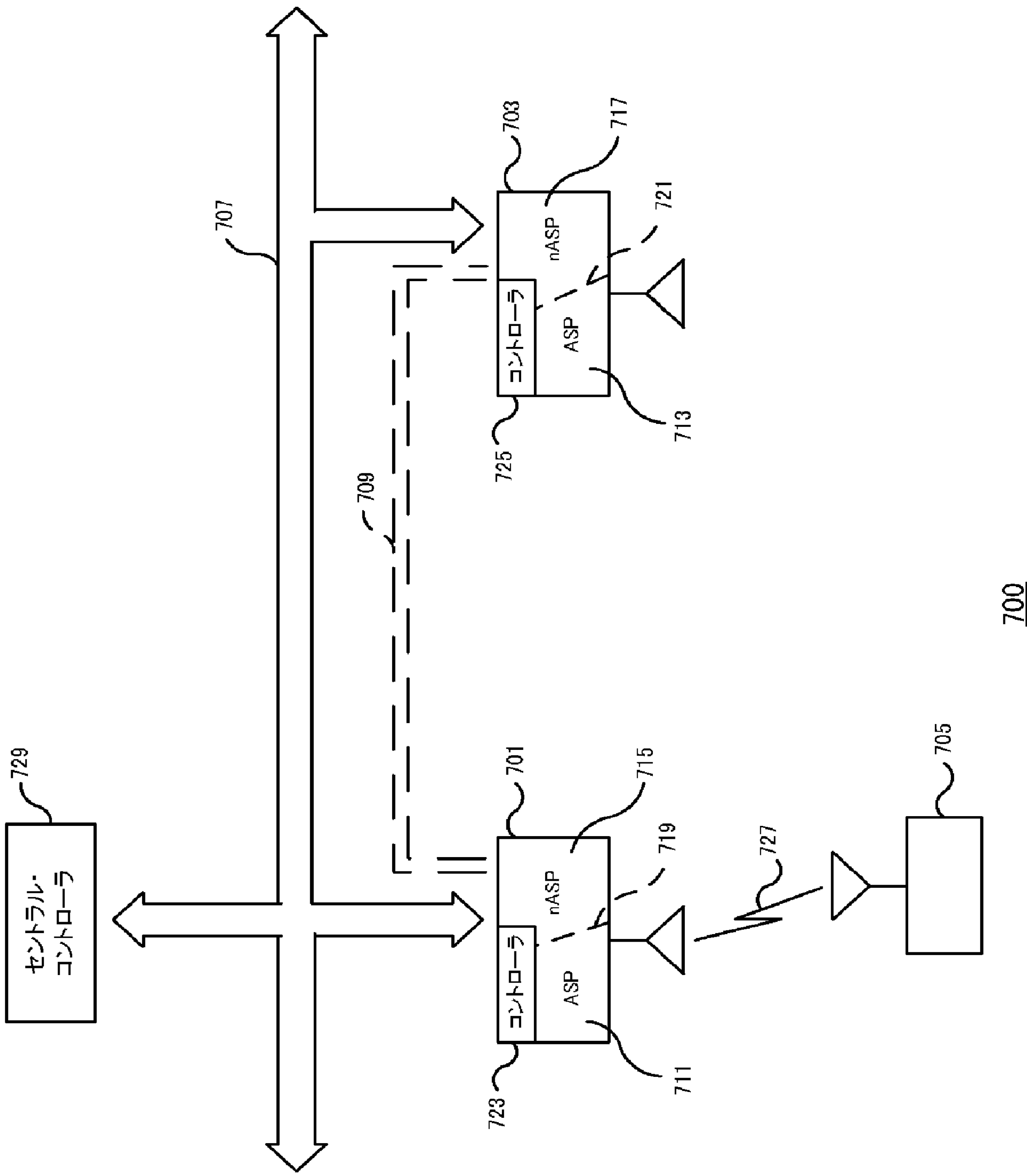
[図5]


スタート
501
nASP処理負荷を監視
503
nASPの負荷ファクタの総計が、
nASPの負荷閾値を超えているかどうかをチェック
いいえ
はい
505
既存のMTとの接続を維持しながら、
nASP処理負荷のどの部分が他のWAPに分散可能かを決定
507
どれがnASP処理負荷の決定部分の処理に同意可能であるかを決定するため、
要請メッセージを他のWAPに送信
509
同意しているWAPとトンネル・コネクションを設定し、
必要に応じて、nASP処理負荷に関連するコンテキスト情報を転送
511
トンネル・コネクションが設定されたWAPに対して、
nASP処理負荷の決定部分を配分
エンド

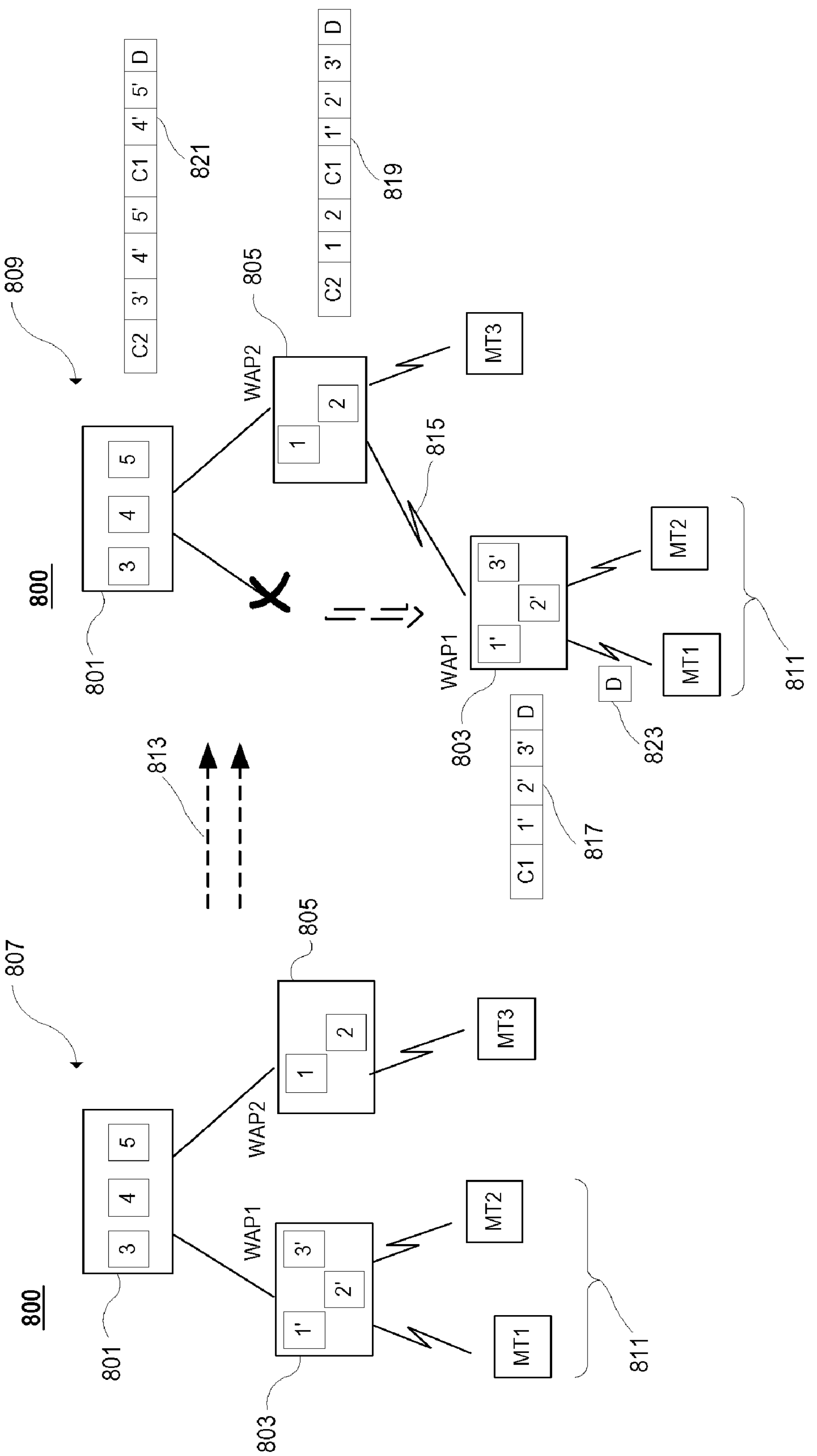
[図6]


601
603
605
607
609
611
613
615
617
619
621
623
625
627
629
631
プロセッサ
プロセッサ
プロセッサ
プロセッサ
1
2
3
4
A
B
C
D
10 tu
5 tu

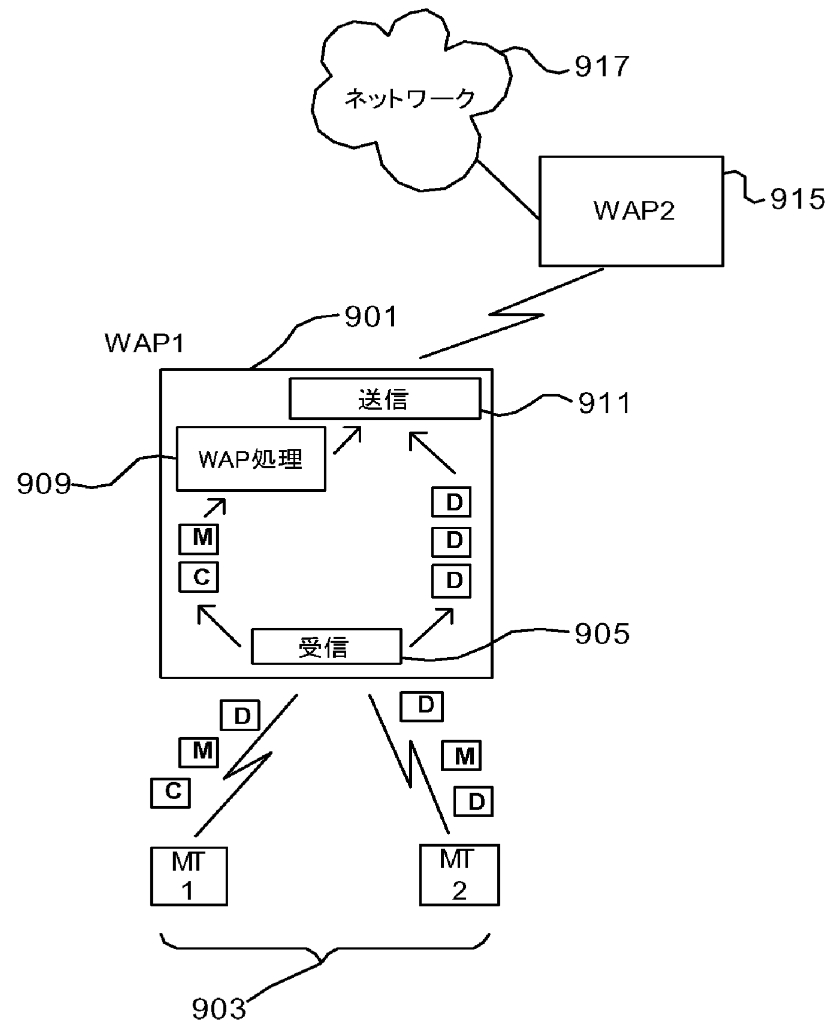
[図7]


700
701
703
705
707
709
711
713
715
717
719
721
723
725
727
729
セントラル・コントローラ
コントローラ
コントローラ
nASP
ASP
nASP
ASP

[図8]


800
801
803
805
807
809
811
813
815
817
819
821
823
WAP1
WAP2
MT1
MT2
MT3
C2 3' 4' 5' C1 4' 5' D
C2 1 2 C1 1' 2' 3' D
C1 1' 2' 3' D
D

[図9]



907

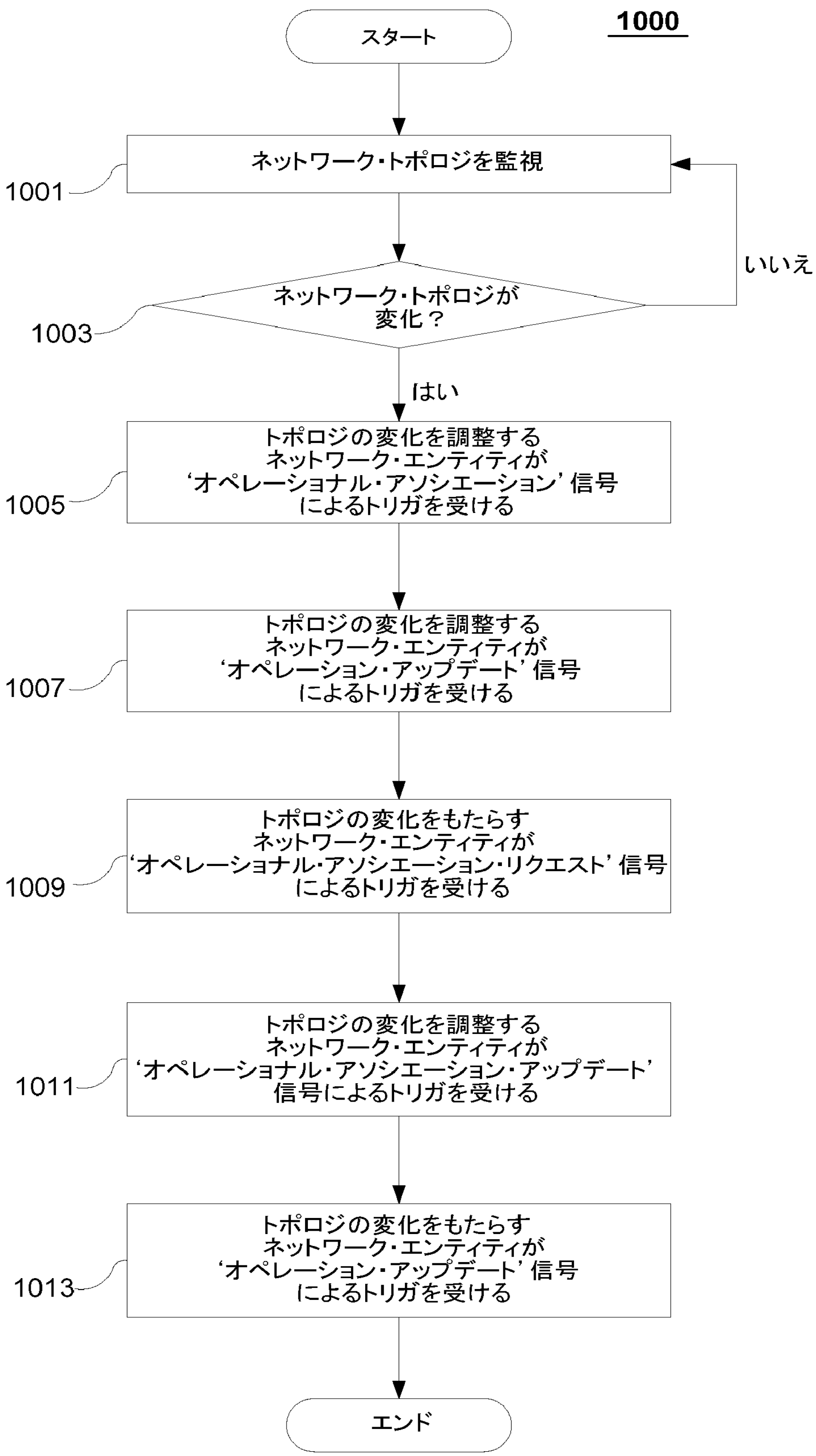
送信先アドレス	動作
...	...

BSSID	動作
...	...

フレームタイプ	動作
ACK用フレーム	SignalProtocol_Cntrl
データ・フレーム	送信ブロックに送信
管理フレーム	ローカルで処理
制御フレーム	ローカルで処理

913

[図10]


1000
スタート
ネットワーク・トポロジを監視
1001
ネットワーク・トポロジが
変化？
1003
いいえ
はい
トポロジの変化を調整する
ネットワーク・エンティティが
‘オペレーショナル・アソシエーション’信号
によるトリガを受ける
1005
トポロジの変化を調整する
ネットワーク・エンティティが
‘オペレーション・アップデート’信号
によるトリガを受ける
1007
トポロジの変化をもたらす
ネットワーク・エンティティが
‘オペレーショナル・アソシエーション・リクエスト’信号
によるトリガを受ける
1009
トポロジの変化を調整する
ネットワーク・エンティティが
‘オペレーショナル・アソシエーション・アップデート’
信号によるトリガを受ける
1011
トポロジの変化をもたらす
ネットワーク・エンティティが
‘オペレーション・アップデート’信号
によるトリガを受ける
1013
エンド

INTERNATIONAL SEARCH REPORT

International application No. PCT/JP2005/003390

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl[7] H04L12/28

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
Int.Cl[7] H04L12/28

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Jitsuyo Shinan Koho	1922-1996	Jitsuyo Shinan Toroku Koho	1996-2005
Kokai Jitsuyo Shinan Koho	1971-2005	Toroku Jitsuyo Shinan Koho	1994-2005

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2000-069050 A (Nippon Telegraph And Telephone Corp.), 03 March, 2000 (03.03.00), Par. No. [0017]; Fig. 1 (Family: none)	1-31
A	JP 10-041969 A (NEC Engineering Kabushiki Kaisha), 13 February, 1998 (13.02.98), Par. Nos. [0015] to [0028]; Fig. 4 (Family: none)	1-31

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search
22 April, 2005 (22.04.05)

Date of mailing of the international search report
17 May, 2005 (17.05.05)

Name and mailing address of the ISA/
Japanese Patent Office

Facsimile No.

Authorized officer

Telephone No.

Form PCT/ISA/210 (second sheet) (January 2004)

国際調査報告　　国際出願番号　ＰＣＴ／ＪＰ２００５／００３３９０

Ａ．　発明の属する分野の分類（国際特許分類（ＩＰＣ））

Int.Cl.[7]　H04L12/28

Ｂ．　調査を行った分野

調査を行った最小限資料（国際特許分類（ＩＰＣ））

Int.Cl.[7]　H04L12/28

最小限資料以外の資料で調査を行った分野に含まれるもの

日本国実用新案公報	１９２２－１９９６年
日本国公開実用新案公報	１９７１－２００５年
日本国実用新案登録公報	１９９６－２００５年
日本国登録実用新案公報	１９９４－２００５年

国際調査で使用した電子データベース（データベースの名称、調査に使用した用語）

Ｃ．　関連すると認められる文献

引用文献のカテゴリー＊	引用文献名　及び一部の箇所が関連するときは、その関連する箇所の表示	関連する請求の範囲の番号
A	ＪＰ　２０００－０６９０５０　Ａ（日本電信電話株式会社）２０００．０３．０３，【００１７】，図１（ファミリーなし）	1-31
A	ＪＰ　１０－０４１９６９　Ａ（日本電気エンジニアリング株式会社）１９９８．０２．１３，【００１５】－【００２８】，図４（ファミリーなし）	1-31

□　Ｃ欄の続きにも文献が列挙されている。　　□　パテントファミリーに関する別紙を参照。

＊　引用文献のカテゴリー

「Ａ」特に関連のある文献ではなく、一般的技術水準を示すもの

「Ｅ」国際出願日前の出願または特許であるが、国際出願日以後に公表されたもの

「Ｌ」優先権主張に疑義を提起する文献又は他の文献の発行日若しくは他の特別な理由を確立するために引用する文献（理由を付す）

「Ｏ」口頭による開示、使用、展示等に言及する文献

「Ｐ」国際出願日前で、かつ優先権の主張の基礎となる出願の日の後に公表された文献

「Ｔ」国際出願日又は優先日後に公表された文献であって出願と矛盾するものではなく、発明の原理又は理論の理解のために引用するもの

「Ｘ」特に関連のある文献であって、当該文献のみで発明の新規性又は進歩性がないと考えられるもの

「Ｙ」特に関連のある文献であって、当該文献と他の１以上の文献との、当業者にとって自明である組合せによって進歩性がないと考えられるもの

「＆」同一パテントファミリー文献

国際調査を完了した日　２２．０４．２００５	国際調査報告の発送日　17.5.2005
国際調査機関の名称及びあて先 日本国特許庁（ＩＳＡ／ＪＰ） 郵便番号１００－８９１５ 東京都千代田区霞が関三丁目４番３号	特許庁審査官（権限のある職員）　５Ｘ　９２９９ 中木　努 電話番号　０３－３５８１－１１０１　内線　３５９６

様式ＰＣＴ／ＩＳＡ／２１０（第２ページ）（２００４年１月）

Document made available under the Patent Cooperation Treaty (PCT)

International application number: PCT/JP05/003390

International filing date: 01 March 2005 (01.03.2005)

Document type: Certified copy of priority document

Document details: Country/Office: JP
Number: 2004-058245
Filing date: 02 March 2004 (02.03.2004)

Date of receipt at the International Bureau: 21 April 2005 (21.04.2005)

Remark: Priority document submitted or transmitted to the International Bureau in compliance with Rule 17.1(a) or (b)

World Intellectual Property Organization (WIPO) - Geneva, Switzerland
Organisation Mondiale de la Propriété Intellectuelle (OMPI) - Genève, Suisse

PCT/JP2005/003390

日本国特許庁
JAPAN PATENT OFFICE

03.03.2005

別紙添付の書類に記載されている事項は下記の出願書類に記載されている事項と同一であることを証明する。

This is to certify that the annexed is a true copy of the following application as filed with this Office.

出願年月日 Date of Application:	２００４年　３月　２日
出願番号 Application Number:	特願２００４－０５８２４５
パリ条約による外国への出願に用いる優先権の主張の基礎となる出願の国コードと出願番号 The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is	ＪＰ２００４－０５８２４５
出願人 Applicant(s):	松下電器産業株式会社

２００５年　４月　７日

特許庁長官
Commissioner,
Japan Patent Office

小川洋

出証番号　出証特２００５－３０３０８２

【書類名】　特許願
【整理番号】　2040860030
【特記事項】　特許法第３６条の２第１項の規定による特許出願
【あて先】　特許庁長官殿
【国際特許分類】　H04L 12/46
H04L 12/28
H04L 12/66
【発明者】
【住所又は居所】　シンガポール５３４４１５シンガポール、タイ・セン・インダストリアル・アベニュー、ブロック１０２２、０４－３５３０番、タイ・セン・インダストリアル・エステイト、パナソニック・シンガポール研究所株式会社内
【氏名】　ホン　チェン
【発明者】
【住所又は居所】　シンガポール５３４４１５シンガポール、タイ・セン・インダストリアル・アベニュー、ブロック１０２２、０４－３５３０番、タイ・セン・インダストリアル・エステイト、パナソニック・シンガポール研究所株式会社内
【氏名】　ペク　ユー・タン
【特許出願人】
【識別番号】　000005821
【氏名又は名称】　松下電器産業株式会社
【代理人】
【識別番号】　100093067
【弁理士】
【氏名又は名称】　二瓶　正敬
【手数料の表示】
【予納台帳番号】　039103
【納付金額】　35,000円
【提出物件の目録】
【物件名】　外国語特許請求の範囲　1
【物件名】　外国語明細書　1
【物件名】　外国語図面　1
【物件名】　外国語要約書　1
【包括委任状番号】　0003222

出証特２００５－３０３０８２０

【書類名】外国語特許請求の範囲

1. A system for providing service in a wireless local area network comprising

i. a single or plurality of wireless access points (WAP) capable of processing a subset of complete functionality defined for the wireless local area network;

ii. a single or plurality of control nodes (CN) capable of providing a subset or complete functionalities defined for the wireless local area network; and

iii. means for the wireless access point to dynamically negotiate with the control node for a secure connections and function split arrangement;

whereby the control node would provide the complementary functionality for the wireless access point to form a complete functionality defined for the wireless local area network.

2. The system according to claim 1 wherein the said wireless access point and control nodes further comprise logically independent functional components of the functionalities defined for the wireless local area network with predefined interface used between each functional components.

3. The system according to claim 2 wherein interfaces between said functional components could be used over remote connections between the said wireless access point and control node.

4. The system according to claim 1 wherein each said control node further comprises a control node controller module and each said wireless access point further comprises a wireless access point controller module.

5. The system according to claim 4 wherein the controller module of control node further comprises a single or plurality of processing schedule composed of sequential lists of descriptors for subsets of functional components used for each wireless access point.

6. The system according to claim 4 wherein the controller module of wireless access point further comprises a single or plurality of processing schedule composed of sequential lists of descriptors for subsets of functional components used for each associated mobile terminal.

7. The system according to claim 1, wherein the wireless access point further comprises:

i. means for discovering the available control node within a specified domain; and

ii. means for negotiating secure connection with control node that could offer the desired functions;

whereby the wireless access point is able to locate the control node that provides necessary complementary functionalities to it with regard to the defined complete wireless local area network functions.

8. The system according to claim 1, wherein the controller module of said control node is capable of generating data unit to resemble that from a mob

ile terminal.

9. A system for load balancing in a wireless local area network (WLAN) without requiring association handover at the mobile terminal comprising:

i. a single or plurality of mobile terminals, each said mobile terminal associated with and receiving services from a single or plurality of wireless access point (WAP);

ii. a single or plurality of said wireless access point that are capable of processing data units received from the mobile terminal or other wireless access point using a subset of its defined WLAN functions; and

iii. a means for the wireless access points to exchange data units processed with a subset or complete defined WLAN functions;

whereby a data unit for a mobile terminal is processed with complete WLAN functions by a plurality of WAP where each WAP processing it with only a subset of the complete WLAN functions.

10. The system according to claim 9 wherein the wireless access point further comprises a control module that is capable of negotiating with other wireless access points of the subset of the complete WLAN functions to be carried out at each wireless access point.

11. The system according to claim 9 wherein the wireless access point further comprising a local database that stores all the association of the mobile terminals attached to it and corresponding subset of the complete WLAN functions to be provided to the mobile terminal.

12. The system according to claim 1, wherein the functionalities of the said WAP and CN collocate in a single network element.

13. A method for providing service in a wireless local area network (WLAN) that allows defined WLAN function split between wireless access point (WAP) and a single or plurality of Control Node (CN) comprising the steps of:

i. containing information about its own subset of the WLAN functions to all the CN by a WAP discover the CN that could provide complementary WLAN functions by sending message;

ii. replying with a message containing information about the subset of the WLAN functions it could offer to the WAP by the CN after received the said discover message; and

iii. choosing from all the replied CNs a proper CN based on local policy and establishing association with it by the said WAP.

14. The method for the WAP to decide which CN to use according to claim 13 using information, the information comprising:

i. the subset of the WLAN functions offered by the CN;

ii. a cost of using the CN;

iii. a vender of the CN;

iv. a characteristics of the connection to the CN; and

v. a weighted sum of the above factors.

15. A method for providing service in a wireless local area network (W

LAN) that allows defined WLAN function split between wireless access point (WAP) and a single or plurality of Control Node (CN) comprising the steps of:

i. dynamically discovering by the CN the capability of a WAP by sending a message to a WAP containing a section that emulates the data unit sends by a mobile terminal;

ii. processing the said section using the same procedure for processing data units from a mobile terminal and sending it back to the said CN in a reply message by the mobile terminal received the said message; and

iii. obtaining the capability information of the said WAP by examining the processed data units in the said reply message by the said CN.

16. A method for providing service in a wireless local area network (WLAN) that allows defined WLAN function split between wireless access point (WAP) and a single or plurality of Control Node (CN) comprising the steps of:

i. obtaining capability of the WAP by the CN; and

ii. negotiating with another or a plurality of CNs for the supplementary WLAN functions to be provided to the WAP by the said CN.

17. A method for carrying out load balancing in a wireless local area network (WLAN) without requiring a mobile terminal to change association relationship with wireless access point (WAP) comprising the steps of:

i. separating the processing function provided to the mobile terminal into association specific and non-association specific by the WAP;

ii. negotiating with another WAP of the non-association specific processing functions and establishing a secure tunnel with it by the said WAP;

iii. tunneling by the said WAP the data unit from a mobile terminal to the said other WAP through the tunnel after processing it with the association specific function; and

iv. receiving the processed data unit through the said tunnel and processing it with non-association specific functions by the said other WAP.

18. The method according to claim 17 further comprising the steps of:

using the wireless channel to establish direct connection with another WAP and setting up secure tunnel over the direct connection by the said WAP.

19. The method according claim 17 further comprising the step of deciding by the WAP on whether to tunnel data unit from the mobile terminal to another WAP for non association specific processing by monitoring the load at WAP and comparing it with a preset threshold value.

20 The method according to claim 17 further comprising the step of deciding by the said WAP on which other WAPs should be used for non association specific processing by monitoring the load at different WAPs it has connection with and comparing it with a preset threshold value.

21. The method according to claim 17 further comprising the step of monitoring by a central control entity the load status on all the WAPs within a certain domain and mandating the distribution of non-association processing function between different WAPs.

22. The method according to claim 17 for the WAP to determine the distribution of non-association specific function based on information, the information comprising:

i. a size of the data unit to be processed;

ii. an expected average time for the processing of the data unit;

iii. an overhead time for processing the data unit; and

iv. a weighted sum of above factors.

23. A method for providing service in a wireless local area network (WLAN) that allows defined WLAN function split between wireless access point (WAP) and a single or plurality of Control Node (CN) comprising the steps of:

i. processing the total of its subset of functionality defined for the WLAN by a subset of WAPs; and

ii. providing distinct subsets of complementary functionality defined for the WLAN to each of the subset of WAPs by the CN.

24. A method for providing service in a wireless local area network (WLAN) that allows defined WLAN function split between wireless access point (WAP) and a single or plurality of Control Node (CN) comprising the steps of:

i. determining a common subset of functionality required for the WLAN available at a subset of the WAPs by the CN;

ii. processing the said determined common subset of functionality by each WAP of the subset; and

iii. providing similar subsets of complementary functionality to each of the subset of WAPs by the CN.

【書類名】外国語明細書
Title of the Invention
System and method for negotiations for WLAN entities

BACKGROUND OF THE INVENTION
Wireless local area networks (WLANs) have invoked great interests from both consumers and the industry. These networks offer increased flexibility and higher productivity gains that appeal to numerous users. Such wide-spread interest has translated into rapidly growing demand for large-scale deployments of WLAN infrastructure.

As WLANs grow in size, they incorporate increasing numbers of wireless access points (WAPs), each providing services to increasing numbers of associated mobile terminals (MTs). Given the number of WAPs required for large-scale WLAN deployments, the task of managing them becomes complex and tedious.

In response to this concern, many equipment manufacturers have introduced wireless switches or other similar devices that aim to simplify the processes of deploying and managing large WLANs. This is achieved by aggregating control of a number of WAPs at a single controller entity, which is the wireless switch, also referred to as the controlling node (CN). CNs are additionally designed to consolidate some WLAN functionality which were previously implemented in legacy WAPs and leave only the remaining functionality to those new WAPs that are compliant with a particular CN and therefore compliant with a particular type of functionality division.

This concept of division of WLAN functionality between WAPs and CNs has been endorsed by various equipment manufacturers. However since WLAN standards, like the popular IEEE 802.11, do not mandate how functionality is to be partitioned among various entities, these divisions vary among different firms. So, different manufacturers incorporate different types of functionality divisions in their products. Consequently, incompatibilities arise between WAPs and CNs from diverse manufacturers. These differences have intensified the challenge of managing large WLANs comprising entities from different manufacturers, each incorporating different degrees of functional capabilities. As such, this ultimately affects the end customer market.

Given such a scenario, it is pertinent that WLAN entities be capable of interoperation with other WLAN entities in spite of the differences in the functionality that they incorporate. Furthermore, entities adhering to different types of functionality divisions should be able to jointly operate within a single WLAN environment. This would provide greater flexibility in deploying and managing WAPs from different manufacturers with different degrees of functionality. Another advantage is the possibility of integrating entities that conform to some type of functional division with the majority of existing entities that do not conform to any specific division, thereby increasing the operability of these WAPs.

The differences between WLAN entities based on their functionality capabilities refer to static differences as these are design aspects and are present throughout their operations. So the means of accommodating static differences between va rious WLAN entities has many advantages as mentioned.

A further benefit involves recognizing and accommodating dynamic differences between WLAN entities. This allows various entities to provide active assistance, like that of load-balancing, to other entities. For instance, during the functioning of a WLAN, the processing load at a WAP can become substantially high even exceeding the processing capacity of the WAP. This could be due to increases in the number of associated MTs or due to increases in the volume of traffic from the associated MTs. These differences in processing load over time constitute a dynamic factor as they are dependent on the dynamics of the MTs.

The dynamism of such situations need not prevail at other WAPs of the WLAN at the same time. Therefore, the processing load at other WAPs may not be as considerable. These differences in processing load across the WAPs comprising a WLAN have traditionally been addressed by affecting handovers of MTs from their associated WAPs where processing load is high, to re-associate the MTs with other WAPs where processing load is relatively low.

"Method and apparatus for facilitating handoff in a wireless local area network", US 2003/0035464 A1, discloses a means for addressing dynamic differences in the levels of processing load at WAPs. In this method, WAPs proactively interact with each other in order to determine those WAPs which are agreeable to take over some MT associations and the consequent processing load from heavily loaded WAPs. The method is essentially one of proactive handovers.

While this method addresses the dynamic differences in processing loads across WAPs, it does to by mandating that MTs associated with one WAP also be within the coverage areas of other WAPs so as to be able to perform handovers and re-associations. If a MT is not within the coverage area of an assisting WAP, it is then expected to physically displace to such a coverage area in order to relieve the first WAP of some processing load. These constraints are rigid and limit the efficacy of the disclosed method. Such limitations are common to all handover-based methods.

"Dynamically configurable beacon intervals for wireless LAN access points", US 2003/0163579 A1, presents a method that requires WAPs to modify, based on prevailing processing load levels, the intervals between the beacon signals that they transmit in order to attract or dissuade MT associations. While the disclosure presents a means for accommodating dynamic differences, it still involves the constraints of requiring a MT to be within the coverage areas of WAPs where processing load is low or being agreeable to displace towards such areas.

"Method and apparatus for selecting an access point in a wireless network", US 6,522,881 B1, describes an invention for MTs to make association decisions based on the level of processing load at WAPs as indicated in the beacon signals that the WAPs transmit. This disclosure focuses on proactive MTs that make association decisions. However the method is also limited by the factors described earlier.

Another shortcoming of these methods and other handover-based methods for dealin g with dynamic differences in WAPs is related to the bulk shifting of communications sessions. In practice MTs maintain a number of communications sessions with the WAPs with which they are associated. As a result, it is very likely that the communications sessions of only one MT or a few MTs constitute a considerable amount of processing load at the WAP. If the WAP were to affect the said MTs to handover and re-associate with another WAP, the processing load at the first WAP would be reduced, however by adversely affecting the other WAP. The other WAP then becomes overloaded and reverses the handover to the first WAP. This may continue without delivering any net gains for the WLAN. This points out that processing load is not finely distributed by methods of handovers. In other words, dynamic differences are not finely managed.

Given these issues, it is necessary to introduce means to deal with the static and dynamic differences in WLAN entities for the purpose of easier large-scale deployment, efficient management and optimal operation.

SUMMARY OF THE INVENTION

The disclosed invention relates to wireless local area networks (WLANs) and particularly to means of addressing the issues of static and dynamic differences among WLAN entities. It introduces policies for negotiations between WLAN entities for the purpose of accommodating these differences.

One aspect of the invention deals with negotiations between controlling nodes (CNs) and wireless access points (WAPs) of a WLAN based on policies that allow for accommodating static differences among them. Specifically, it presents means for determining a flexible division in WLAN functionality between the negotiating entities. The invention first involves classifying the functional capabilities of WLAN entities. The entities then determine the capabilities of other entities followed by negotiations between them on how best to divide the functionality among them. Further operations of the WLAN entities are then based on the determined division of functionality. This aspect of the invention enhances interoperability for WLAN entities.

Another aspect of the invention deals with negotiations between WLAN entities based on policies that allow for accommodating the dynamic differences between them. Particularly, it addresses the issue of distributing processing load among WAPs without requiring physical displacement of associated mobile terminals (MTs). It involves first determining the need to distribute parts of processing load at a WAP. This is followed by the determination of which parts of processing load may be distributed while at the same time maintaining existing association relationships between MT and WAP. Next, an overloaded WAP enters into negotiations with other WAPs in order to determine how the determined parts of processing load may be distributed among them. This aspect of the invention overcomes the limitations of handover-based methods for managing dynamic differences between WLAN entities.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The disclosed invention of policies for negotiations between entities of a wireless local area network (WLAN) is described in two major aspects, the first focusing on negotiations for accommodating static differences among WLAN entities whi

出証特２００５－３０３０８２０

le the second illustrates the aspect dealing with dynamic differences, particularly in levels of processing load.

In the following description, for purpose of explanation, specific numbers, times, structures, and other parameters are set forth in order to provide a thorough understanding of the present invention. However, it will be apparent to anyone skilled in the art that the present invention may be practiced without these specific details.

Negotiations for Accommodating Static Differences:

A WLAN system embodying a first aspect of the invention dealing with accommodating static differences among WLAN entities is exemplified in FIG. 1. The diagram illustrates a WLAN system 100 comprising a controller node (CN) 101, a number of wireless access points (WAPs) 105 and 107, a plurality of mobile terminals (MTs) 113 and a network backbone 117. For the sake of simplicity, WLAN system 100 is shown with a single CN whereas the system embodying the invention may comprise any number of CNs. Also, the diagram indicates a direct connection between CN 101 and the WAPs 105 and 107. Alternatively there may be a number of intermediate nodes between them. Similarly, the connection between CN 101 and the network backbone 117 may also include a number of intermediate nodes. In all such cases, the disclosed invention holds scope.

The CN 101 provides support and control to the WAPs 105 and 107 that associate with it. A new WAP in the WLAN system must first choose and establish association relationships with one or more CNs before it receives support and control from the CN or CNs. As such, WAPs may simultaneously hold more than one association relationship with one or more CNs. Similarly, the MTs 113 choose and maintain associations with the WAPs, which in turn provide them with services. These services include radio transmission and reception, secure transport and mobility. An MT may maintain a number of associations with one or more WAPs, however FIG. 1 simplifies this with each MT maintaining only one association with one WAP.

It can be inferred about the WLAN system 100 that the WAPs connect to the network backbone via the CN. Alternatives to this include the WAPs connecting to the network backbone by other means possibly through other intermediate nodes. In such cases, the CN will only be responsible for the control and management of the WAPs associated with it, while connectivity to an external network may be handled by other entities.

FIG. 1 shows the CN 101 capable of performing the complete set of WLAN functional operations, as specified by some established WLAN standard. It is also capable of other control and management functional operations. Each functional operation is logically represented by one of the functional components 115. The operations represented by each of the functional components may include encryption, decryption, medium access control protocol data unit (MAC PDU) processing, authentication, association, quality of service (QoS) processing, Internet Protocol (IP) processing etc.

Each functional component is represented by a functional component code. For the purpose of illustration some of the functional components in FIG. 1 are represented by functional component codes 'a', 'b' and 'c'. For example functional component 'a' may denote the processing required for a certain type of encryption, for example Wi-Fi Protected Access (WPA) or Advanced Encryption Standard (AES), functional component 'b' for QoS processing, for example priority handling, while functional component 'c' may be that for power control during radio transmission and reception. The functional components are logical units and may be implemented with a single processor using different sets of instructions and context for different functional components. Alternatively, each functional component may be implemented by individual processing entities possibly in disparate entities. While it is envisaged that the actual implementations of the functional components may vary among manufacturers and their implementations, the interfaces linking different components will be common so as to allow seamless processing of a control or data unit from one WLAN entity to another.

Since the WAPs may be from different manufacturers or of different implementations, they may incorporate among them varying degrees of WLAN functional components. These correspond to the different divisions in functionality between CNs and WAPs. For example, WAP 105 is shown to be capable of processing functional components 'a', 'b' and 'c' whereas WAP 107 is only capable of processing functional components 'b' and 'c'. The remaining functional components necessary for their WLAN operations and their control are left to be processed by CN 101. These differences between the WAP and CN entities represent the static differences that are to be accommodated by each other WLAN entity by means of the disclosed method for negotiations.

For the proper operation of the invention, it is necessary for the CNs and WAPs from different manufacturers to follow pre-defined naming conventions for the functional components that they incorporate and recognize. This ensures that negotiating entities can precisely distinguish which functional components a peer entity implements. To this end, the functional component codes need to be consistent in representing various functional components. This convention however need not be followed strictly to the letter. For example, the convention may present standard descriptors for various functional components from which the negotiating entities may discern their properties. As an illustration, "IEEE 802.11i" describes an IEEE WLAN standard pertaining to security functionality. So based on such descriptors, negotiating CNs and WAPs may match parts or all of the names with other descriptors to infer the nature of the functionality components which the descriptors represent.

As mentioned earlier, the interfaces between functional components also need to be consistent across WLAN entities. This is to ensure that the processing of a control or data unit can be performed seamlessly from one WLAN entity to another. For example, a WAP may perform decoding with an appropriate functional component and then send the decoded data unit to a CN in a form suitable for further processing, say, a form that may be readily decrypted by a decryption functional component at the CN. So although there are different functional components in different WLAN entities, the interfaces between them are mutually recognizable so as to provide seamless processing.

Each WLAN entity is controlled in general by a controller entity. Thus, CN controller 103, WAP controllers 109 and 111 are responsible for the overall operations of CN 101, WAPs 105 and 107, respectively. While the WLAN system 100 shows the controllers to be integral to the WLAN entities, the controllers may also be separate entities. As such, they may remain disparate for each WLAN entity or combined together for a number of WLAN entities. It may be envisaged that specialized controllers exist for each type of entity.

The controllers are particularly responsible for establishing processing schedules for each of the entities that associate with the entities managed by the controllers. Consistent with this, the CN controller maintains processing schedules for WAPs 105 and 107 whereas the WAP controllers in turn maintain processing schedules for their respectively associated MTs 113.

A processing schedule refers to a sequence of functional components that are to be processed for control and data units received from associated devices by the entity that the said controller manages. For example, WAP controller 109 for WAP 105 maintains a processing schedule comprising a sequence of its functional components 'a', 'b' and 'c'. When a control or data unit arrives from an associated MT 113, WAP 105 performs the processing of functional components 'a', 'b' and 'c' based on the established processing schedule. The processing schedule at a WAP may be the same for all associated MTs if all the MTs incorporate consistent functionality. However if MTs implement different degrees of functionality, WAPs may also maintain separate processing schedules for processing the control and data units from different MTs.

In one embodiment of this first aspect of the invention, WAP controllers 109 and 111 for WAPs 105 and 107, respectively, first perform a step 201 in FIG. 2 of discovering CNs. The CNs to be discovered may be within the same administrative domain as the WAPs or the CNs may belong to different administrative domains. This step of discovery may be accomplished based on any node discovery protocol or by the broadcast/multicast/anycast of a specific, mutually recognizable message invoking responses from available CNs.

Next the WAP controllers choose which among the discovered CNs to associate with in a step 203. One possible metric for this choice may be the round-trip latency between the WAPs and CNs. This metric has the advantage of allowing for prompt exchanges of control messages between the WLAN entities. Other metrics that may be used for CN selection include network status, congestion, link status, random selection, cost of using the link, and manufacturer identification. Having chosen a CN 101 with which to associate, WAP controllers 109 and 111 then enter an association phase with the CN. This phase may include mutual authentication, exchanges of security information and the establishment of communications protocols for further exchanges.

Then, in a step 205, WAP controllers 109 and 111 enter a negotiation phase with CN controller 103 for the purpose of establishing means to accommodate the possible differences in their respective functional capabilities. In particular, the negotiations are to establish a division of WLAN functionality that is consistent with the capabilities of the negotiating entities and are optimal for the oper ation and management of the whole WLAN.

The negotiations may be initiated by either a WAP controller or a CN controller as in a step 207. WAP controllers initiate by sending information regarding the functional capabilities of the associated WAPs to the chosen CN. This information includes the appropriate codes corresponding to the functional components that the WAPs are capable of processing and their processing schedules. A CN controller initiates negotiations by requesting for functional capabilities information from the associated WAPs.

Upon receiving capabilities information from the associated WAPs and based on established policies, CN controller 103 determines an initial division of WLAN functionality. This division is then enforced between CN 101 and the associated WAPs 105 and 107 as in step 209. The functionality division specifies which of the functional components that can be processed by the WAPs needs to be active and processed by the WAPs themselves and which need to be inactive so that they may be processed by the CN.

In one embodiment, the initial division of functionality is based on a policy that allows each associated WAP to process all the functional components that they are capable of. With such a division, only those functional components that an associated WAP cannot inherently process are left to the CN. Such functional components are then included in the processing schedule of the CN controller. Since WAPs may have dissimilar degrees of functional capabilities, the CN controller may be required to establish separate processing schedules for each associated WAP. As such this embodiment presents a policy which allows for the full capabilities of each WAP to be leveraged on. However this is achieved at the expense of running different processing schedules at the CN controller for different WAPs.

In another embodiment, the initial division of functionality is based on a policy in which the CN controller first determines a subset of functional components that are common across all associated WAPs. The associated WAPs must then process only the determined subset of functional components even if they are capable of processing other functional components. Therefore, the remaining set of functional components required to be processed for each associated WAP will be common to all of them. This common set can then be processed by the CN. This embodiment presents a policy in which the CN controller may maintain a single processing schedule for all associated WAPs. If a new WAP, incorporating functionality components fewer than or incompatible with those specified in the existing processing schedule, associates with the CN, the CN controller repeats the step of determining the subset of functional components that are common across all currently associated WAPs. It is noted that this step need not be performed if a new WAP involves more functionality components than that specified in the single, previously established processing schedule.

Alternatively, the association of a new WAP with a CN may invoke a grace period, in which two processing schedules are maintained simultaneously. The first corresponds to the existing processing schedule which was established before the association of the new WAP, while the second corresponds to the processing schedule which takes into account the functionality of the newly associated WAP. Then da ta units processed during the grace period are done so based on the processing schedule that is most appropriate. This embodiment provides uninterrupted services to existing MTs in the event of new WAPs associating with the CN.

In another embodiment, the initial division of functionality is based on a combination of policies, where a subset of associated WAPs is allowed to process all the functional components that they are capable of. Another subset of associated WAPs process only a common subset of functional components that they are capable of processing even if they have greater capabilities. The CN controller determines the subset of functional components that are common across all of the subset of associated WAPs. The remaining set of functional components required to be processed for each associated WAP will be performed by the CN. Therefore the remaining set of functional components will be distinct for each of the associated WAPs of one subset of associated WAPs and be similar for each of the associated WAPs of the other subset of associated WAPs.

Next, having determined an initial division of WLAN functionality, the division is then sent to the associated WAPs for confirmation as in a step 209. The WAP controllers in turn verify that the division is feasible and upon verification return a positive acknowledgement to the CN as in steps 211 and 213.

Given that some WAPs may implement functional components in a non-partitioned manner, for example in a hardwire system, such WAPs may not be able to adhere to the specified initial functionality division. In these cases, the WAPs send a negative acknowledgement to the CN with an updated processing schedule that indicates operational dependencies between their functional components as in a step 215. The CN controller then takes this new processing schedule into account and formulates another functionality division that may be compatible with the WAPs. If the new division is feasible, the WAPs return a positive acknowledgement and if not, the negotiations continue in a similar fashion. As a last resort, upon a fixed number of unsuccessful negotiation exchanges, the CN allows the WAPs to process all their functional components.

During the initial negotiation phase, either CN or associated WAP may choose to forcibly terminate further negotiations based on pre-defined policies and rules even before the negotiation phase is complete. These policies are enforced by either CN or WAP when it is inferred that further negotiations will be moot as in steps 219 and 221. For example, if the difference between the initial divisions of WLAN functionality is significantly dissimilar from the capabilities of a WAP, the WAP may choose to terminate negotiations as it may be futile to proceed further. Alternatively, if either entity determines that the other is illegitimate, the negotiations may be terminated. Many other policies may also be used to enforce termination of negotiations.

Once a functionality division is acceptable to all participating WLAN entities, CN controller 103 establishes appropriate processing schedules for associated WAPs 105 and 107 as in a step 217. These schedules define the sequence of functional components that are to be processed by CN 101 for control and data units received from associated WAPs 105 and 107. Then, CN controller 101 manages each associated WAP in a manner consistent with the processing schedules.

In one embodiment, WLAN functionality may be divided into four functional components that may be denoted by functional component codes 1, 2, 3 and 4. The functional component corresponding to code 1 relates to that parts of WLAN functionality concerning the radio aspects. This may include radio transmission and reception, coding, modulation, power control and beacon signal control. Such a division combining aspects concerning the radio interface will allow for simpler design. The code 2 functional component relates to security aspects, which may include authentication, association, encryption and decryption. The basis for this division is that processing for security involves mathematical computation for which reason they may be consolidated and optimized. Then, the functional component of code 3 deals with the processing required for control and data protocol data units (PDUs). This includes bridging, routing, retransmissions and Internet Protocol (IP) layer processing for which specialized network processors have been developed. Next, the code 4 functional component relates to the general control and management of the WLAN. Quality of Service (QoS) control, configurations and policy management are some of the aspects of this functional component. This embodiment presents a simple and practical classification for WLAN functionality. Negotiations between various WLAN entities may then be based on these classifications. The classifications may also be used to describe different entities. For example, a WAP implementing only radio aspects of WLAN may be referred to as a type 1 entity which will then require a CN capable of the remaining functional components 2, 3 and 4.

In another embodiment of the first aspect, a WAP controller need not explicitly send its functional capabilities information to a CN controller, rather the CN controller infers the capabilities of an associated WAP. Such a means for automated capabilities discovery allows for easier determination of functional capabilities without requiring the explicit exchange of functional component codes between a CN and associated WAPs. In this embodiment, a CN controller sends a special command to an associated WAP to which the WAP responds by generating a data unit and processing it based on its functional components. The emulated data unit is then sent to the CN after being processed by the WAP. The CN controller then infers the functional capabilities of the associated WAP based on the received emulated data unit. Subsequent operations then follow from step 209 in FIG. 2. This embodiment requires associated WAPs to be capable of recognizing and responding to the special command issued by the CN controller.

An alternate form of the embodiment involves a CN controller simulating a data unit as if it was a mobile terminal and sending the simulated data unit to an associated WAP. The destination address of the simulated data unit is set to be the CN itself. Upon receiving the data unit, the WAP performs its processing based on its capabilities and forwards the processed data unit back to the CN. The CN controller then infers the functional capabilities of the associated WAP from the processed data unit. After this, the CN controller devises an initial division of WLAN functionality and sends this to the associated WAP. Subsequent operations then follow from step 209 in FIG. 2.

In another embodiment of the invention, a single entity that integrates both WLAN operational functionality and control and management functionality is presente

d. FIG. 3 exemplifies this embodiment in that it illustrates such an integrated WLAN entity 301. The integrated WLAN entity is capable of both WAP operations and CN control and management operations for which there are a WAP controller 303 and a CN controller 305, respectively. Each of the WAP and CN functional operations is logically represented by one of the functional components 307 each denoted by a functional component code. These functional components encompass WAP operations like radio transmission and reception, in addition to CN operations like WLAN monitoring and configuration management.

The set of functional components 307 are common to both WAP and CN controllers so that the processing schedule at each controller may include any of the functional components. Each controller operates in an independent manner with the understanding that the complete set of functional components is available for it to schedule. As such, during the negotiations phase between WAP controller and CN controller, the WAP controller sends its capabilities information so as to include the complete set of codes corresponding to all of functional components 307.

Associated with the integrated WLAN entity is a number of MTs 309. WLAN system 300 shows the associated MTs connecting to a network backbone 311 via the integrated WLAN entity. It is also possible for this connection to be made through alternate means like that through other intermediate nodes. To the associated MTs however, there is no difference between an ordinary WAP and the integrated WLAN entity.

Operationally, in this embodiment, the WAP controller of an integrated WLAN entity first performs a discovery of CNs. In essence, the discovery results in finding itself as a CN. Upon discovery, an association phase follows after which the CN controller and WAP controller enter a negotiations phase. Discovery and association are token operations as both the WAP and CN reside within a single entity.

Next, the WAP controller and CN controller begin negotiations in order to determine a suitable division of functionality between them. The WAP controller first sends information regarding its capabilities to the CN controller. This information will include the functional component codes corresponding to all the functional components available within the integrated WLAN entity and a processing schedule that involves all the codes. In response to the capabilities information and based on established policies for functionality divisions, the CN controller devises an initial division of functionality and sends this to the WAP controller. The initial division of functionality will be feasible and acceptable to the WAP controller since its feasibility is based on that of the CN controller which in turn determines the division. As a result, the WAP controller sends a positive acknowledgement to the CN controller. Then both controllers establish processing schedules according to the accepted division in functionality and operate on that basis. This embodiment illustrates how the process of negotiations may take place within an integrated WLAN entity. As such, the disclosed invention will be consistent will various designs for these entities.

In another embodiment of the first aspect of the invention, different CNs may incorporate varying degrees of functionality. As such, a WAP associating with a CN may require the processing of functionality which is unavailable both with itself and with the CN that it associates. This embodiment serves to address such situations by allowing the various CNs in a WLAN to negotiate among them for the purpose of accommodating differences in their functional capabilities. The CNs may follow the steps put forth in FIG. 2 to determine how the static differences in their functionality may be managed. For example, a first CN may only incorporate 2 types of functional components and it may necessitate in a third component that it is not capable of, but yet it is required for providing services to the WAPs associated with it. In such a case, the first CN discovers and associates with a second CN in the WLAN with which it then negotiates. The negotiations are for the purpose of dividing functionality among the CNs. As a result, the first CN may allow processing of the third functional component to be performed by the second CN.

The embodiments of this first aspect of the invention described insofar illustrate policies with which WLAN entities may negotiate with each other in order to accommodate the varying degrees of static differences that each such entity incorporates. They describe how WAPs incorporating varying degrees of WLAN functionality may be integrally managed by a controlling node. The disclosed method for negotiations provides for flexibility in deploying WLANs with entities from different manufacturers or of different implementations. While prior arts focus on mandating proprietary means of dividing functionality among WLAN entities, this invention serves to accommodate entities of different degrees of functionality. As a result, the division of WLAN functionality between controlling nodes and wireless access points may be achieved in a flexible manner.

Negotiations for Accommodating Dynamic Differences:

This aspect of the invention describes policies with which WLAN entities embodying the disclosed invention may negotiate with each other for the purpose of accommodating dynamic differences among them. It is exemplified by using the varying levels of processing load at different WLAN entities particularly WAPs.

A simplified representation of a WLAN system 400 embodying this aspect of the invention is depicted in FIG. 4. It shows WAPs 401 and 403 that are capable of providing services and performing related processing for a number of associated MTs. The WAPs and MTs may maintain a number of associations with each other, however for reasons of simplicity, the WLAN system of 400 only shows one association with WAP 401 for the single MT 405. This MT 405 is associated with and receives services from WAP 401 over a wireless connection 427. Also the WAPs 401 and 403 are shown to be connected to a network backbone 407, through which they can communicate with other networks and with each other, either directly or via intermediate switching or routing devices. The WAPs may also connect to the network backbone or with each other through a number of intermediate nodes.

During the operation of WLAN system 400, the processing loads at the WAPs may vary due to the dynamic nature of communications. For example, a number of new MTs may choose to associate with a WAP thereby necessitating in additional processing at the WAP. Another example is of a MT choosing to be involved in additional numbers of communications sessions again resulting in extra processing for the W

AP with which it is associated. Consequently, the processing load at various WAPs in the WLAN system will vary over time. It is this dynamism that the disclosed invention addresses by requiring WAPs to negotiate with each other for the purpose of distributing processing load from a heavily loaded WAP to a relatively lightly loaded WAP while maintaining existing association relationships with their MTs.

From FIG. 4, WAPs 401 and 403 provide services to associated MTs by performing some type of processing on their behalf. The processing can be logically divided by lines 419 and 421 in WAPs 401 and 403, respectively, as being association-specific (ASP) and non-association-specific (nASP) processing. ASP processing 411 and 413 involves those that are directly dependent on the association between MTs and WAPs. Such processing requires interaction with the wireless interface between a WAP and an associated MT. Examples of ASP processing include transmission and reception of data units, power control, coding and modulation.

nASP processing 415 and 417 refer to processing that are not directly dependent on the wireless aspects of a connection between WAP and associated MT. Examples of nASP processing include bridging, filtering, protocol data unit (PDU) processing and PDU delivery.

WAP controllers 423 and 425 manage and control the overall processing at WAPs 401 and 403, respectively.

The operations involved with this aspect of the invention are described with reference to FIG. 5. The WAP controller in each of the WAPs in a WLAN system embodying the invention performs a step 501 of monitoring the nASP processing load at the WAP. This includes monitoring the nASP processing load for each of the communications sessions for all the associated MTs. Examples of how processing load may be monitored include means for monitoring the processor usage or duration of processor activity for a communications session and then aggregating this for all communications sessions. Another example is a means for monitoring the amount of memory usage for communications sessions. Similarly, a number of other factors may be monitored, either independently or in any combination, to monitor the overall nASP processing load at a WAP. Furthermore, other means of monitoring may also be used.

In one embodiment of the invention, a WAP controller 423 for a WAP 401 derives a resource characteristic for the WAP based on the various factors of nASP processing load that are monitored for each communications session of the associated MTs. The resource characteristic is a representation of the resources or processing load required for providing services to a communications session.

Next, the resource characteristics of all communications sessions for all associated MTs are combined to obtain an aggregate nASP load factor for WAP 401. The aggregate nASP load factor is then compared to a nASP load threshold, in a step 503, to determine impending nASP processing overload conditions that may not be manageable by WAP 401. If the aggregate nASP load factor is determined to be manageable at WAP 401, the monitoring of step 501 is repeated.

If, however, impending nASP processing overload conditions are determined, WAP controller 423 then determines in a step 505, which parts of the nASP processing load at WAP 401 may be distributed to other WAPs of the WLAN system with the aim of reducing overall processing load at WAP 401 while at the same time maintaining existing association relationships with associated MTs, such as that with MT 405. Such a mechanism is unique from traditional methods of distributing processing load which mandate handovers that may necessitate in a MT physically displacing to a coverage area of another WAP. The step 505 is based on the resource characteristics of the communications sessions of MTs associated with WAP 401. For example, a WAP controller may choose to distribute those parts of processing load with the greatest resource characteristics or those with the least resource characteristics. This choice may also be based on other factors such as the expectation of future changes in resource characteristics.

Next, the negotiations phase begins between a first WAP controller and other WAP controllers. This phase involves determining which of the other WAPs are agreeable to accommodate the dynamic differences in processing loads by taking over some parts of the nASP processing load of the overloaded first WAP. In a first stage of negotiations, the WAP controller 423 executes a step 507 of sending solicitation messages to other WAPs of the WLAN system. The solicitation messages include the resource characteristics of those parts of nASP processing load of WAP 401 that have been determined by the WAP controller to be distributed to other WAPs.

WAP controllers receiving the solicitation message determine if they are capable of accommodating the additional processing load as specified in the message. These controllers then respond to the WAP controller initiating the solicitation by either accepting to take over the complete specified load or accepting to handle partial amounts of the load. The initiating WAP controller then uses the responses to determine which of the other WAPs are agreeable and to which extent agreeable, to receiving parts of the nASP processing load that it initially specified. The negotiations may also extend beyond the initial solicitation message if such a need is inferred to exist by the initiating WAP controller. As such, step 507 is used to determine which of the other WAPs in the WLAN system are agreeable to receiving and perform processing of parts of nASP processing load of WAP 401 in order to reduce the processing load at WAP 401.

Next, in a step 509, WAP controller 423, of the overloaded or soon to be overloaded WAP, establishes a tunnel connection 409, between WAP 401 and the WAPs determined in a step 507 to be agreeable to receiving and processing the determined parts of nASP processing load of WAP 401. FIG. 4 illustrates one of the agreeable WAPs to be WAP 403. Relevant context information required for processing of the determined parts of nASP processing load is then transmitted over the established tunnel connection to the agreeable WAPs. Then, in a step 511, WAP controller 423 distributes the determined parts of the ASP processing load of WAP 401 to the agreeable WAPs over the tunnel connection. In doing so WAP controller 423 reduces the overall processing load at WAP 401. All this is achieved while maintaining existing associations with associated MTs and in a fine grained manner so as not to overwhelm the agreeable WAPs.

This embodiment illustrates the efficacy of this aspect of the invention in distributing processing load without the limitations of existing handover-based methods. As such, there are no constraints as to the geographic position or willingness to displace for the associated MTs.

In another embodiment of this aspect of the invention, an overloaded WAP simply relays the processing load required for communications sessions of associated MTs to other agreeable WAPs. This relay may be over wireless, wired or a combination of both types of links. Relevant context information will also need to be relayed so as to facilitate the processing of the relayed processing load.

In one embodiment, the tunnel connection between two WAPs is established over a direct link between WAPs. This direct link may be wireless and similar to the link between WAPs and MTs in which case the WAPs determine a radio channel alternate from the channel used for communications with associated MTs and use this to exchange relevant context information and determined parts of nASP processing load. Alternatively, the link between two WAPs can be wired and directly connected. With this embodiment, the tunnel connection need not traverse the network backbone but rather can be established directly.

In another embodiment of the invention, nASP processing load is defined as the processing required for security algorithms used for the encryption and decryption of MAC PDUs that are transmitted to and received from associated MTs. Processing of security algorithms is a type of non-association-specific processing which is computationally intensive due to the complex characteristic. As such, a significant increase in the number of associated MTs or in the volume of traffic to and from associated MTs will in turn lead to a corresponding increase in the processing of the security algorithms. In this embodiment, WAPs and associated MTs encrypt their respective transmissions over the wireless connection based on an established security algorithm. Upon receipt of transmissions, the WAPs and MTs perform decryption processing based on the same established security algorithm.

When the nASP processing load for encryption and decryption becomes significant, as measured by its resource characteristic exceeding a nASP load threshold, a WAP controller 423 of WAP 401 sends a solicitation message to determine which of other WAPs in the WLAN system are agreeable to receiving and processing parts of nASP processing load corresponding to the security algorithms used for transmissions between WAP 401 and MT 405. If WAP 403 is agreeable to processing the nASP processing load, its WAP controller 425 responds to the solicitation message. Upon receipt of the response to the solicitation message, WAP controller 423 establishes a tunnel connection to WAP 403 and then sends relevant security keys and context information to WAP 403 via the established tunnel connection.

Next, upon establishment of the tunnel connection and exchange of the security keys and context information, WAP controller 423 sends to WAP 403 encrypted MAC PDUs received from associated MT 405. WAP controller 423 also sends to WAP 403, MAC PDUs that are to be encrypted before transmission to the associated MT 405. WAP 403 then processes the nASP processing load for encryption of MAC PDUs and sends the encrypted MAC PDUs to WAP 401 via the tunnel connection. Having received the encrypted MAC PDUs, WAP 401 then transmits them to the associated MTs. In t his embodiment, the computationally intensive processing of security algorithms is distributed across WAPs so as to lower the processing load at a WAP. This is performed without affecting re-associations of MTs and as such this method is no t limited by the shortcomings of handover-based methods.

In another embodiment, a WAP controller distributes the nASP processing load cor responding to those security algorithms that cannot be processed by the WAP due to reasons of unfamiliarity of the said security algorithms while at the same ti me maintaining association relationships with associated MTs. Given the growing numbers of MTs and other devices in which WLAN capabilities are incorporated, th ere may be many security features implemented in such MTs and devices, all of wh ich not being recognizable by all WAPs with which associations are sought. As su ch this embodiment allows a WAP to maintain associations with MTs and other devi ces even if some of the required processing is not possible at the said WAP. Th e embodiment is described using an uncommon security algorithm as example; howev er it is valid for any other type of processing that is uncommon between WAP and MT.

During an association of a MT with a WAP, a security algorithm that is knowledge able to both entities is negotiated upon for securing transmissions over the wir eless connection between the two entities. Traditionally, if the WAP is not know ledgeable of any of the security algorithms used by the MT, the MT cannot be ass ociated with the said WAP. The here forth described embodiment of the invention transcends this limitation and permits MTs to associate with a WAP even if the WAP is not knowledgeable of any of the security algorithms used by the MTs.

In this embodiment, a WAP controller 423 permits a MT 405 to associate with WAP 401 even though there are no common security algorithms that both WAP 401 and MT 405 are knowledgeable of. During the association phase, WAP controller 423 send s a solicitation message to other WAPs in the WLAN system to determine which WAP s are knowledgeable of and agreeable to processing any of the security algorithm s familiar to MT 405. If WAP 403 is knowledgeable of and agreeable to processing any of the security algorithms familiar to MT 405, WAP controller 425 responds to the solicitation message from WAP controller 423 with a chosen security algor ithm. Upon receipt of the response to solicitation message, WAP controller 423 t hen establishes a tunnel connection 409 with WAP 403. WAP controller 423 next se nds relevant security keys and context information to WAP 403 via the establishe d tunnel connection. The chosen security algorithm is then intimated to MT 405 a nd it is associated with WAP 401.

Upon establishment of tunnel connection and exchange of security keys and contex t information, WAP controller 423 sends to WAP 403, MAC PDUs received from MT 40 5 associated with WAP 401, that have been encrypted based on the chosen security algorithm. WAP 403 receives the encrypted MAC PDUs via the tunnel connection an d decrypts them based on chosen security algorithm and established security keys and context information. WAP controller 423 also sends to WAP 403, MAC PDUs tha t are to be encrypted before transmission to the associated MT 405. In this case , WAP 403 receives MAC PDUs via the tunnel connection, encrypts them based on ch osen security algorithm and sends the encrypted MAC PDUs back to WAP 401. WAP 40 1 then transmits the encrypted MAC PDUs to the associated MT 405. In this embodi ment, the lack of knowledge about a security algorithm does not limit a WAP from allowing a MT to associate with it. As such it provides greater flexibility in providing services to a great number of MTs with different processing requirements.

Another embodiment of the invention relates to the size of PDUs processed by WAPs. Studies in processor scheduling have shown that processing large PDUs before small PDUs leads to greater average processing time as compared to cases where small PDUs are processed before large PDUs. FIG. 6 illustrates this through example. In a first case, it shows two processing schedules 601 and 603 for processors 613 and 615, respectively. The scheduling order 605 and 607 denote the relative order in which PDUs A, B, C and D are processed. 609 and 611 denote the processing time, in arbitrary time units (tu), required for processing each of the PDUs.

In schedule 601, large PDUs A and B are processed before small PDUs C and D. The average processing time for the PDUs is 21.25 tu, while it is only 16.25 tu for the PDUs in schedule 603 where small PDUs C and D are processed before large PDUs A and B. Clearly schedule 603, in which small PDUs are processed before large PDUs, leads to significant reductions in average processing time.

In a second case, the aspect of processing overhead for processor scheduling is considered. The processing of each PDU requires some processing overhead which includes memory access time and context transfer time. The overhead is generally independent of the size of the PDU as it is required before the actual processing. FIG. 6 depicts a schedule 617 for small PDUs alone in which processing overhead time and actual processing time is shown by 621 and 625, respectively. Processing overhead time 623 and processing time 627 is for large PDUs in schedule 619. From this, it is seen that the processing overhead takes up 50% of total time in schedule 617 whereas overhead constitutes only 331/3% in schedule 619. This illustrates how processing only small PDUs can lead to a processor handling more overhead than when a processor handles large PDUs.

In an embodiment of the invention related to the size of PDUs, the nASP processing load is defined as the size of PDUs handled by a WAP. A WAP controller 423 of WAP 401 monitors the size of PDUs received over a wireless connection 427 from an associated MT 405. When WAP controller 423 determines that WAP 401 is processing any of the previous described cases, the controller determines a processing schedule for a subset of the monitored received PDUs. The aim of the processing schedule is to optimize average processing time and processing overhead time at WAP 401.

Next, WAP controller 423 derives a resource characteristic for the PDUs that may be distributed to other agreeable WAPs for processing. As such, the resource characteristic represents the processing load required for processing PDUs other than those that are processed by the WAP 401 itself. The resource characteristic is then sent to other WAPs of the WLAN system as part of a solicitation message to determine WAPs agreeable to processing the PDUs described in the message.

If WAP 403 is agreeable to the nASP processing of PDUs described in the solicita tion message, WAP controller 425 responds accordingly. A WAP in the WLAN system will be agreeable to processing PDUs from another WAP when processing such PDUs would allow it to optimize its own average processing time and processing overhe ad time. Upon receipt of the response, WAP controller 423 then establishes a tun nel connection 409 with WAP 403 and sends relevant context information to WAP 40 3 via the established tunnel connection.

Having established the tunnel connection and exchanged relevant context informat ion, WAP controller 423 sends to WAP 403, PDUs described by the previously sent resource characteristic with the aim of optimizing average processing time and p rocessing overhead time at WAP 401. So with this embodiment, the nASP processing of PDUs of different sizes may be distributed in a manner so as to optimize pro cessing while at the same time maintaining association relationships between WAP s and MTs.

Another embodiment of the disclosed method concerns the distribution of processi ng of ISO-OSI layer 3 and layers above layer 3 from a first WAP to other WAPs wh ile maintaining association relations between the first WAP and MTs associated w ith it. Many WAPs are currently capable of processing up to ISO-OSI layer 2, how ever there are vendors manufacturing WAPs capable of ISO-OSI layer 3 processing. This embodiment refers to such devices and other similar WAPs. Processing for I SO-OSI layer 3 and layers above layer 3 includes quality of service (QoS) provis ioning, routing and scheduling. In this embodiment, nASP processing load is defi ned as the processing concerning ISO-OSI layer 3 and layers above layer 3.

In this embodiment, a WAP controller 423 for WAP 401 derives a resource characte ristic for the processing of ISO-OSI layer 3 and layers above 3 based on the fac tors of nASP processing load monitored for each of the communications sessions b etween WAP 401 and associated MT 405. The resource characteristics of all commun ications sessions are then combined to derive an aggregate nASP load factor for WAP 401 which is then compared to a nASP load threshold to determine impending n ASP processing overload conditions.

If impending nASP processing overload conditions are determined, WAP controller 423 then determines parts of nASP processing load of ISO-OSI layer 3 and layers above 3 that may be distributed to other WAPs in the WLAN system with the aim of reducing overall processing load at WAP 401. Next, WAP controller 423 sends a s olicitation message, comprising resource characteristics of the determined parts of nASP processing load of ISO-OSI layer 3 and layers above 3, to determine whi ch other WAPs are agreeable to receiving and performing processing of the parts of nASP processing load on behalf of WAP 401.

If WAP 403 is agreeable to processing the parts of nASP processing load based on the solicitation message, WAP controller 425 sends a positive response to WAP 4 01. Upon receiving the response, WAP controller 423 establishes a tunnel connect ion 409 between WAP 401 and WAP 403 after which relevant context information req uired for processing of parts of nASP processing load of ISO-OSI layer 3 and lay ers above 3 is transmitted over tunnel connection to WAP 403. Then WAP controlle r 423 sends the determined parts of nASP processing load to WAP 403 with the aim of reducing nASP processing load at WAP 401 by distributing parts of processing load to other WAPs while maintaining existing association relations between WAPs and MTs.

In yet another embodiment of the aspect of the invention dealing with negotiations for accommodating dynamic differences among WLAN entities, a central controller entity takes part in the negotiations. Broadly, the central controller entity coordinates how the dynamic differences are to be managed among participating WLAN entities. One particular embodiment involves the central controller coordinating the distribution of nASP processing load across the WAPs under its purview.

This is described with reference to FIG. 7 which illustrates a central controller 729 that is capable of monitoring the nASP processing loads at WAPs 701 and 703. When the nASP processing load at WAP 701 exceeds a nASP processing load threshold, the central controller sends a solicitation message to other WAPs in the WLAN system requesting assistance for the processing of parts of processing load of WAP 701. This begins the negotiations phase between the central controller and other WAPs in the WLAN system. The solicitation message includes descriptors of the parts of processing load at WAP 701 to be distributed to other WAPs with the aim of reducing overall processing load at WAP 701.

If WAP 703 is agreeable to assist with the processing for WAP 701, a WAP controller 725 responds to the solicitation message. The central controller then intimates WAP 701 about the acceptance, after which WAP 701 establishes a tunnel connection 709 with WAP 703. It then sends WAP 703 relevant context information followed by the parts of processing load as specified in the solicitation message. Alternatively, WAP 701 may send the context information and parts of processing load to the central controller which then forwards this to the agreeable WAPs like WAP 703. So with this embodiment, processing load is distributed across WAPs of a WLAN with a central controller coordinating the distribution.

In another embodiment, the central controller receives regular information from WAP controllers of the WAPs under its purview regarding their nASP processing loads. As such, the WAP controllers themselves determine overload conditions and the need to distribute parts or all of nASP processing load to other WAPs or other WLAN entities. The negotiations phase in this embodiment is thus initiated by the WAP controllers and then further pursued between the central controller and other WAPs.

The embodiments presented so far exhibit how negotiations between various WLAN entities based on the disclosed policies may be used to accommodate the dynamic differences among them. In particular, they describe how processing load may be classified as being association-specific and non-association-specific. They also illustrate how parts of nASP processing load may be distributed to other WAPs of the WLAN system for the purpose of reducing overall processing load at a first WAP. The disclosed invention is unique in that it permits the distribution of processing load while maintaining existing association relationships between WAPs and MTs. As such, the disclosed method for accommodating dynamic differences does not necessitate in the physical displacement of any WLAN entity which is unlike existing methods. This innovation is therefore more flexible than handover-based methods for distributing processing load. It also transcends the limitations of such schemes.

The various aspects of the disclosure presented insofar illustrate the novelty of the method for negotiations in accommodating static and dynamic differences among WLAN entities. Whereas, extant methods focus on hard divisions in functionality among WLAN entities, this invention presents alternate means where functionality divisions may be made in flexible manners. Also, while existing methods require re-associations and the consequent geographical and physical limitations of handovers, this innovation puts forth ways of dealing with imbalances in processing load without the constraints of handover-based methods.

It will be clear to anyone skilled in the related art that the disclosed invention may take the form of numerous other embodiments with numerous other policies for the negotiation and handling of differences among WLAN entities without deviating from the essence and scope of this disclosure. As such this invention will be applicable in all such embodiments and practices.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 illustrates an operational representation of a wireless local area network (WLAN) system used to illustrate a first aspect of the disclosed invention dealing with policies for negotiations between WLAN entities, particularly between a controlling node (CN) and wireless access points (WAPs);

FIG. 2 depicts the general operational steps involved in a first aspect of the invention dealing with policies for negotiations between a CN and WAP.

FIG. 3 shows an integrated WLAN entity exemplifying one embodiment of a first aspect of the invention in which the capabilities of a CN and WAP are integrated into one entity;

FIG. 4 illustrates a simplified framework for a second aspect of the invention dealing with policies for negotiations for the purpose of accommodating dynamic differences among WLAN entities, particularly between WAPs;

FIG. 5 depicts the general operational steps involved in a second aspect of the invention dealing with policies for negotiations for accommodating dynamic differences among WLAN entities. Specifically, it deals with processing loads at various entities;

FIG. 6 serves to explain the reasoning for one embodiment of a second aspect of the invention, wherein the definition of processing load is taken to be the size of the protocol data unit (PDU) that is received by the WAP from associated MTs;

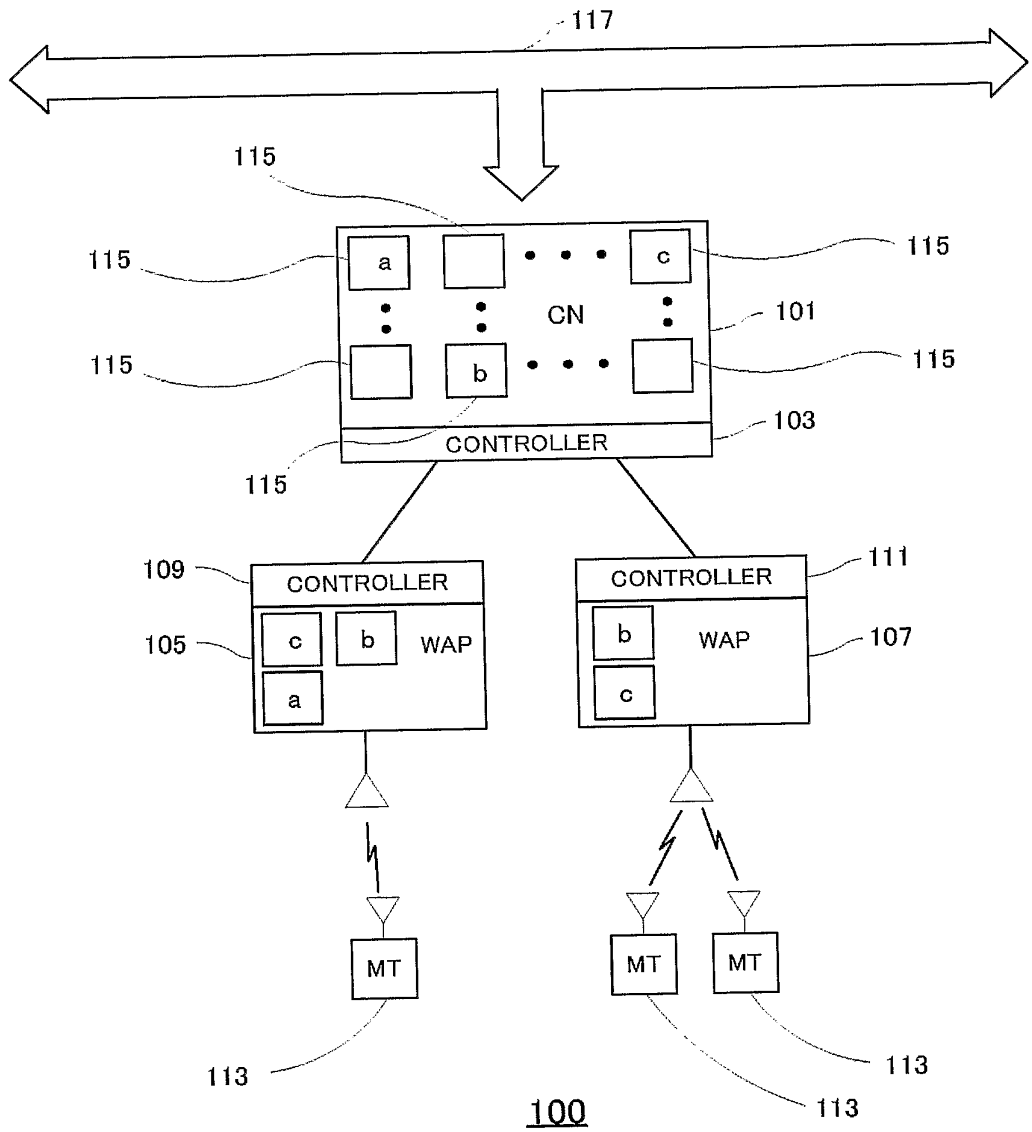
FIG. 7 illustrates one embodiment of a second aspect of the invention in which a central controller performs a supervisory role in the negotiations for accommodating dynamic differences among WLAN entities.

Description of the Symbols

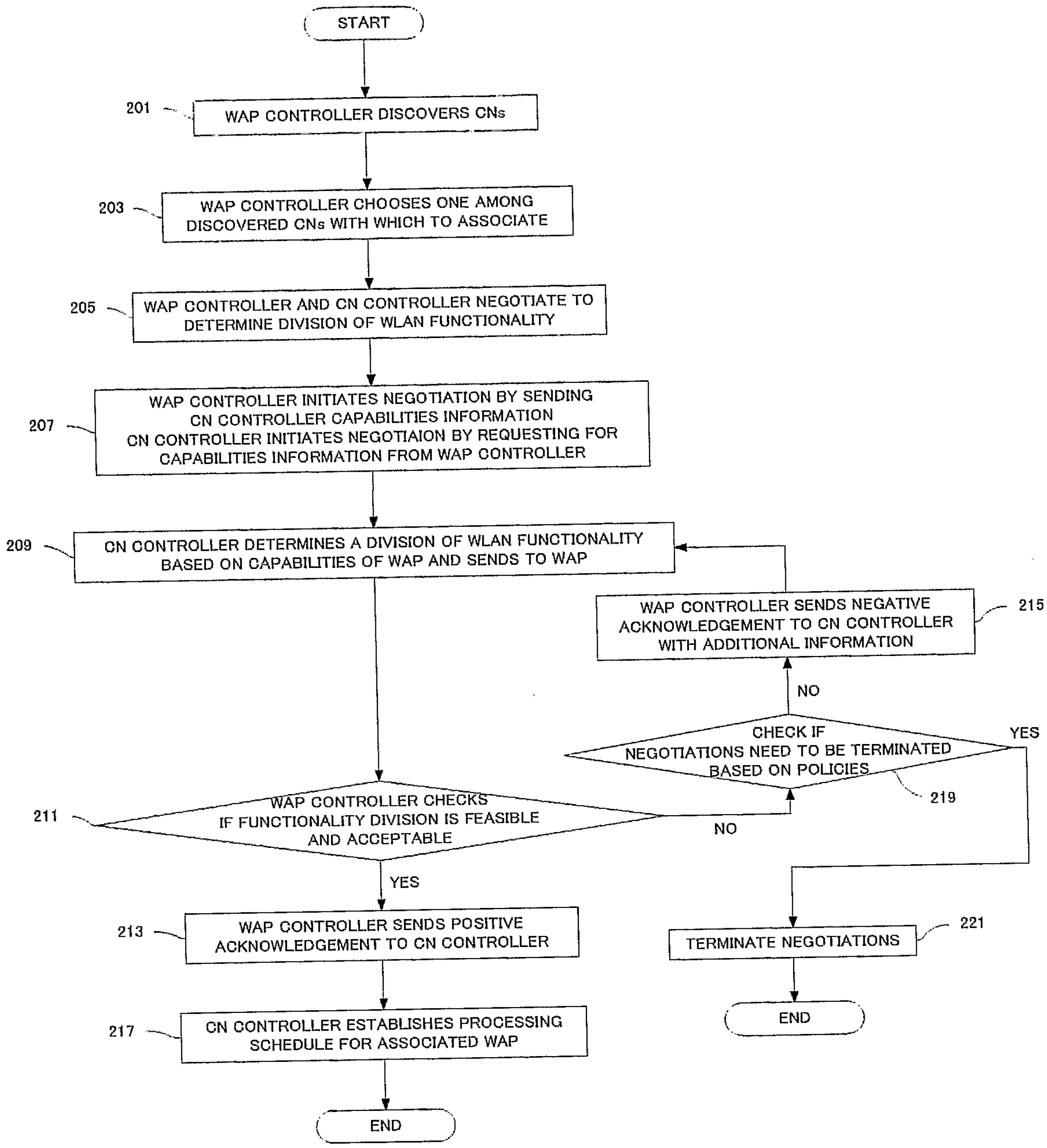
100, 300, 400, 700　Wireless Local Area Network (WLAN) system
101　controller node (CN)
103, 305　CN controller
105, 107, 401, 403, 701, 703　wireless access point (WAP)
109, 111, 303, 423, 425, 723, 725　WAP controller
113, 309, 405, 705　mobile terminal (MT)
115, 307　functional component

117, 311, 407, 707 network backbone
301 WLAN entity
409, 709 tunnel connection
411, 413, 711, 713 ASP
415, 417, 715, 717 nASP
427, 727 wireless connection
613, 615, 629, 631 processor
605, 607 scheduling order
729 central controller

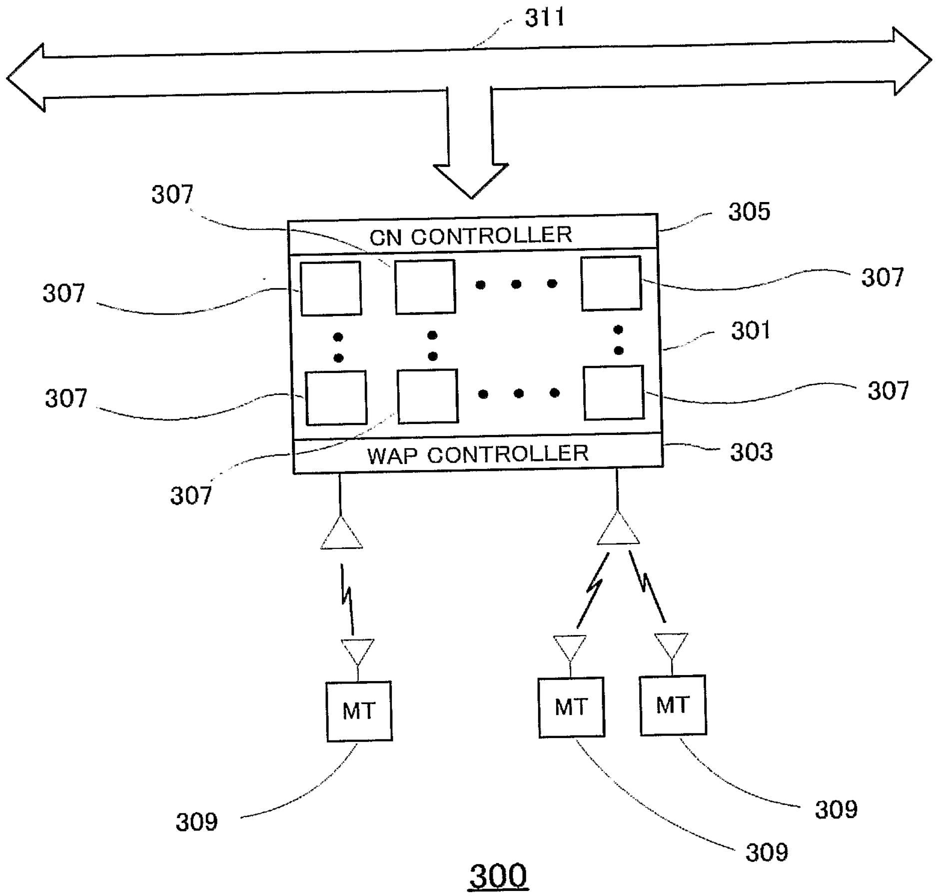
【書類名】外国語図面
【図１】



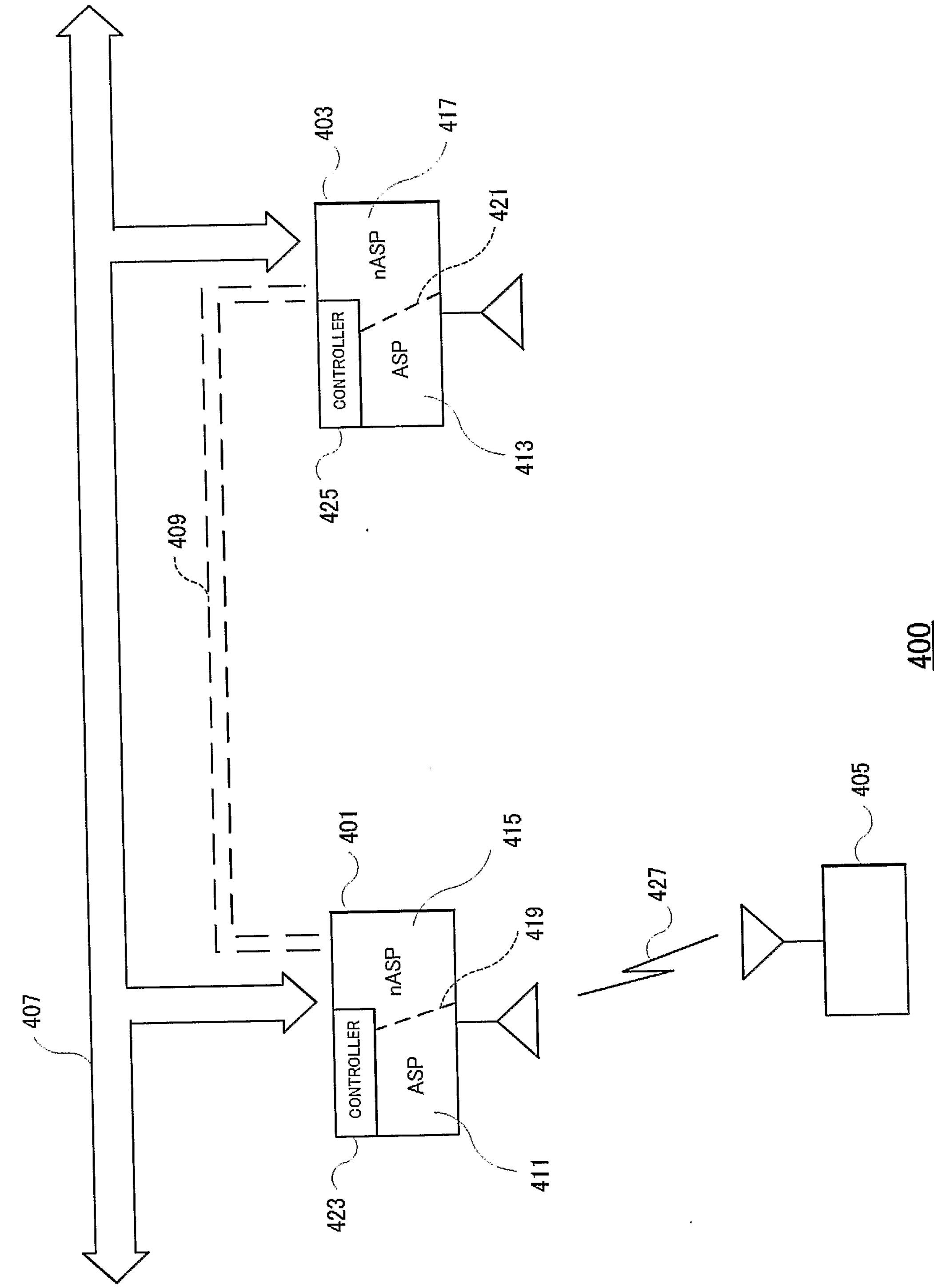
【図２】


START
201
WAP CONTROLLER DISCOVERS CNs
203
WAP CONTROLLER CHOOSES ONE AMONG DISCOVERED CNs WITH WHICH TO ASSOCIATE
205
WAP CONTROLLER AND CN CONTROLLER NEGOTIATE TO DETERMINE DIVISION OF WLAN FUNCTIONALITY
207
WAP CONTROLLER INITIATES NEGOTIATION BY SENDING CN CONTROLLER CAPABILITIES INFORMATION
CN CONTROLLER INITIATES NEGOTIAION BY REQUESTING FOR CAPABILITIES INFORMATION FROM WAP CONTROLLER
209
CN CONTROLLER DETERMINES A DIVISION OF WLAN FUNCTIONALITY BASED ON CAPABILITIES OF WAP AND SENDS TO WAP
WAP CONTROLLER SENDS NEGATIVE ACKNOWLEDGEMENT TO CN CONTROLLER WITH ADDITIONAL INFORMATION
215
NO
CHECK IF NEGOTIATIONS NEED TO BE TERMINATED BASED ON POLICIES
YES
219
211
WAP CONTROLLER CHECKS IF FUNCTIONALITY DIVISION IS FEASIBLE AND ACCEPTABLE
NO
YES
213
WAP CONTROLLER SENDS POSITIVE ACKNOWLEDGEMENT TO CN CONTROLLER
221
TERMINATE NEGOTIATIONS
END
217
CN CONTROLLER ESTABLISHES PROCESSING SCHEDULE FOR ASSOCIATED WAP
END

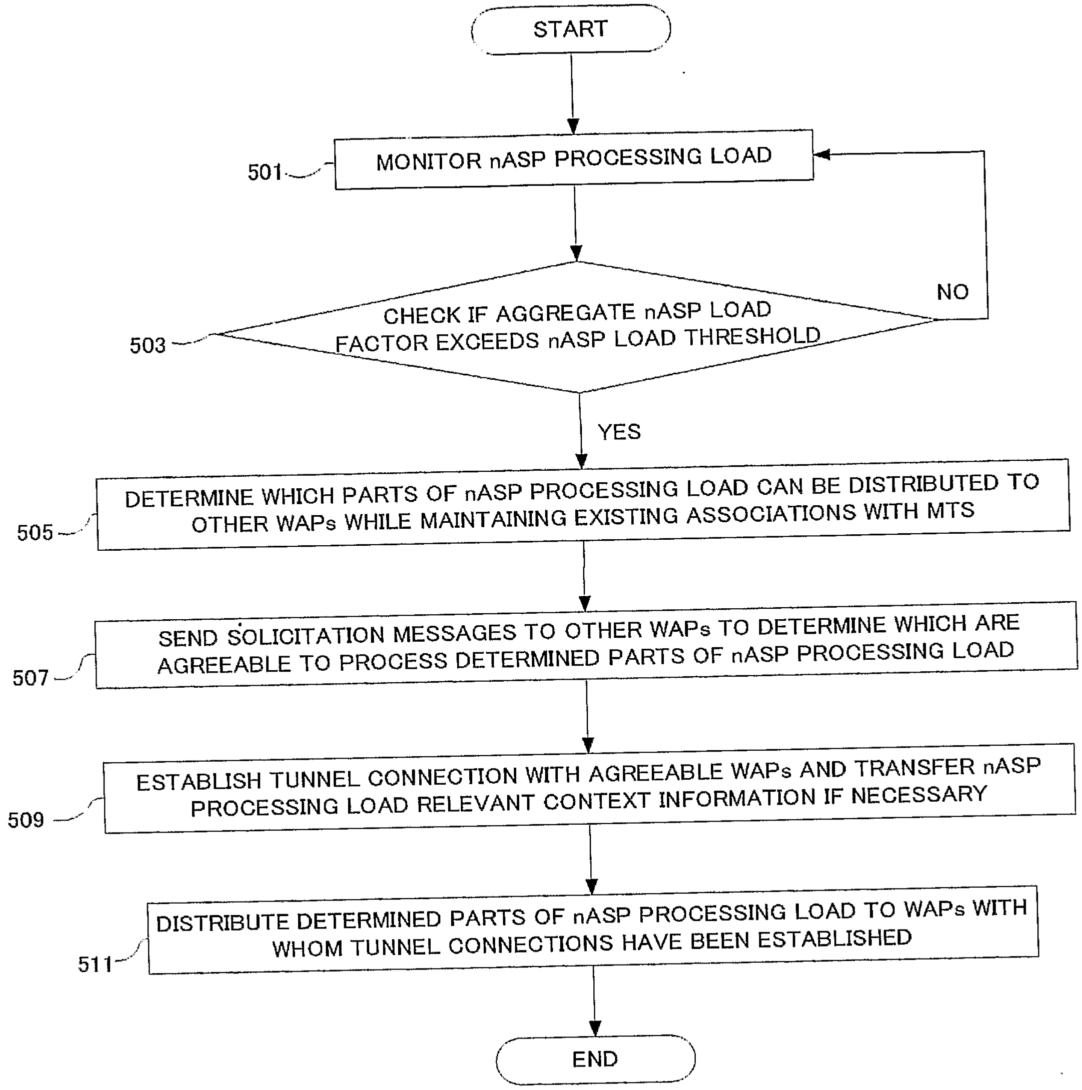
【図３】


311
307
305
CN CONTROLLER
307
307
301
307
307
WAP CONTROLLER
303
307
MT
MT
MT
309
309
309
300

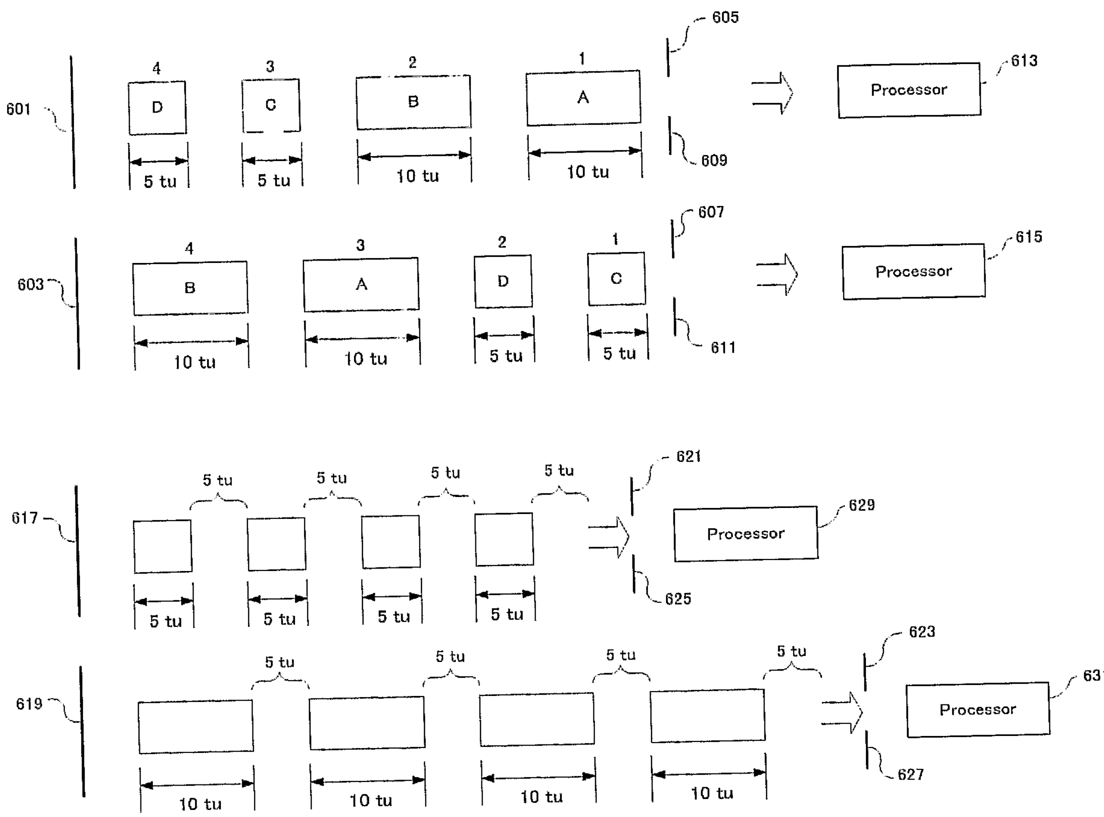
【図４】


403
417
421
nASP
CONTROLLER
ASP
413
425
409
400
405
401
415
427
419
407
nASP
CONTROLLER
ASP
411
423

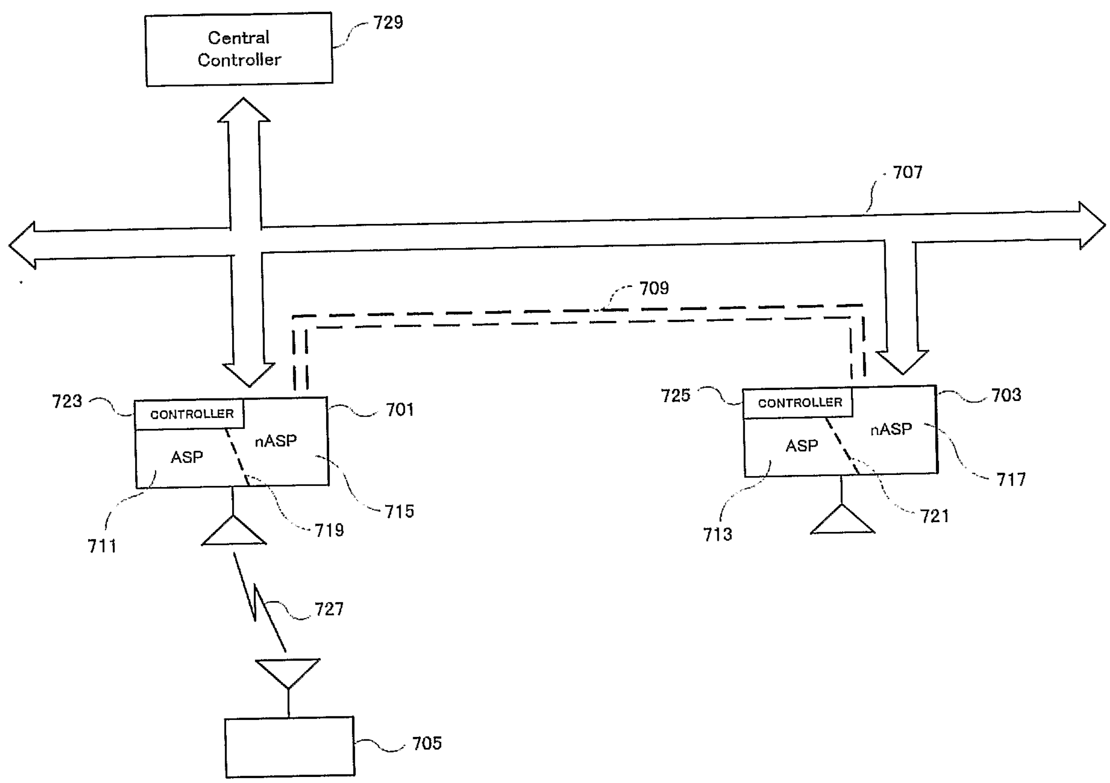
【図５】


START
501
MONITOR nASP PROCESSING LOAD
503
CHECK IF AGGREGATE nASP LOAD FACTOR EXCEEDS nASP LOAD THRESHOLD
NO
YES
505
DETERMINE WHICH PARTS OF nASP PROCESSING LOAD CAN BE DISTRIBUTED TO OTHER WAPs WHILE MAINTAINING EXISTING ASSOCIATIONS WITH MTS
507
SEND SOLICITATION MESSAGES TO OTHER WAPs TO DETERMINE WHICH ARE AGREEABLE TO PROCESS DETERMINED PARTS OF nASP PROCESSING LOAD
509
ESTABLISH TUNNEL CONNECTION WITH AGREEABLE WAPs AND TRANSFER nASP PROCESSING LOAD RELEVANT CONTEXT INFORMATION IF NECESSARY
511
DISTRIBUTE DETERMINED PARTS OF nASP PROCESSING LOAD TO WAPs WITH WHOM TUNNEL CONNECTIONS HAVE BEEN ESTABLISHED
END

【図６】


601
4
D
5 tu
3
C
5 tu
2
B
10 tu
1
A
10 tu
605
609
Processor
613
603
4
B
10 tu
3
A
10 tu
2
D
5 tu
1
C
5 tu
607
611
Processor
615
617
5 tu
5 tu
5 tu
5 tu
5 tu
5 tu
5 tu
5 tu
621
625
Processor
629
619
5 tu
5 tu
5 tu
5 tu
10 tu
10 tu
10 tu
10 tu
623
627
Processor
631

【図７】


Central Controller
729
707
709
723
CONTROLLER
ASP
nASP
701
715
719
711
727
705
725
CONTROLLER
ASP
nASP
703
717
721
713

700

【書類名】外国語要約書

1　Abstract

A method for negotiations between various entities of a wireless local area network (WLAN) including negotiations between controlling nodes (CNs) and wireless access points (WAPs) and negotiations between WAPs is disclosed. These negotiations are used for the purpose of establishing the capabilities of the various entities, determining how such capabilities may be optimally divided among the negotiating entities and then dividing the capabilities among the entities based on this determination. The capabilities include those required for the operation, control and management of the WLAN entities and the encompassing WLAN. The disclosed method introduces means for flexibly accommodating the varying degrees of differences in capabilities among the WLAN entities between the WLAN entities.

2　Representative Drawing　Figure 1

認定・付加情報

特許出願の番号	特願２００４－０５８２４５
受付番号	５０４００３４２７１５
書類名	特許願
担当官	金井　邦仁　　　　　　３０７２
作成日	平成１６年　６月　３日

＜認定情報・付加情報＞

【提出日】　平成16年 3月 2日

特願２００４－０５８２４５

出　願　人　履　歴　情　報

識別番号　［０００００５８２１］

１．変更年月日　１９９０年　８月２８日
　　［変更理由］　新規登録
　　　住　所　大阪府門真市大字門真１００６番地
　　　氏　名　松下電器産業株式会社

出証番号　出証特２００５－３０３０８２０

Document made available under the Patent Cooperation Treaty (PCT)

International application number: PCT/JP05/003390

International filing date: 01 March 2005 (01.03.2005)

Document type: Certified copy of priority document

Document details: Country/Office: JP
Number: 2004-209470
Filing date: 16 July 2004 (16.07.2004)

Date of receipt at the International Bureau: 21 April 2005 (21.04.2005)

Remark: Priority document submitted or transmitted to the International Bureau in compliance with Rule 17.1(a) or (b)

World Intellectual Property Organization (WIPO) - Geneva, Switzerland
Organisation Mondiale de la Propriété Intellectuelle (OMPI) - Genève, Suisse

PCT/JP2005/003390

日 本 国 特 許 庁
JAPAN PATENT OFFICE

03.03.2005

別紙添付の書類に記載されている事項は下記の出願書類に記載されている事項と同一であることを証明する。

This is to certify that the annexed is a true copy of the following application as filed with this Office.

出 願 年 月 日 Date of Application:	２００４年　７月１６日
出 願 番 号 Application Number:	特願２００４－２０９４７０
パリ条約による外国への出願に用いる優先権の主張の基礎となる出願の国コードと出願番号 The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is	ＪＰ２００４－２０９４７０
出 願 人 Applicant(s):	松下電器産業株式会社

２００５年　４月　８日

特許庁長官
Commissioner,
Japan Patent Office

小 川 洋

出証番号　出証特２００５－３０３１４７３

【書類名】　特許願
【整理番号】　2040860078
【特記事項】　特許法第３６条の２第１項の規定による特許出願
【あて先】　特許庁長官殿
【国際特許分類】　H04L 12/46
　　H04L 12/28
　　H04L 12/66
【発明者】
　【住所又は居所】　シンガポール５３４４１５シンガポール、タイ・セン・アベニュー、ブロック１０２２、０６－３５３０番、タイ・セン・インダストリアル・エステイト、パナソニック・シンガポール研究所株式会社内
　【氏名】　ホン　チェン
【発明者】
　【住所又は居所】　シンガポール５３４４１５シンガポール、タイ・セン・アベニュー、ブロック１０２２、０６－３５３０番、タイ・セン・インダストリアル・エステイト、パナソニック・シンガポール研究所株式会社内
　【氏名】　ペク　ユー　タン
【特許出願人】
　【識別番号】　000005821
　【氏名又は名称】　松下電器産業株式会社
【代理人】
　【識別番号】　100093067
　【弁理士】
　【氏名又は名称】　二瓶　正敬
【先の出願に基づく優先権主張】
　【出願番号】　特願2004- 58245
　【出願日】　平成16年 3月 2日
【手数料の表示】
　【予納台帳番号】　039103
　【納付金額】　26,000円
【提出物件の目録】
　【物件名】　外国語特許請求の範囲　1
　【物件名】　外国語明細書　1
　【物件名】　外国語図面　1
　【物件名】　外国語要約書　1
　【包括委任状番号】　0003222

【書類名】外国語特許請求の範囲

1. A system for providing service in a wireless local area network comprising

i. a single or plurality of wireless access points (WAP) capable of processing a subset of complete functionality defined for the wireless local area network;

ii. a single or plurality of control nodes (CN) capable of providing a subset or complete functionalities defined for the wireless local area network; and

iii. negotiation means for the wireless access points to dynamically negotiate with the control node for a secure connections and function split arrangement;

whereby, in use, the control node would negotiate with the WAPs using the negotiation means and provide same or different complementary functionality for each of the WAPs to form a complete functionality defined for the wireless local area network according to decision of the negotiation means.

2. The system according to claim 1 wherein said wireless access point and control nodes further comprise logically independent functional components of the functionalities defined for the wireless local area network with predefined interface used between each functional components.

3. The system according to claim 2 wherein interfaces between said functional components could be used over remote connections between said wireless access point and control node.

4. The system according to claim 1 wherein each said control node further comprises a control node controller module and each said wireless access point further comprises a wireless access point controller module.

5. The system according to claim 4 wherein the controller module of control node further comprises a single or plurality of processing schedules composed of sequential lists of descriptors for subsets of functional components used for each wireless access point.

6. The system according to claim 4 wherein the controller module of wireless access point further comprises a single or plurality of processing schedules composed of sequential lists of descriptors for subsets of functional components used for each associated mobile terminal.

7. The system according to claim 1, wherein the wireless access point further comprises:

i. means for discovering the available control node within a specified domain; and

ii. means for negotiating secure connection with control node that could offer the desired functions;

whereby, in use, the wireless access point is able to locate the control node that provides necessary complementary functionalities with regard to a set of defined complete wireless local area network functions with the means for discovering and establishing secure connection with the control node with the means for negotiating.

8. The system according to claim 1, wherein the controller module of said control node is capable of generating data unit to resemble that from a mobile terminal.

9. A system for load balancing in a wireless local area network (WLAN) without requiring association handover at a mobile terminal comprising:

i. a single or plurality of mobile terminals, each said mobile terminal associated with and receiving services from a single or plurality of wireless access point (WAP);

ii. a single or plurality of wireless access point that are capable of processing data units received from the mobile terminal or other wireless access point using a subset of defined WLAN functions; and

iii. a means for the wireless access points to exchange data units processed with a subset or complete defined WLAN functions;

whereby a data unit for a mobile terminal is processed with complete WLAN functions by a single or plurality of WAPs where each WAP processes the data unit with only a subset of complete WLAN functions.

10. The system according to claim 9 wherein the wireless access point further comprises a control module that is capable of negotiating with other wireless access points for a subset of the complete WLAN functions to be carried out at each wireless access point.

11. The system according to claim 9 wherein the wireless access point further comprising a local database that stores all the associations of the mobile terminals attached to said wireless access point and corresponding subset of the complete WLAN functions to be provided to the mobile terminal.

12. The system according to claim 1, wherein the functionalities of said WAP and CN collocate in a single network element.

13. A method for providing service in a wireless local area network (WLAN) that allows defined WLAN function split between wireless access point (WAP) and a single or plurality of Control Node (CN) comprising the steps in which:

i. a WAP discovers the CN that may provide complementary WLAN functions by sending a single or plurality of messages containing information about its own subset of WLAN functions to all the CN;

ii. a CN after receiving said discover message replies with a single or plurality of messages containing information about a subset of WLAN functions said CN could offer to the WAP; and

iii. said WAP chooses from all the replied CNs a proper CN based on local policy and establishes association with said chosen CN.

14. The method for the WAP to decide which CN to use according to claim 13 using information, the information comprising:

i. the subset of the WLAN functions offered by the CN;

ii. a cost of using the CN;

iii. a vendor of the CN;

iv. a characteristics of the connection to the CN; and
v. a weighted sum of the above factors.

15. A method for providing service in a wireless local area network (WLAN) that allows defined WLAN function split between wireless access point (WAP) and a single or plurality of Control Node (CN) comprising the steps in which:

i. a CN dynamically discovers the capability of a WAP by sending a single or plurality of messages to a WAP containing a section that emulates a data unit sent by a mobile terminal;

ii. a WAP receives said message, processes said section using the same procedure for processing data units received from a mobile terminal and sends data unit back to said CN in a reply message; and

iii. said CN obtains the capability information of said WAP by examining the processed data units in said reply message.

16. A method for providing service in a wireless local area network (WLAN) that allows defined WLAN function split between a wireless access point (WAP) and a single or plurality of Control Node (CN) comprising the steps in which:

i. a CN obtaining capability of the WAP; and

ii. said CN negotiating with another one or a plurality of CNs for the supplementary WLAN functions to be provided to the WAP.

17. A method for carrying out load balancing in a wireless local area network (WLAN) without requiring a mobile terminal to change association relationship with a wireless access point (WAP) comprising the steps in which:

i. the WAP separates the processing function provided to the mobile terminal into an association specific part and a non-association specific part;

ii. said WAP negotiates with another WAP of the non-association specific part and establishes a secure tunnel with said another WAP;

iii. said WAP tunnels the data unit from a mobile terminal to the said another WAP through the tunnel after processing data unit with the association specific part of functions; and

iv. said another WAP receiving the processed data unit through said tunnel and processing it with non-association specific part of functions.

18. The method according to claim 17 further comprising the step in which said WAP uses a wireless channel to establish direct connection with another WAP and sets up secure tunnel over the direct connection.

19. The method according claim 17 further comprising the step in which the WAP decides on whether to tunnel data unit from the mobile terminal to another WAP for non association specific processing by monitoring the load at WAP and comparing it with a preset threshold value.

20. The method according to claim 17 further comprising the step in which said WAP decides on which other WAPs should be used for non association specific processing by monitoring the loads at different WAPs it has connections with and compares them with a preset threshold value.

21. The method according to claim 17 further comprising the step in which a central control entity monitors the load status on all WAPs within a certain domain and mandates distribution of non-association processing function between different WAPs.

22. The method according to claim 17 for the WAP to determine the distribution of non-association specific function based on information, the information comprising:

i. a size of the data unit to be processed;

ii. an expected average time for the processing of the data unit;

iii. an overhead time for processing the data unit; and

iv. a weighted sum of above factors.

23. A method for providing service in a wireless local area network (WLAN) that allows defined WLAN function split between wireless access point (WAP) and a single or plurality of Control Node (CN) comprising the steps in which:

i. a subset of WAPs processes the total of its subset of functionality defined for the WLAN; and

ii. a CN provides distinct subsets of complementary functionality defined for the WLAN to each of the subset of WAPs.

24. A method for providing service in a wireless local area network (WLAN) that allows defined WLAN function split between wireless access point (WAP) and a single or plurality of Control Node (CN) comprising the steps in which:

i. a CN determines a common subset of functionality required for the WLAN available at a subset of the WAPs;

ii. each WAP of the subset processes the said determined common subset of functionality; and

iii. a CN provides similar subsets of complementary functionality to each of the subset of WAPs.

25. A method for accommodating variances in a wireless network topology comprising the step of dynamically adapting the operations logic of at least one network entity of said wireless network topology to alter processing of one or more functional sub-components.

26. The method acording to claim 25 further comprising the step of altering the processing of selected functional sub-components at the at least one network entity by means of bypassing processing of said selected functional sub-components.

27. The method according to claim 25 further comprising the step of altering the processing of a selected functional sub-components at the at one or more network entity by means of selectively processing said selected functional sub-components.

28. A method for compensating variances in latency in a wireless network comprising the steps of;

i. bypassing processing of selected functional sub-components at a first network entity and;

ii. performing processing of said bypassed functional sub-components at a second network entity.

29. A method for altering local-level functional semantics while maintaining system-wide functional semantics of a wireless network comprising the step of selectively activating functional sub-components of selected network entities such that the sum of activated functional sub-components across said wireless network corresponds to complete functional sub-components of said wireless network.

30. The method according to claim 29 further comprising the step of shifting the processing of said activated functional sub-components from a first network entity to a second network entity.

31. A method for determining topology of a wireless network, wherein a first network entity alters connectivity association with a second network entity by including one or more third network entities in the communications path of the alternate connectivity association, comprising the steps of;

i. exchanging information on neighbouring network entities among said network entities of said wireless network;

ii. analyzing communications frames received by said network entities based on pre-established representations of topology of said wireless network;

iii. analyzing association request frames received by said network entities based on pre-established representations of topology of said network.

【書類名】外国語明細書
Title of the Invention
System and method for negotiations for WLAN entities

FIELD OF THE INVENTION
This invention relates to the field of wireless local area networks and in parti cular to the operation of such networks in heterogeneous environments.

BACKGROUND OF THE INVENTION
Wireless local area networks (WLANs) have invoked great interests from both cons umers and the industry. The current most popular WLANs are based on the [Non Pat ent Prior-Art 1] standards. While these standards have helped the initial uptake of WLANs, in their current form, they are not suited for large-scale wireless n etwork deployments. This is because the cost and control of WLAN entities become s complex in large environments.

Currently, many WLAN equipment manufacturers have addressed large-scale deployme nts by introducing a new split architecture. Here, control aspects of the [Non P atent Prior-Art 1] WLAN specifications are centralized at controller nodes (CNs) while other aspects are distributed to numerous wireless access points (WAPs). With the diversity of manufacturers and their implementations of the split archi tecture, there are incompatibilities between WLAN entities from different manufa cturers.

There are currently some efforts to provide standardized means for managing larg e-scale WLANs in the Internet Engineering Task Forces (IETF) Control and Provisi oning of Wireless Access Point (CAPWAP) working group. [Non Patent Prior-Art 2] describes the efforts of the CAPWAP working group. However these efforts do not consider the problems of accommodating WAPs with dissimilar functional capabilit ies within a single WLAN. As such these problems limit the development of the WL AN market.

Furthermore, it is expected that future deployments of WLANs will feature dynami c wireless networks. In such types of deployments, network topologies will chang e during the operational lifecycle of the WLAN to enable enhanced applications a nd services. WLAN elements in such networks will be provisioned with both wired and wireless connectivity to enable dynamic topologies. However current assumpti ons of WLANs - and also CAPWAP - only refer to static network topologies. So whi le current WLANs are capable of adjusting to the dynamic conditions of the wirel ess medium, they are unable to accommodate the effects of dynamic topology chang es.

For example, current WLAN systems adjust to declines in the signal-to-interferen ce ratio (SIR) of the wireless medium by increasing the signal transmission powe r. However such minor corrections are inadequate to accommodate the variances in latency and overhead introduced by changes in WLAN topology. Furthermore, these variances in latency and overhead impede the operation of the CAPWAP split arch itecture. This is because the split architecture is sensitive to delays due to t he very nature of the distributed operations. The redundancies of WLAN and CAPWA P processing performed at intermediate wireless access points (WAP) of a dynamic

CAPWAP topology together with the corresponding physical overheads are detrimental to the CAPWAP split operations.

Given such scenarios, WLAN entities currently available from various vendors are incapable of interoperation in a single WLAN and are also incapable of operation in a dynamic topology WLAN.

These problems refer to static differences between WLAN entities as they are results of differences in basic design. In addition to these, there are also problems related to dynamic differences between WLAN entities.

In particular, during the functioning of a WLAN, the processing load at a WAP can become substantially high even exceeding the processing capacity of the WAP. This could be due to increases in the number of associated mobile terminals (MTs) or due to increases in the volume of traffic from the associated MTs. These differences in processing load over time constitute a dynamic factor as they are dependent on the dynamics of the MTs.

These dynamic differences in processing load across the WAPs comprising a WLAN have traditionally been addressed by affecting handovers of MTs from their associated WAPs where processing load is high, to re-associate the MTs with other WAPs where processing load is relatively low.

[Patent Application Prior-Art 3] discloses a means for addressing dynamic differences in the levels of processing load at WAPs by means of proactive handovers of associated MTs. While [Patent Application Prior-Art 3] addresses the problem of dynamic differences in processing loads across WAPs, it does so by mandating that MTs associated with one WAP also be within the coverage areas of other WAPs so as to be able to perform handovers and re-associations. If a MT is not within the coverage area of one or more other assisting WAPs, it is then expected to physically displace to such a coverage area in order to relieve the first WAP of some processing load. These constraints are rigid and limit the efficacy of [Patent Application Prior-Art 3]. Such limitations are common to all handover-based methods.

[Patent Application Prior-Art 4] presents a method for WAPs to modify, based on prevailing processing load levels, the intervals between the beacon signals that they transmit in order to attract or dissuade MT associations. This method also involves the constraints of requiring a MT to be within the coverage areas of alternate WAPs where processing load is low or being agreeable to displace towards such areas.

[Patent Prior-Art 5] focuses on proactive MTs that make association decisions. However the method is also limited by the factors described earlier.

While such methods attempt to solve the problem of dynamic differences in processing load, they do so by introducing stringent prerequisites and thereby introduce more problems. Another shortcoming of [Patent Application Prior-Art 3], [Patent Application Prior-Art 4], [Patent Prior-Art 5] and other handover-based methods for dealing with dynamic differences in WAPs is related to the bulk shifting of communications sessions. In practice MTs maintain a number of communications sessions with the WAPs with which they are associated. As a result, it is very likely that the communications sessions of only one MT or a few MTs constitute a considerable amount of processing load at the WAP. If the WAP were to affect the said MTs to handover and re-associate with another WAP, the processing load at the first WAP would be reduced, however by adversely affecting the other WAP. The other WAP then becomes overloaded and reverses the handover to the first WAP. This may continue without delivering any net gains for the WLAN. This points out that processing load is not finely distributed by methods of handovers. In other words, dynamic differences are not finely managed.

[Non Patent Prior-Art 1] Institute of Electrical and Electronics Engineers Standard 802.11 - 1999 (R2003)
[Non Patent Prior-Art 2] "CAPWAP Problem Statement", draft-ietf-capwap-problem-statement-02.txt
[Patent Application Prior-Art 3] "Method and apparatus for facilitating handoff in a wireless local area network", US 2003/0035464 A1
[Patent Application Prior-Art 4] "Dynamically configurable beacon intervals for wireless LAN access points", US 2003/0163579 A1
[Patent Prior-Art 5] "Method and apparatus for selecting an access point in a wireless network", US 6,522,881 B1

OBJECTIVE OF THE INVENTION

In view of the above discussed problems, it is the objective of the invention to provide an apparatus and methods for negotiation between controlling nodes (CNs) and wireless access points (WAPs) of a WLAN based on policies that allow for accommodating static and dynamic differences among the WLAN entities including dynamic changes in WLAN topologies within a single WLAN.

It is another objective of the invention to provide methods and policies for negotiations between WLAN entities for the purpose of determining selected subsets of functional, load or other components to be processed by each of said WLAN entities so as to accommodate variations in system design, processing load or network topology.

It is another objective of the invention to provide an apparatus and methods for negotiations between WLAN entities based on polices that allow for accommodating the dynamic differences between them such as differences in processing load levels at various WLAN entities within a single WLAN.

It is yet another objective of the invention to provide means for accommodating the operations of split architecture WLANs in the presence of dynamically changing network topologies.

SUMMARY OF THE INVENTION

The disclosed invention relates to wireless local area networks (WLANs) and particularly to means of addressing the issues of static and dynamic differences among WLAN entities. It introduces policies for negotiations between WLAN entities for the purpose of accommodating these differences.

One aspect of the invention deals with negotiations between controlling nodes (CNs) and wireless access points (WAPs) of a WLAN based on policies that allow for accommodating static differences among them. Specifically, it presents means for determining a flexible division in WLAN functionality between the negotiating entities. The invention first involves classifying the functional capabilities of WLAN entities. The entities then determine the capabilities of other entities followed by negotiations between them on how best to divide the functionality among them. Further operations of the WLAN entities are then based on the determined division of functionality. This aspect of the invention enhances interoperability for WLAN entities.

Another aspect of the invention deals with negotiations between WLAN entities based on polices that allow for accommodating the dynamic differences between them. Particularly, it addresses the issue of distributing processing load among WAPs without requiring physical displacement of associated mobile terminals (MTs). It involves first determining the need to distribute parts of processing load at a WAP. This is followed by the determination of which parts of processing load may be distributed while at the same time maintaining existing association relationships between MT and WAP. Next, an overloaded WAP enters into negotiations with other WAPs in order to determine how the determined parts of processing load may be distributed among them. This aspect of the invention overcomes the limitations of handover-based methods for managing dynamic differences between WLAN entities.

In its broadest aspect, the invention provides a system for providing service in a WLAN whereby a control node negotiates with WAPs and provides similar or different complimentary functionality for each of the WAPs to form a complete functionality defined for the WLANs.

In its preferred form, the invention allows for a controller module for control nodes to comprise a single or plurality of processing schedules composed of sequential lists of descriptors for subsets of functional components used for each wireless access point.

In another preferred form, the invention provides a method for providing services in a WLAN wherein a control node dynamically discovers the capability of a WAP by sending a single or plurality of messages to a WAP containing a section that emulates the data unit sent by a mobile terminal, a WAP receiving said message processes said section using the same procedure for processing data units received from a mobile terminal and sends it back to said control node in a reply message and said control node obtaining capabilities information of said WAP by examining the processed data units in the reply message.

In another preferred form, the invention allows a method for providing service in a WLAN that allows defined WLAN function split between WAPs and one or more control nodes wherein a subset of WAPs process the total of their subset of functionality defined for the WLAN, a control node provides distinct subsets of complementary functionality defined for the WLAN to each of the subset of WAPs.

In yet another preferred form, the invention allows for means for determining a flexible division in WLAN functionality between the negotiating entities. The in vention first involves classifying the functional capabilities of WLAN entities. The entities then determine the capabilities of other entities followed by nego tiations between them on how best to divide the functionality among them. Furthe r operations of the WLAN entities are then based on the determined division of f unctionality. .

In another aspect, the invention provides a system for load-balancing in a WLAN without requiring association handover at a mobile terminal whereby a data unit for a mobile terminal is processed with the complete WLAN functions by a single of plurality of WAPs where each WAP processes the data unit with only a subset o f complete WLAN functions.

In its preferred form, the invention allows for a method of carrying out load ba lancing in a WLAN without requiring a mobile terminal to change association rela tionship with a WAP wherein the WAP separates the processing functions provided to the mobile terminal into an association specific part and a non-association s pecific part, the WAP negotiates with another WAP to process the non-association specific part and establishes a secure tunnel with the another WAP, the WAP tun nels a data unit from a mobile terminal to the another WAP through the tunnel af ter processing the data unit with the association specific part of functions and the another WAP receiving the processed data unit through the tunnel and proces sing it with non-association part of the functions.

In another preferred form, the invention provides a method for determining the d istribution of non-association specific functions based on information comprisin g the size of the data unit to be processed, the expected average time for proce ssing a data unit, the overhead time for processing a data unit or a weighted su m of said information.

In another aspect, the invention provides a method for accommodating variances i n a wireless network topology wherein the method comprises the step of dynamical ly adapting the operations logic of at least one network entity of the wireless network topology to alter processing of one or more functional sub-components.

In its preferred form, the invention allows for a method of accommodating varian ces in a WLAN by altering the processing of selected functional sub-components a t at least one network entity by means of bypassing processing of said selected functional sub-components.

In its preferred form, the invention allows for a method of accommodating varian ces in a WLAN by altering the processing of selected functional sub-components a t at least one network entity by means of selectively processing said selected f unctional sub-components.

In another preferred form, the invention provides a method for altering local-le vel functional semantics while maintaining system-wide functional semantics of a wireless network by selectivity activating functional sub-components of selecte d network entities such that the sum of activated functional sub-components acro ss said wireless network corresponds to complete functional sub-components of sa id wireless network.

In yet another preferred form, the invention provides a method for altering local-level functional semantics while maintaining system-wide functional semantics of a wireless network by means of shifting the processing of said activated functional sub-components from a first network entity to a second network entity.

Based on the aspects and preferred forms of the invention, the problem of incompatibility of WAPs of different functional capabilities is solved. The invention also solves the problem of WLAN operations in dynamic topology environments. In yet another aspect, the invention solves the problem of accommodating dissimilar volumes of processing loads over time.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The disclosed invention of policies for negotiations between entities of a wireless local area network (WLAN) is described in two major aspects, the first focusing on negotiations for accommodating static differences among WLAN entities also comprising accommodating changes in WLAN topologies. While the second aspect illustrates means of dealing with dynamic differences, particularly in levels of processing load.

In the following description, for purpose of explanation, specific numbers, times, structures, and other parameters are set forth in order to provide a thorough understanding of the present invention. However, it will be apparent to anyone skilled in the art that the present invention may be practiced without these specific details.

Negotiations for Accommodating Static Differences:

A WLAN system embodying a first aspect of the invention dealing with accommodating static differences among WLAN entities is exemplified in FIG. 1. The diagram illustrates a WLAN system 100 comprising a controller node (CN) 101, a number of wireless access points (WAPs) 105 and 107, a plurality of mobile terminals (MTs) 113 and a network backbone 117. For the sake of simplicity, WLAN system 100 is shown with a single CN whereas the system embodying the invention may comprise any number of CNs. Also, the diagram indicates a direct connection between CN 101 and the WAPs 105 and 107. Alternatively there may be a number of intermediate nodes between them. Similarly, the connection between CN 101 and the network backbone 117 may also include a number of intermediate nodes. In all such cases, the disclosed invention holds scope.

The CN 101 provides support and control to the WAPs 105 and 107 that associate with it. A new WAP in the WLAN system must first choose and establish association relationships with one or more CNs before it receives support and control from the one or more CNs. As such, WAPs may simultaneously hold more than one association relationship with one or more CNs. Similarly, the MTs 113 choose and maintain associations with the WAPs, which in turn provide them with services. These services include radio transmission and reception, secure transport and mobility. An MT may maintain a number of associations with one or more WAPs, however FIG. 1 simplifies this with each MT maintaining only one association with one WAP.

It can be inferred about the WLAN system 100 that the WAPs connect to the network backbone via the CN. Alternatives to this include the WAPs connecting to the network backbone by other means possibly through other intermediate nodes. In such cases, the CN will only be responsible for the control and management of the WAPs associated with it, while connectivity to an external network may be handled by other entities.

FIG. 1 shows the CN 101 capable of performing the complete set of WLAN functional operations, as specified by some established WLAN standard. It is also capable of other control and management functional operations. Each functional operation is logically represented by one of the functional components 115. The operations represented by each of the functional components may include encryption, decryption, medium access control protocol data unit (MAC PDU) processing, authentication, association, quality of service (QoS) processing, Internet Protocol (IP) processing etc.

Each functional component is represented by a functional component code. For the purpose of illustration some of the functional components in FIG. 1 are represented by functional component codes 'a', 'b' and 'c'. For example functional component 'a' may denote the processing required for a certain type of encryption, for example Wi-Fi Protected Access (WPA) or Advanced Encryption Standard (AES), functional component 'b' for QoS processing, for example priority handling, while functional component 'c' may be that for power control during radio transmission and reception. The functional components are logical units and may be implemented with a single processor using different sets of instructions and context for different functional components. Alternatively, each functional component may be implemented by individual processing entities possibly in disparate entities. While it is envisaged that the actual implementations of the functional components may vary among manufacturers and their implementations, the interfaces linking different components will be common or compatible so as to allow seamless processing of a control or data unit from one WLAN entity to another.

Since the WAPs may be from different manufacturers or of different implementations, they may incorporate among them varying degrees of WLAN functional components. These correspond to the different divisions in functionality between CNs and WAPs. For example, WAP 105 is shown to be capable of processing functional components 'a', 'b' and 'c' whereas WAP 107 is only capable of processing functional components 'b' and 'c'. The remaining functional components necessary for their WLAN operations and their control are left to be processed by CN 101. These differences between the WAP and CN entities represent the static differences that are to be accommodated by each other WLAN entity by means of the disclosed method for negotiations.

For the proper operation of the invention, it is necessary for the CNs and WAPs from different manufacturers to follow pre-defined naming conventions for the functional components that they incorporate and recognize. This ensures that negotiating entities can precisely distinguish which functional components a peer entity implements. To this end, the functional component codes need to be consistent in representing various functional components. This convention however need not be followed strictly to the letter. For example, the convention may present st andard descriptors for various functional components from which the negotiating entities may discern their properties. As an illustration, "IEEE 802.11i" describes an IEEE WLAN standard pertaining to security functionality. So based on such descriptors, negotiating CNs and WAPs may match parts or all of the names with other descriptors to infer the nature of the functionality components which the descriptors represent.

As mentioned earlier, the interfaces between functional components also need to be consistent across WLAN entities. This is to ensure that the processing of a control or data unit may be performed seamlessly from one WLAN entity to another. For example, a WAP may perform decoding with an appropriate functional component and then send the decoded data unit to a CN in a form suitable for further processing, say, a form that may be readily decrypted by a decryption functional component at the CN. So although there are different functional components in different WLAN entities, the interfaces between them are mutually recognizable so as to provide seamless processing.

Each WLAN entity is controlled in general by a controller entity. Thus, CN controller 103, WAP controllers 109 and 111 are responsible for the overall operations of CN 101, WAPs 105 and 107, respectively. While the WLAN system 100 shows the controllers to be integral to the WLAN entities, the controllers may also be separate entities. As such, they may remain disparate for each WLAN entity or combined together for a number of WLAN entities. It may be envisaged that specialized controllers exist for each type of entity.

The controllers are particularly responsible for establishing processing schedules for each of the entities that associate with the entities managed by the controllers. Consistent with this, the CN controller maintains processing schedules for WAPs 105 and 107 whereas the WAP controllers in turn maintain processing schedules for their respectively associated MTs 113.

A processing schedule refers to a sequence of functional components that are to be processed for control and data units received from associated devices by the entity that the said controller manages. For example, WAP controller 109 for WAP 105 maintains a processing schedule comprising a sequence of its functional components 'a', 'b' and 'c'. When a control or data unit arrives from an associated MT 113, WAP 105 performs the processing of functional components 'a', 'b' and 'c' based on the established processing schedule. The processing schedule at a WAP may be the same for all associated MTs if all the MTs incorporate consistent functionality. However if MTs implement different degrees of functionality, WAPs may also maintain separate processing schedules for processing the control and data units from different MTs.

In one embodiment of this first aspect of the invention, WAP controllers 109 and 111 for WAPs 105 and 107, respectively, first perform a step 201 in FIG. 2 of discovering CNs. The CNs to be discovered may be within the same administrative domain as the WAPs or the CNs may belong to different administrative domains. This step of discovery may be accomplished based on any node discovery protocol or by the broadcast/multicast/anycast of a specific, mutually recognizable message invoking responses from available CNs.

Next the WAP controllers choose which among the discovered CNs to associate with in a step 203. One possible metric for this choice may be the round-trip latency between the WAPs and CNs. This metric has the advantage of allowing for prompt exchanges of control messages between the WLAN entities. Other metrics that may be used for CN selection include network status, congestion, subset of WLAN functions offered by CN, cost of using the CN, the vendor of the CN, the characteristics of the connection to the CN, link status, random selection, cost of using the link, manufacturer identification and a weighted sum of these metrics. Having chosen a CN 101 with which to associate, WAP controllers 109 and 111 then enter an association phase with the CN. This phase may include mutual authentication, exchanges of security information and the establishment of communications protocols for further exchanges.

Then, in a step 205, WAP controllers 109 and 111 enter a negotiation phase with CN controller 103 for the purpose of establishing means to accommodate the possible differences in their respective functional capabilities. In particular, the negotiations are to establish a division of WLAN functionality that is consistent with the capabilities of the negotiating entities and are optimal for the operation and management of the whole WLAN.

The negotiations may be initiated by either a WAP controller or a CN controller as in a step 207. WAP controllers initiate by sending information regarding the functional capabilities of the associated WAPs to the chosen CN. This information includes the appropriate codes corresponding to the functional components that the WAPs are capable of processing and their processing schedules. A CN controller initiates negotiations by requesting for functional capabilities information from the associated WAPs.

Upon receiving capabilities information from the associated WAPs and based on established policies, CN controller 103 determines an initial division of WLAN functionality. This division is then enforced between CN 101 and the associated WAPs 105 and 107 as in step 209. The functionality division specifies which of the functional components that can be processed by the WAPs needs to be active and processed by the WAPs themselves and which need to be inactive so that they may be processed by the CN.

In one embodiment, the initial division of functionality is based on a policy that allows each associated WAP to process all the functional components that they are capable of. With such a division, only those functional components that an associated WAP cannot inherently process are left to the CN. Such functional components are then included in the processing schedule of the CN controller. Since WAPs may have dissimilar degrees of functional capabilities, the CN controller may be required to establish separate processing schedules for each associated WAP. As such this embodiment presents a policy which allows for the full capabilities of each WAP to be leveraged on. However this is achieved at the expense of running different processing schedules at the CN controller for different WAPs.

In another embodiment, the initial division of functionality is based on a policy in which the CN controller first determines a subset of functional components that are common across all associated WAPs. The associated WAPs must then process only the determined subset of functional components even if they are capable of processing other functional components. Therefore, the remaining set of functional components required to be processed for each associated WAP will be common to all of them. This common set can then be processed by the CN. This embodiment presents a policy in which the CN controller may maintain a single processing schedule for all associated WAPs. If a new WAP, incorporating functionality components fewer than or incompatible with those specified in the existing processing schedule, associates with the CN, the CN controller repeats the step of determining the subset of functional components that are common across all currently associated WAPs. It is noted that this step need not be performed if a new WAP involves more functionality components than that specified in the single, previously established processing schedule.

Alternatively, the association of a new WAP with a CN may invoke a grace period, in which two processing schedules are maintained simultaneously. The first corresponds to the existing processing schedule which was established before the association of the new WAP, while the second corresponds to the processing schedule which takes into account the functionality of the newly associated WAP. Then data units processed during the grace period are done so based on the processing schedule that is most appropriate. This embodiment provides uninterrupted services to existing MTs in the event of new WAPs associating with the CN.

In another embodiment, the initial division of functionality is based on a combination of policies, where a subset of associated WAPs is allowed to process all the functional components that they are capable of. Another subset of associated WAPs process only a common subset of functional components that they are capable of processing even if they have greater capabilities. The CN controller determines the subset of functional components that are common across all of the subset of associated WAPs. The remaining set of functional components required to be processed for each associated WAP will be performed by the CN. Therefore the remaining set of functional components will be distinct for each of the associated WAPs of one subset of associated WAPs and be similar for each of the associated WAPs of the other subset of associated WAPs.

Next, having determined an initial division of WLAN functionality, the division is then sent to the associated WAPs for confirmation as in a step 209. The WAP controllers in turn verify that the division is feasible and upon verification return a positive acknowledgement to the CN as in steps 211 and 213.

Given that some WAPs may implement functional components in a non-partitioned manner, for example in a hardwire system, such WAPs may not be able to adhere to the specified initial functionality division. In these cases, the WAPs send a negative acknowledgement to the CN with an updated processing schedule that indicates operational dependencies between their functional components as in a step 215. The CN controller then takes this new processing schedule into account and formulates another functionality division that may be compatible with the WAPs. If the new division is feasible, the WAPs return a positive acknowledgement and if not, the negotiations continue in a similar fashion. As a last resort, upon a fixed number of unsuccessful negotiation exchanges, the CN allows the WAPs to proc ess all their functional components.

During the initial negotiation phase, either CN or associated WAP may choose to forcibly terminate further negotiations based on pre-defined policies and rules even before the negotiation phase is complete. These policies are enforced by either CN or WAP when it is inferred that further negotiations will be moot as in steps 219 and 221. For example, if the difference between the initial division of WLAN functionality is significantly dissimilar from the capabilities of a WAP, the WAP may choose to terminate negotiations as it may be futile to proceed further. Alternatively, if either entity determines that the other is illegitimate, the negotiations may be terminated. Many other policies may also be used to enforce termination of negotiations.

Once a functionality division is acceptable to all participating WLAN entities, CN controller 103 establishes appropriate processing schedules for associated WAPs 105 and 107 as in a step 217. These schedules define the sequence of functional components that are to be processed by CN 101 for control and data units received from associated WAPs 105 and 107. Then, CN controller 101 manages each associated WAP in a manner consistent with the processing schedules.

In one embodiment, WLAN functionality may be divided into four functional components that may be denoted by functional component codes 1, 2, 3 and 4. The functional component corresponding to code 1 relates to that parts of WLAN functionality concerning the radio aspects. This may include radio transmission and reception, coding, modulation, power control and beacon signal control. Such a division combining aspects concerning the radio interface will allow for simpler design. The code 2 functional component relates to security aspects, which may include authentication, association, encryption and decryption. The basis for this division is that processing for security involves mathematical computation for which reason they may be consolidated and optimized. Then, the functional component of code 3 deals with the processing required for control and data protocol data units (PDUs). This includes bridging, routing, retransmissions and Internet Protocol (IP) layer processing for which specialized network processors have been developed. Next, the code 4 functional component relates to the general control and management of the WLAN. Quality of Service (QoS) control, configurations and policy management are some of the aspects of this functional component. This embodiment presents a simple and practical classification for WLAN functionality. Negotiations between various WLAN entities may then be based on these classifications. The classifications may also be used to describe different entities. For example, a WAP implementing only radio aspects of WLAN may be referred to as a type 1 entity which will then require a CN capable of the remaining functional components 2, 3 and 4.

In another embodiment of the first aspect, a WAP controller need not explicitly send its functional capabilities information to a CN controller, rather the CN controller infers the capabilities of an associated WAP. Such a means for automated capabilities discovery allows for easier determination of functional capabilities without requiring the explicit exchange of functional component codes between a CN and associated WAPs. In this embodiment, a CN controller sends a special command to an associated WAP to which the WAP responds by generating a data uni t and processing it based on its functional components. The emulated data unit is then sent to the CN after being processed by the WAP. The CN controller then infers the functional capabilities of the associated WAP based on the received emulated data unit. Subsequent operations then follow from step 209 in FIG. 2. This embodiment requires associated WAPs to be capable of recognizing and responding to the special command issued by the CN controller.

An alternate form of the embodiment involves a CN controller simulating a data unit as if it was a mobile terminal and sending the simulated data unit to an associated WAP. The destination address of the simulated data unit is set to be the CN itself. Upon receiving the data unit, the WAP performs its processing based on its capabilities and forwards the processed data unit back to the CN. The CN controller then infers the functional capabilities of the associated WAP from the processed data unit. After this, the CN controller devises an initial division of WLAN functionality and sends this to the associated WAP. Subsequent operations then follow from step 209 in FIG. 2.

In another embodiment of the invention, a single entity that integrates both WLAN operational functionality and control and management functionality is presented. FIG. 3 exemplifies this embodiment in that it illustrates such an integrated WLAN entity 301. The integrated WLAN entity is capable of both WAP operations and CN control and management operations for which there are a WAP controller 303 and a CN controller 305, respectively. Each of the WAP and CN functional operations is logically represented by one of the functional components 307 each denoted by a functional component code. These functional components encompass WAP operations like radio transmission and reception, in addition to CN operations like WLAN monitoring and configuration management.

The set of functional components 307 are common to both WAP and CN controllers so that the processing schedule at each controller may include any of the functional components. Each controller operates in an independent manner with the understanding that the complete set of functional components is available for it to schedule. As such, during the negotiations phase between WAP controller and CN controller, the WAP controller sends its capabilities information so as to include the complete set of codes corresponding to all of functional components 307.

Associated with the integrated WLAN entity is a number of MTs 309. WLAN system 300 shows the associated MTs connecting to a network backbone 311 via the integrated WLAN entity. It is also possible for this connection to be made through alternate means like that through other intermediate nodes. To the associated MTs however, there is no difference between an ordinary WAP and the integrated WLAN entity.

Operationally, in this embodiment, the WAP controller of an integrated WLAN entity first performs a discovery of CNs. In essence, the discovery results in finding itself as a CN. Upon discovery, an association phase follows after which the CN controller and WAP controller enter a negotiations phase. Discovery and association are token operations as both the WAP and CN reside within a single entity.

Next, the WAP controller and CN controller begin negotiations in order to determ ine a suitable division of functionality between them. The WAP controller first sends information regarding its capabilities to the CN controller. This informat ion will include the functional component codes corresponding to all the functio nal components available within the integrated WLAN entity and a processing sche dule that involves all the codes. In response to the capabilities information an d based on established policies for functionality divisions, the CN controller d evises an initial division of functionality and sends this to the WAP controller . The initial division of functionality will be feasible and acceptable to the W AP controller since its feasibility is based on that of the CN controller which in turn determines the division. As a result, the WAP controller sends a positiv e acknowledgement to the CN controller. Then both controllers establish processi ng schedules according to the accepted division in functionality and operate on that basis. This embodiment illustrates how the process of negotiations may take place within an integrated WLAN entity. As such, the disclosed invention will b e consistent will various designs for these entities.

In another embodiment of the first aspect of the invention, different CNs may in corporate varying degrees of functionality. As such, a WAP associating with a CN may require the processing of functionality which is unavailable both with itse lf and with the CN that it associates. This embodiment serves to address such si tuations by allowing the various CNs in a WLAN to negotiate among them for the p urpose of accommodating differences in their functional capabilities. The CNs ma y follow the steps put forth in FIG. 2 to determine how the static differences i n their functionality may be managed. For example, a first CN may only incorpora te 2 types of functional components and it may necessitate in a third component that it is not capable of, but yet it is required for providing services to the WAPs associated with it. In such a case, the first CN discovers and associates w ith a second CN in the WLAN with which it then negotiates. The negotiations are for the purpose of dividing functionality among the CNs. As a result, the first CN may allow processing of the third functional component to be performed by the second CN.

In yet another embodiment of a first aspect of the invention, dynamics changes i n WLAN topologies is addressed. Fig. 8 illustrates the general aspects of a CAPW AP based dynamic WLAN system 800. Here, WLAN functions - represented by function al components 1 through 5 - are divided between the central controlling node 801 and the set of distributed wireless access points, WAP1 803 and WAP2 805. It is emphasized that the central controlling node 801 is capable of managing WAPs, W AP1 803 and WAP2 805, of dissimilar capabilities.

The first instance of the topology 807 represents a static case of operation. He re, WAP1 803 and WAP2 805 have fixed connections in the WLAN system 800. Then a transition 813 occurs in which the WLAN system 800 transforms into the second in stance of the topology 809. In this instance, WAP1 803 displaces to an alternate location in which it establishes a new connection 815 to the controlling node 8 01 via WAP2 805. The transition 813 represents a dynamic change and the second i nstance 809 represents a new WLAN topology in which WAP1 803 still provides serv ices to its mobile clients 811. At the same time, WAP1 803 behaves as another mo bile client to WAP2 805.

In the second instance of the topology 809, communications unit 823 exemplifies the communications traffic from the mobile clients 811. The communications unit 823 is first handled by WAP1 803 - as seen by step 817 - where all three WLAN functional components and the CAPWAP control component are processed. It is noted that this step 817 also adds physical overhead in the form of a CAPWAP protocol header in addition to the header required for transmission to WAP2 805. This is illustrated by the 'C1' sub-field of step 817. Next, at WAP2 805, a step 819 is performed where again another set of WLAN functional and CAPWAP control components are processed. Next, in a step 821, the central controller 801 performs complementary functions for each of the steps 817 and 819. Based the sub-fields of step 821, it is clear that central controller 801 duplicates some of the complementary functions. It is the aim of the invention to avoid this processing duplication and transmission overhead.

The operations of the invention are herein described with respect to the steps in Figure 10. In the steps 1001 and 1003, the topology of the wireless network is monitored so as to determine any changes in the network configuration. A means of realizing these steps is to analyze the header fields of received communications units and compare them to pre-established representations of network topology. For instance, in the case of IEEE802.11 specifications based WLANs, if the controlling node 801 receives an Association Request from WAP2 805 for a mobile client with credentials corresponding to WAP1 803, it is inferred that the topology between the controlling node 801 and WAP1 803 now includes the WAP2 805. Another means of establishing topology change is by periodically exchanging information on neighbouring network entities. A variance in these exchanges implies an alternate topology.

Once a network topology change has been determined, the network entity that will accommodate the change, WAP2 805, is triggered with an 'Operational Associations' signal as in a step 1005. This signal comprises preliminary state information regarding the network entity affecting the topology change, WAP1 803, and the mobile clients 811 managed by said WAP1 803. In one embodiment based on the IEEE802.11 specifications, the preliminary state information comprises the number of mobile clients 811 managed by WAP1 803, association identifications for mobile clients 811 and Source MAC addresses of mobile clients 811. The preliminary state information may also comprise additional state information exemplified by the MAC address of network entity effecting topology change, WAP1 803. Next, in a step 1007, the network entity accommodating the topology change, WAP2 805, is triggered with an 'Operations Update' signal to adapt its functioning so as to handle the topology change. In one embodiment based on the IEEE802.11 specifications, the 'Operations Update' signal comprises a code value corresponding to an action 'Forward Frames to Transmission Block' and a code value corresponding to those 'Data Frame' type for which said action is to be taken for. The 'Operations Update' signal may also comprise additional parameters exemplified by 'Basis Service Set Identification (BSSID)', 'Source MAC address' or 'Destination MAC address'. In another embodiment based on the IEEE802.11 specifications, the 'Operations Update' signal affects the Medium Access Control (MAC) management and control logic of WAP2 805. Specifically, the logic is altered such that communications frames from the mobile clients 811 managed by the network entity effecting the topol ogy change - WAP1 803 - may now be managed by WAP2 805 without going through the normal association and authentication phases. In yet another embodiment this logic alteration is realized by modifying the 'Filter_MPDU' process of the 'Reception' block of WAP2 805 so as to direct all communications frames received from the mobile clients 811 to the normal sequence of processing. Alternatively, the associations and authentications may be pre-established by the controlling node 801.

After the network entity accommodating the topology change, WAP2 805, is updated, an 'Operational Associations Request' signal is triggered at the network entity effecting the topology change, WAP1 803, as in step 1009. In one embodiment based on the IEEE802.11 specifications, the 'Operational Associations Request' signal comprises code values corresponding to 'Security Algorithm Type', 'Security Key', 'Session Identification' or 'Association Identification' parameters for which corresponding information values are requested. The request signal is to obtain specific state information regarding WAP1 803 and the mobile clients 811 which it manages. This state information is then made aware to WAP2 805 by an 'Operational Associations Update' signal, as in a step 1011, in preparation for future functioning. In one embodiment based on the IEEE802.11 specifications, the 'Operational Associations Update' signal comprises information values corresponding to 'Security Algorithm Type', 'Security Key', 'Session Identification' or 'Association Identification' parameters.

Next, in a step 1013, an 'Operations Update' signal is triggered to the network entity effecting the topology change, WAP1 803, so as to alter its functioning logic. In particular the signal directs WAP1 803 to bypass certain processing that may be duplicated at WAP2 805. The intent of the step 1013 is to prevent duplication of WLAN and CAPWAP processing at both WAP1 803 and WAP2 805. Furthermore, bypassing of processing at WAP1 803 reduces the physical overhead for transmissions over the newly established wireless connection 815 and thereby reduces transmission delays. These two aspects combined ensure that the timing constraints between WAP1 803 and controlling node 801 are maintained according to the initial topology instance.

In one embodiment based on the IEEE802.11 specifications and CAPWAP framework, Operational Association state information is exchanged between the network entities accommodating topology changes and network entities effecting topology changes via the central controlling node.

In an alternative to the above described embodiment for exchanging Operational Association state information, said exchange is accomplished between the network entities accommodating topology changes and network entities effecting topology changes without establishing explicit operational associations between them. The network entity effecting the topology change, WAP1 803, is instructed to use a specific 'Frame Type' code for communications frames containing state information. Next, an 'Operations Update' signal is triggered to the network entity accommodating the topology change, WAP2 805, so as to enable it to handle communications frames with the specific 'Frame Type' code in alternate means. Alternatively, specific 'Subtype', 'Duration/ID' codes are used. Specifically, the alternate means comprises de-capsulation of payload of said communications frames and using the payload as state information. In one case of the embodiment, the controlling node 801 governs the various trigger signals.

In the dynamic CAPWAP framework, the network entity effecting topology change, WAP1 803, communicates with the controlling node 801 via the network entity accommodating topology change, WAP2 805.

In the steps 1007 and 1013, the local-level of WLAN and CAPWAP functional semantics - wherein functional semantics corresponds to the set and sequence of processing required for WLAN operation - are broken such that selected sub-components of said processing are bypassed at selected network entities, the network entities accommodating topology changes and the network entities effecting topology changes. However, with the combined steps of 1000 the invention achieves system-wide semantics of WLAN and CAPWAP functional processing by dividing selected processing sub-components among the controlling node 801, WAP1 803 and WAP2 805. So the steps of 1000 selectively activate various processing sub-components and by doing so, achieve system-wide functional semantics. It will be clear to those skilled in the art that the steps put forth in 1000 may be combined, separated or generally altered for the purposes of optimization, implementation or any other aim without deviating from the essence of the invention. As such the scope of the invention is not limited to the specific steps of 1000.

Figure 9 illustrates an embodiment of the invention operating on steps 1000 for the WAP1 901. The logical operations of WAP1 901 are based on the IEEE802.11 WLAN specifications but may readily exemplify other wireless specifications also. WAP1 901 manages mobile clients 903 by processing various data (D), management (M) and control (C) frames in addition to general operations. The processing logically comprises 'Reception' 905, 'WAP Processes' 909 and 'Transmission' 911 blocks. The 'Reception' block 905 further comprises a 'Filter_MPDU' process whose logic is based on a filter 907. The filter 907 is used to compare arriving frames based on various metrics and appropriately handle them.

In response to the 'Operations Update' signal of step 1013, the filter logic is updated to include the changes of filter logic update 913. In the embodiment, data frames are directly sent to the 'Transmission' block 911 completely bypassing the 'WAP Processes' 909. As a result, processing time for the majority data frames is drastically reduced at WAP1 901. These data frames are then handled by WAP2 915 whose operations were updated according to step 1007. Since management and control frames directly relate to the connection between WAP1 901 and the mobile clients 903, they are processed locally at WAP1 901. So the invention selectively activates processing by affecting the reception logic of WAP1 901.

In one embodiment, the network entities accommodating topology changes and the network entities effecting topology changes operate according to dissimilar wireless specifications. With respect to Figure 8, WAP1 803 operates according to IEEE802.11 specifications and WAP2 805 operates according to IEEE802.16. The principles of adapting local-level functional semantics while maintaining system-wide functional semantics are then applied to the network entities operating according to dissimilar wireless specifications. It is noted that the dissimilarity in operations may comprise Bluetooth connectivity, IEEE802.20, cellular telephony or any other wireless specifications.

There are a number of scenarios and applications in which the invention for dynamic WLAN topologies will be incorporated. For example, future home networks will be capable of extending coverage areas in impromptu manners. Transportation systems will incorporate transmission and reception components so that the network topology changes with each passing stop, station or seaport. Manufacturing facilities will be provisioned with communications networks providing connectivity to diverse locations at various time instances. The invention described insofar may be embodied in these scenarios to address the problems of latency and overhead in dynamic topology environments.

The embodiments of this first aspect of the invention described insofar illustrate policies with which WLAN entities may negotiate with each other in order to accommodate the varying degrees of static differences that each such entity incorporates. Additionally, the embodiments illustrate the application of the first aspect of the invention wherein local-level of functional semantics are broken so as to enable dynamic changes in WLAN topologies in which system-wide functional semantics are maintained. They describe how WAPs incorporating varying degrees of WLAN functionality may be integrally managed by a controlling node. The disclosed method for negotiations provides for flexibility in deploying WLANs with entities from different manufacturers or of different implementations. While prior arts focus on mandating proprietary means of dividing functionality among WLAN entities, this invention serves to accommodate entities of different degrees of functionality. As a result, the division of WLAN functionality between controlling nodes and wireless access points may be achieved in a flexible manner.

Negotiations for Accommodating Dynamic Differences:

This aspect of the invention describes policies with which WLAN entities embodying the disclosed invention may negotiate with each other for the purpose of accommodating dynamic differences among them. It is exemplified by using the varying levels of processing load at different WLAN entities particularly WAPs.

A simplified representation of a WLAN system 400 embodying this aspect of the invention is depicted in FIG. 4. It shows WAPs 401 and 403 that are capable of providing services and performing related processing for a number of associated MTs. The WAPs and MTs may maintain a number of associations with each other, however for reasons of simplicity, the WLAN system of 400 only shows one association with WAP 401 for the single MT 405. This MT 405 is associated with and receives services from WAP 401 over a wireless connection 427. Also the WAPs 401 and 403 are shown to be connected to a network backbone 407, through which they can communicate with other networks and with each other, either directly or via intermediate switching or routing devices. The WAPs may also connect to the network backbone or with each other through a number of intermediate nodes.

During the operation of WLAN system 400, the processing loads at the WAPs may vary due to the dynamic nature of communications. For example, a number of new MTs may choose to associate with a WAP thereby necessitating in additional processing at the WAP. Another example is of a MT choosing to be involved in additional numbers of communications sessions again resulting in extra processing for the WAP with which it is associated. Consequently, the processing load at various WAPs in the WLAN system will vary over time. It is this dynamism that the disclosed invention addresses by requiring WAPs to negotiate with each other for the purpose of distributing processing load from a heavily loaded WAP to a relatively lightly loaded WAP while maintaining existing association relationships with their MTs.

From FIG. 4, WAPs 401 and 403 provide services to associated MTs by performing some type of processing on their behalf. The processing may be logically divided by lines 419 and 421 in WAPs 401 and 403, respectively, as being association-specific (ASP) and non-association-specific (nASP) processing. ASP processing 411 and 413 involves those that are directly dependent on the association between MTs and WAPs. Such processing requires interaction with the wireless interface between a WAP and an associated MT. Examples of ASP processing include transmission and reception of data units, power control, coding and modulation.

nASP processing 415 and 417 refer to processing that are not directly dependent on the wireless aspects of a connection between WAP and associated MT. Examples of nASP processing include bridging, filtering, protocol data unit (PDU) processing and PDU delivery.

WAP controllers 423 and 425 manage and control the overall processing at WAPs 401 and 403, respectively.

The operations involved with this aspect of the invention are described with reference to FIG. 5. The WAP controller in each of the WAPs in a WLAN system embodying the invention performs a step 501 of monitoring the nASP processing load at the WAP. This includes monitoring the nASP processing load for each of the communications sessions for all the associated MTs. Examples of how processing load may be monitored include means for monitoring the processor usage or duration of processor activity for a communications session and then aggregating this for all communications sessions. Another example is a means for monitoring the amount of memory usage for communications sessions. Similarly, a number of other factors may be monitored, either independently or in any combination, to monitor the overall nASP processing load at a WAP. Furthermore, other means of monitoring may also be used.

In one embodiment of the invention, a WAP controller 423 for a WAP 401 derives a resource characteristic for the WAP based on the various factors of nASP processing load that are monitored for each communications session of the associated MTs. The resource characteristic is a representation of the resources or processing load required for providing services to a communications session.

Next, the resource characteristics of all communications sessions for all associated MTs are combined to obtain an aggregate nASP load factor for WAP 401. The aggregate nASP load factor is then compared to a nASP load threshold, in a step 503, to determine impending nASP processing overload conditions that may not be manageable by WAP 401. If the aggregate nASP load factor is determined to be manageable at WAP 401, the monitoring of step 501 is repeated.

If, however, impending nASP processing overload conditions are determined, WAP controller 423 then determines in a step 505, which parts of the nASP processing load at WAP 401 may be distributed to other WAPs of the WLAN system with the aim of reducing overall processing load at WAP 401 while at the same time maintaining existing association relationships with associated MTs, such as that with MT 405. Such a mechanism is unique from traditional methods of distributing processing load which mandate handovers that may necessitate in a MT physically displacing to a coverage area of another WAP. The step 505 is based on the resource characteristics of the communications sessions of MTs associated with WAP 401. For example, a WAP controller may choose to distribute those parts of processing load with the greatest resource characteristics or those with the least resource characteristics. This choice may also be based on other factors such as the expectation of future changes in resource characteristics.

Next, the negotiations phase begins between a first WAP controller and other WAP controllers. This phase involves determining which of the other WAPs are agreeable to accommodate the dynamic differences in processing loads by taking over some parts of the nASP processing load of the overloaded first WAP. In a first stage of negotiations, the WAP controller 423 executes a step 507 of sending solicitation messages to other WAPs of the WLAN system. The solicitation messages include the resource characteristics of those parts of nASP processing load of WAP 401 that have been determined by the WAP controller to be distributed to other WAPs.

WAP controllers receiving the solicitation message determine if they are capable of accommodating the additional processing load as specified in the message. These controllers then respond to the WAP controller initiating the solicitation by either accepting to take over the complete specified load or accepting to handle partial amounts of the load. The initiating WAP controller then uses the responses to determine which of the other WAPs are agreeable and to which extent agreeable, to receiving parts of the nASP processing load that it initially specified. The negotiations may also extend beyond the initial solicitation message if such a need is inferred to exist by the initiating WAP controller. As such, step 507 is used to determine which of the other WAPs in the WLAN system are agreeable to receiving and perform processing of parts of nASP processing load of WAP 401 in order to reduce the processing load at WAP 401.

Next, in a step 509, WAP controller 423, of the overloaded or soon to be overloaded WAP, establishes a tunnel connection 409, between WAP 401 and the WAPs determined in a step 507 to be agreeable to receiving and processing the determined parts of nASP processing load of WAP 401. FIG. 4 illustrates one of the agreeable WAPs to be WAP 403. Relevant context information required for processing of the determined parts of nASP processing load is then transmitted over the established tunnel connection to the agreeable WAPs. Then, in a step 511, WAP controller 423 distributes the determined parts of the ASP processing load of WAP 401 to the agreeable WAPs over the tunnel connection. In doing so WAP controller 423 reduces the overall processing load at WAP 401. All this is achieved while maintaining existing associations with associated MTs and in a fine grained manner so as not to overwhelm the agreeable WAPs.

This embodiment illustrates the efficacy of this aspect of the invention in distributing processing load without the limitations of existing handover-based methods. As such, there are no constraints as to the geographic position or willingness to displace for the associated MTs.

In another embodiment of this aspect of the invention, an overloaded WAP simply relays the processing load required for communications sessions of associated MTs to other agreeable WAPs. This relay may be over wireless, wired or a combination of both types of links. Relevant context information may also be relayed so as to facilitate the processing of the relayed processing load.

In one embodiment, the tunnel connection between two WAPs is established over a direct link between WAPs. This direct link may be wireless and similar to the link between WAPs and MTs in which case the WAPs determine a radio channel alternate from the channel used for communications with associated MTs and use this to exchange relevant context information and determined parts of nASP processing load. Alternatively, the link between two WAPs can be wired and directly connected. With this embodiment, the tunnel connection need not traverse the network backbone but rather can be established directly.

In another embodiment of the invention, nASP processing load is defined as the processing required for security algorithms used for the encryption and decryption of MAC PDUs that are transmitted to and received from associated MTs. Processing of security algorithms is a type of non-association-specific processing which is computationally intensive due to the complex characteristic. As such, a significant increase in the number of associated MTs or in the volume of traffic to and from associated MTs will in turn lead to a corresponding increase in the processing of the security algorithms. In this embodiment, WAPs and associated MTs encrypt their respective transmissions over the wireless connection based on an established security algorithm. Upon receipt of transmissions, the WAPs and MTs perform decryption processing based on the same established security algorithm. When the nASP processing load for encryption and decryption becomes significant, as measured by its resource characteristic exceeding a nASP load threshold, a WAP controller 423 of WAP 401 sends a solicitation message to determine which of other WAPs in the WLAN system are agreeable to receiving and processing parts of nASP processing load corresponding to the security algorithms used for transmissions between WAP 401 and MT 405. If WAP 403 is agreeable to processing the nASP processing load, its WAP controller 425 responds to the solicitation message. Upon receipt of the response to the solicitation message, WAP controller 423 establishes a tunnel connection to WAP 403 and then sends relevant security keys and context information to WAP 403 via the established tunnel connection.

Next, upon establishment of the tunnel connection and exchange of the security keys and context information, WAP controller 423 sends to WAP 403 encrypted MAC PDUs received from associated MT 405. WAP controller 423 also sends to WAP 403, MAC PDUs that are to be encrypted before transmission to the associated MT 405. WAP 403 then processes the nASP processing load for encryption of MAC PDUs and sends the encrypted MAC PDUs to WAP 401 via the tunnel connection. Having received the encrypted MAC PDUs, WAP 401 then transmits them to the associated MTs. In t his embodiment, the computationally intensive processing of security algorithms is distributed across WAPs so as to lower the processing load at a WAP. This is performed without affecting re-associations of MTs and as such this method is no t limited by the shortcomings of handover-based methods.

In another embodiment, a WAP controller distributes the nASP processing load cor responding to those security algorithms that cannot be processed by the WAP due to reasons of unfamiliarity of the said security algorithms while at the same ti me maintaining association relationships with associated MTs. Given the growing numbers of MTs and other devices in which WLAN capabilities are incorporated, th ere may be many security features implemented in such MTs and devices, all of wh ich not being recognizable by all WAPs with which associations are sought. As su ch this embodiment allows a WAP to maintain associations with MTs and other devi ces even if some of the required processing is not possible at the said WAP. Th e embodiment is described using an uncommon security algorithm as example; howev er it is valid for any other type of processing that is uncommon between WAP and MT.

During an association of a MT with a WAP, a security algorithm that is knowledge able to both entities is negotiated upon for securing transmissions over the wir eless connection between the two entities. Traditionally, if the WAP is not know ledgeable of any of the security algorithms used by the MT, the MT cannot be ass ociated with the said WAP. The here forth described embodiment of the invention transcends this limitation and permits MTs to associate with a WAP even if the WAP is not knowledgeable of any of the security algorithms used by the MTs.

In this embodiment, a WAP controller 423 permits a MT 405 to associate with WAP 401 even though there are no common security algorithms that both WAP 401 and MT 405 are knowledgeable of. During the association phase, WAP controller 423 send s a solicitation message to other WAPs in the WLAN system to determine which WAP s are knowledgeable of and agreeable to processing any of the security algorithm s familiar to MT 405. If WAP 403 is knowledgeable of and agreeable to processing any of the security algorithms familiar to MT 405, WAP controller 425 responds to the solicitation message from WAP controller 423 with a chosen security algor ithm. Upon receipt of the response to solicitation message, WAP controller 423 t hen establishes a tunnel connection 409 with WAP 403. WAP controller 423 next se nds relevant security keys and context information to WAP 403 via the establishe d tunnel connection. The chosen security algorithm is then intimated to MT 405 a nd it is associated with WAP 401.

Upon establishment of tunnel connection and exchange of security keys and contex t information, WAP controller 423 sends to WAP 403, MAC PDUs received from MT 40 5 associated with WAP 401, that have been encrypted based on the chosen security algorithm. WAP 403 receives the encrypted MAC PDUs via the tunnel connection an d decrypts them based on chosen security algorithm and established security keys and context information. WAP controller 423 also sends to WAP 403, MAC PDUs tha t are to be encrypted before transmission to the associated MT 405. In this case , WAP 403 receives MAC PDUs via the tunnel connection, encrypts them based on ch osen security algorithm and sends the encrypted MAC PDUs back to WAP 401. WAP 40 1 then transmits the encrypted MAC PDUs to the associated MT 405. In this embodi ment, the lack of knowledge about a security algorithm does not limit a WAP from allowing a MT to associate with it. As such it provides greater flexibility in providing services to a great number of MTs with different processing requirements.

Another embodiment of the invention relates to the size of PDUs processed by WAPs. Studies in processor scheduling have shown that processing large PDUs before small PDUs leads to greater average processing time as compared to cases where small PDUs are processed before large PDUs. FIG. 6 illustrates this through example. In a first case, it shows two processing schedules 601 and 603 for processors 613 and 615, respectively. The scheduling order 605 and 607 denote the relative order in which PDUs A, B, C and D are processed. 609 and 611 denote the processing time, in arbitrary time units (tu), required for processing each of the PDUs.

In schedule 601, large PDUs A and B are processed before small PDUs C and D. The average processing time for the PDUs is 21.25 tu, while it is only 16.25 tu for the PDUs in schedule 603 where small PDUs C and D are processed before large PDUs A and B. Clearly schedule 603, in which small PDUs are processed before large PDUs, leads to significant reductions in average processing time.

In a second case, the aspect of processing overhead for processor scheduling is considered. The processing of each PDU requires some processing overhead which includes memory access time and context transfer time. The overhead is generally independent of the size of the PDU as it is required before the actual processing. FIG. 6 depicts a schedule 617 for small PDUs alone in which processing overhead time and actual processing time is shown by 621 and 625, respectively. Processing overhead time 623 and processing time 627 is for large PDUs in schedule 619. From this, it is seen that the processing overhead takes up 50% of total time in schedule 617 whereas overhead constitutes only $33^1/_3$% in schedule 619. This illustrates how processing only small PDUs can lead to a processor handling more overhead than when a processor handles large PDUs.

In an embodiment of the invention related to the size of PDUs, the nASP processing load is defined as the size of PDUs handled by a WAP. A WAP controller 423 of WAP 401 monitors the size of PDUs received over a wireless connection 427 from an associated MT 405. When WAP controller 423 determines that WAP 401 is processing any of the previous described cases, the controller determines a processing schedule for a subset of the monitored received PDUs. The aim of the processing schedule is to optimize average processing time and processing overhead time at WAP 401.

Next, WAP controller 423 derives a resource characteristic for the PDUs that may be distributed to other agreeable WAPs for processing. As such, the resource characteristic represents the processing load required for processing PDUs other than those that are processed by the WAP 401 itself. The resource characteristic is then sent to other WAPs of the WLAN system as part of a solicitation message to determine WAPs agreeable to processing the PDUs described in the message.

If WAP 403 is agreeable to the nASP processing of PDUs described in the solicita tion message, WAP controller 425 responds accordingly. A WAP in the WLAN system will be agreeable to processing PDUs from another WAP when processing such PDUs would allow it to optimize its own average processing time and processing overhead time. Upon receipt of the response, WAP controller 423 then establishes a tunnel connection 409 with WAP 403 and sends relevant context information to WAP 403 via the established tunnel connection.

Having established the tunnel connection and exchanged relevant context information, WAP controller 423 sends to WAP 403, PDUs described by the previously sent resource characteristic with the aim of optimizing average processing time and processing overhead time at WAP 401. So with this embodiment, the nASP processing of PDUs of different sizes may be distributed in a manner so as to optimize processing while at the same time maintaining association relationships between WAPs and MTs.

In another embodiment, a WAP controller distributes the nASP processing load based on information comprising the size of the data unit to be processed, the expected average time for processing a data unit, the overhead time for processing a data unit and a weighted sum of said information.

Another embodiment of the disclosed method concerns the distribution of processing of ISO-OSI layer 3 and layers above layer 3 from a first WAP to other WAPs while maintaining association relations between the first WAP and MTs associated with it. Many WAPs are currently capable of processing up to ISO-OSI layer 2, however there are vendors manufacturing WAPs capable of ISO-OSI layer 3 processing. This embodiment refers to such devices and other similar WAPs. Processing for ISO-OSI layer 3 and layers above layer 3 includes quality of service (QoS) provisioning, routing and scheduling. In this embodiment, nASP processing load is defined as the processing concerning ISO-OSI layer 3 and layers above layer 3.

In this embodiment, a WAP controller 423 for WAP 401 derives a resource characteristic for the processing of ISO-OSI layer 3 and layers above 3 based on the factors of nASP processing load monitored for each of the communications sessions between WAP 401 and associated MT 405. The resource characteristics of all communications sessions are then combined to derive an aggregate nASP load factor for WAP 401 which is then compared to a nASP load threshold to determine impending nASP processing overload conditions.

If impending nASP processing overload conditions are determined, WAP controller 423 then determines parts of nASP processing load of ISO-OSI layer 3 and layers above 3 that may be distributed to other WAPs in the WLAN system with the aim of reducing overall processing load at WAP 401. Next, WAP controller 423 sends a solicitation message, comprising resource characteristics of the determined parts of nASP processing load of ISO-OSI layer 3 and layers above 3, to determine which other WAPs are agreeable to receiving and performing processing of the parts of nASP processing load on behalf of WAP 401.

If WAP 403 is agreeable to processing the parts of nASP processing load based on the solicitation message, WAP controller 425 sends a positive response to WAP 401. Upon receiving the response, WAP controller 423 establishes a tunnel connect ion 409 between WAP 401 and WAP 403 after which relevant context information required for processing of parts of nASP processing load of ISO-OSI layer 3 and layers above 3 is transmitted over tunnel connection to WAP 403. Then WAP controller 423 sends the determined parts of nASP processing load to WAP 403 with the aim of reducing nASP processing load at WAP 401 by distributing parts of processing load to other WAPs while maintaining existing association relations between WAPs and MTs.

In yet another embodiment of the aspect of the invention dealing with negotiations for accommodating dynamic differences among WLAN entities, a central controller entity takes part in the negotiations. Broadly, the central controller entity coordinates how the dynamic differences are to be managed among participating WLAN entities. One particular embodiment involves the central controller coordinating the distribution of nASP processing load across the WAPs under its purview. This is described with reference to FIG. 7 which illustrates a central controller 729 that is capable of monitoring the nASP processing loads at WAPs 701 and 703. When the nASP processing load at WAP 701 exceeds a nASP processing load threshold, the central controller sends a solicitation message to other WAPs in the WLAN system requesting assistance for the processing of parts of processing load of WAP 701. This begins the negotiations phase between the central controller and other WAPs in the WLAN system. The solicitation message includes descriptors of the parts of processing load at WAP 701 to be distributed to other WAPs with the aim of reducing overall processing load at WAP 701.

If WAP 703 is agreeable to assist with the processing for WAP 701, a WAP controller 725 responds to the solicitation message. The central controller then intimates WAP 701 about the acceptance, after which WAP 701 establishes a tunnel connection 709 with WAP 703. It then sends WAP 703 relevant context information followed by the parts of processing load as specified in the solicitation message. Alternatively, WAP 701 may send the context information and parts of processing load to the central controller which then forwards this to the agreeable WAPs like WAP 703. So with this embodiment, processing load is distributed across WAPs of a WLAN with a central controller coordinating the distribution.

In another embodiment, the central controller receives regular information from WAP controllers of the WAPs under its purview regarding their nASP processing loads. As such, the WAP controllers themselves determine overload conditions and the need to distribute parts or all of nASP processing load to other WAPs or other WLAN entities. The negotiations phase in this embodiment is thus initiated by the WAP controllers and then further pursued between the central controller and other WAPs.

The embodiments presented so far exhibit how negotiations between various WLAN entities based on the disclosed policies may be used to accommodate the dynamic differences among them. In particular, they describe how processing load may be classified as being association-specific and non-association-specific. They also illustrate how parts of nASP processing load may be distributed to other WAPs of the WLAN system for the purpose of reducing overall processing load at a first WAP. The disclosed invention is unique in that it permits the distribution of processing load while maintaining existing association relationships between WAPs and MTs. As such, the disclosed method for accommodating dynamic differences does not necessitate in the physical displacement of any WLAN entity which is unlike existing methods. This innovation is therefore more flexible than handover-based methods for distributing processing load. It also transcends the limitations of such schemes.

The various aspects of the disclosure presented insofar illustrate the novelty of the method for negotiations in accommodating static and dynamic differences among WLAN entities. Whereas, extant methods focus on hard divisions in functionality among WLAN entities, this invention presents alternate means where functionality divisions may be made in flexible manners. Also, while existing methods require re-associations and the consequent geographical and physical limitations of handovers, this innovation puts forth ways of dealing with imbalances in processing load without the constraints of handover-based methods.

It will be clear to anyone skilled in the related art that the disclosed invention may take the form of numerous other embodiments with numerous other policies for the negotiation and handling of differences among WLAN entities without deviating from the essence and scope of this disclosure. As such this invention will be applicable in all such embodiments and practices.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 illustrates an operational representation of a wireless local area network (WLAN) system used to illustrate a first aspect of the disclosed invention dealing with policies for negotiations between WLAN entities, particularly between a controlling node (CN) and wireless access points (WAPs);

FIG. 2 depicts the general operational steps involved in a first aspect of the invention dealing with policies for negotiations between a CN and WAP.

FIG. 3 shows an integrated WLAN entity exemplifying one embodiment of a first aspect of the invention in which the capabilities of a CN and WAP are integrated into one entity;

FIG. 4 illustrates a simplified framework for a second aspect of the invention dealing with policies for negotiations for the purpose of accommodating dynamic differences among WLAN entities, particularly between WAPs;

FIG. 5 depicts the general operational steps involved in a second aspect of the invention dealing with policies for negotiations for accommodating dynamic differences among WLAN entities. Specifically, it deals with processing loads at various entities;

FIG. 6 serves to explain the reasoning for one embodiment of a second aspect of the invention, wherein the definition of processing load is taken to be the size of the protocol data unit (PDU) that is received by the WAP from associated MTs;

FIG. 7 illustrates one embodiment of a second aspect of the invention in which a central controller performs a supervisory role in the negotiations for accommodating dynamic differences among WLAN entities.

FIG. 8 illustrates one embodiment of a first aspect of the invention in which negotiations strategies are applied to enable CAPWAP split operations in dynamic WLAN topologies.

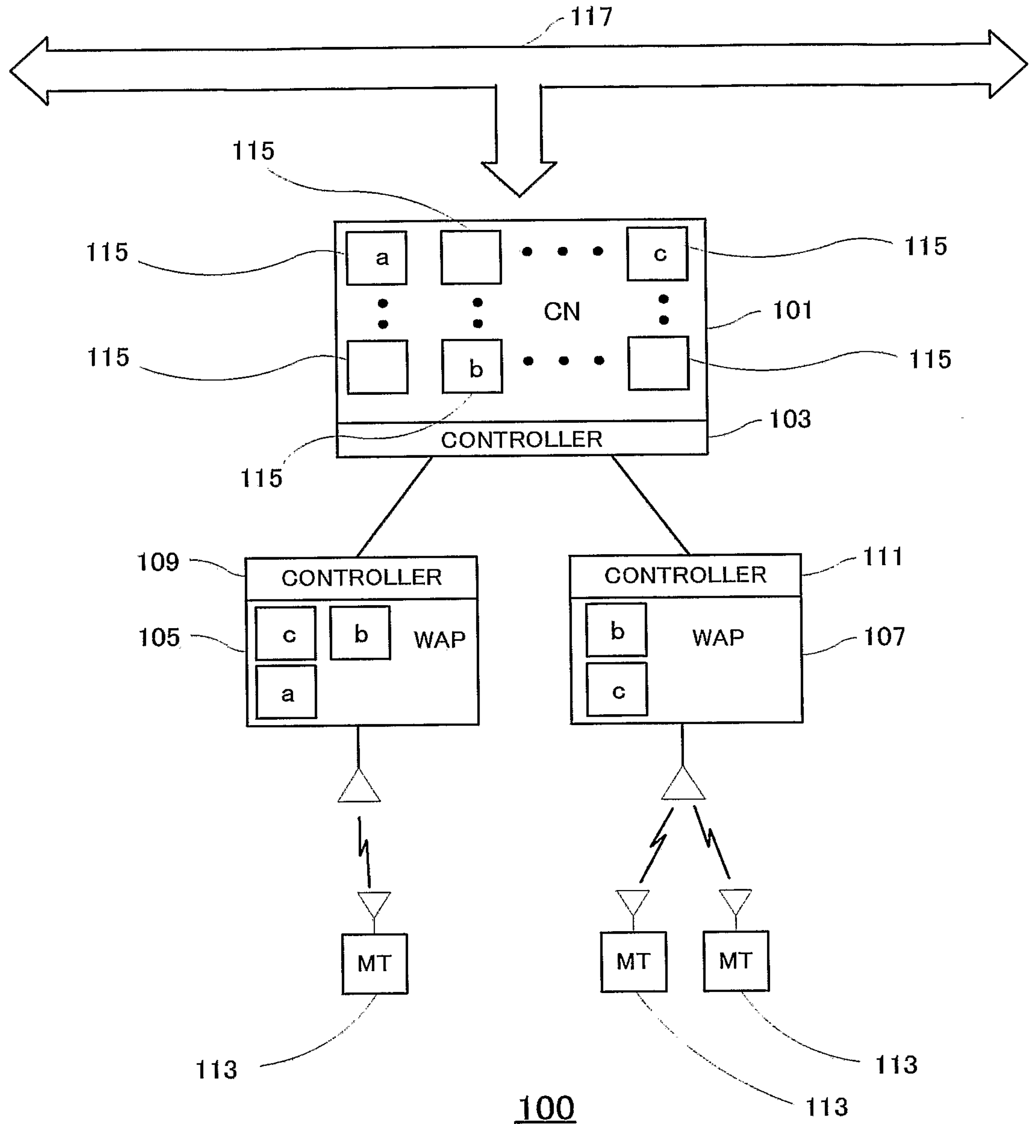
FIG. 9 exemplifies a particular embodiment of a first aspect of the invention relating to IEEE802.11 WLAN specifications.

FIG. 10 depicts a sequence of steps of a first aspect of the invention in which dynamic WLAN topologies are enabled.

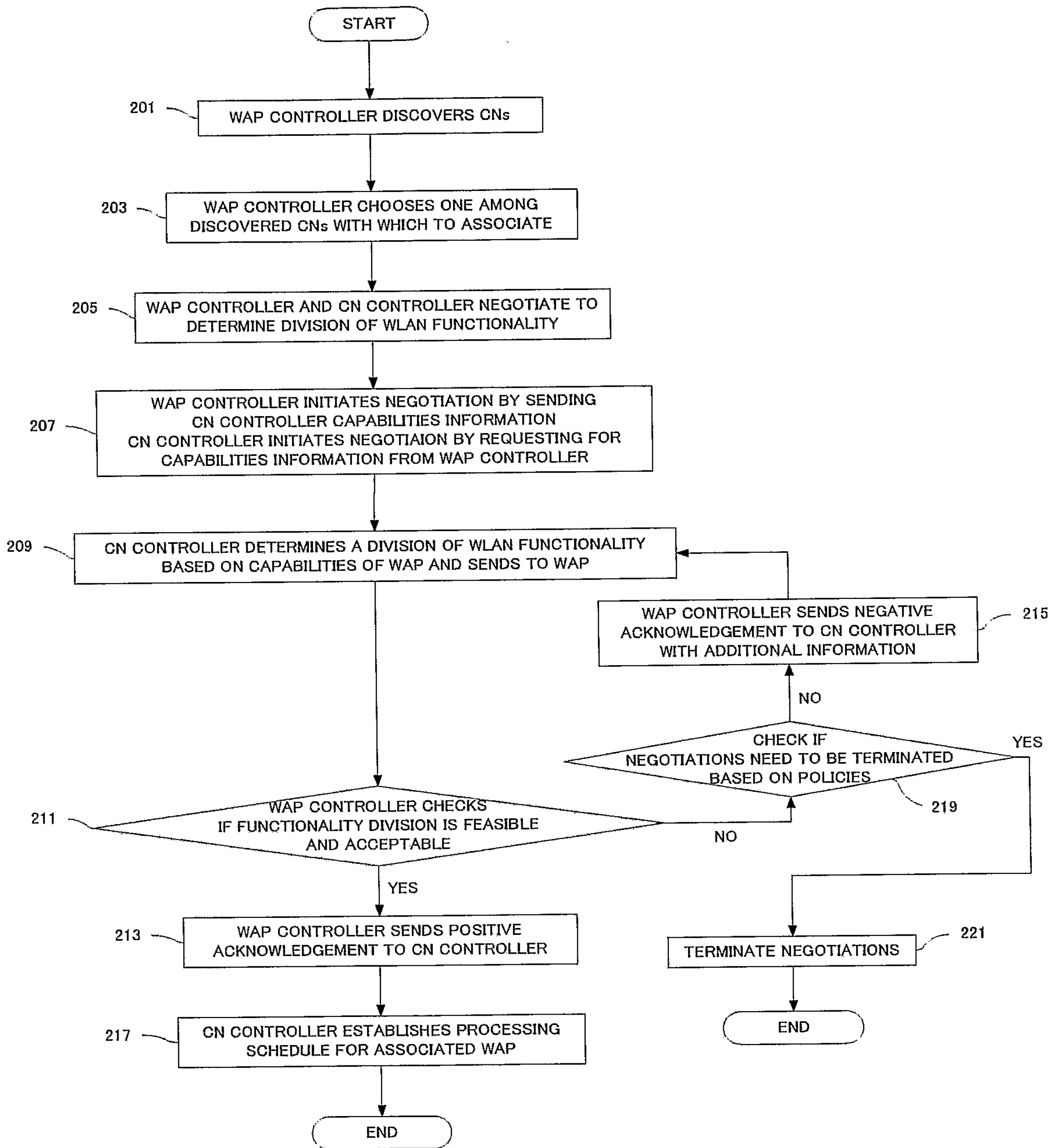
Description of the Symbols

100, 300, 400, 700, 800 Wireless Local Area Network (WLAN) system
101 controller node (CN)
103, 305 CN controller
105, 107, 401, 403, 701, 703 wireless access point (WAP)
109, 111, 303, 423, 425, 723, 725 WAP controller
113, 309, 405, 705 mobile terminal (MT)
115, 307 functional component
117, 311, 407, 707 network backbone
301 WLAN entity
409, 709 tunnel connection
411, 413, 711, 713 ASP
415, 417, 715, 717 nASP
427, 727 wireless connection
613, 615, 629, 631 processor
605, 607 scheduling order
729, 801 central controller (central controlling node)
807, 809 topology
803, 901 WAP1
811, 903 mobile clients
813 transition
815 new connection (newly established wireless connection)
817, 819, 821 step
823 communications unit
905 'Reception' block
907 filter
909 'WAP Processes' block
911 'Transmission' block
913 filter logic update
805, 915 WAP2
917 network

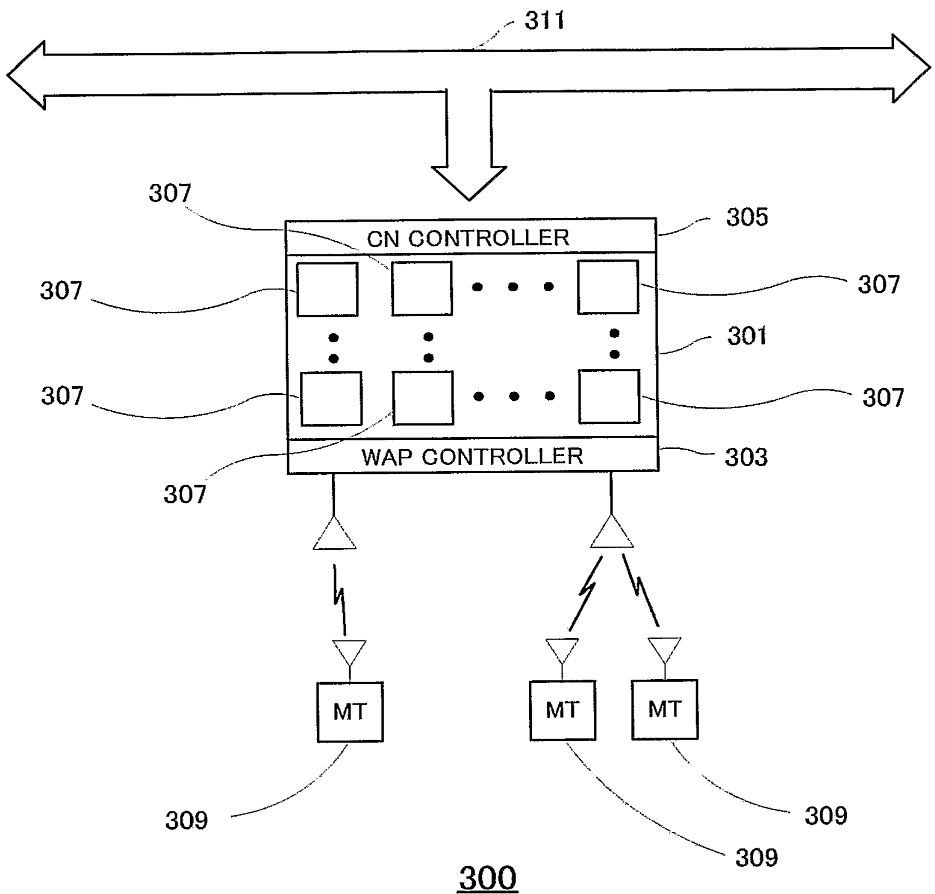
【書類名】外国語図面
【図１】



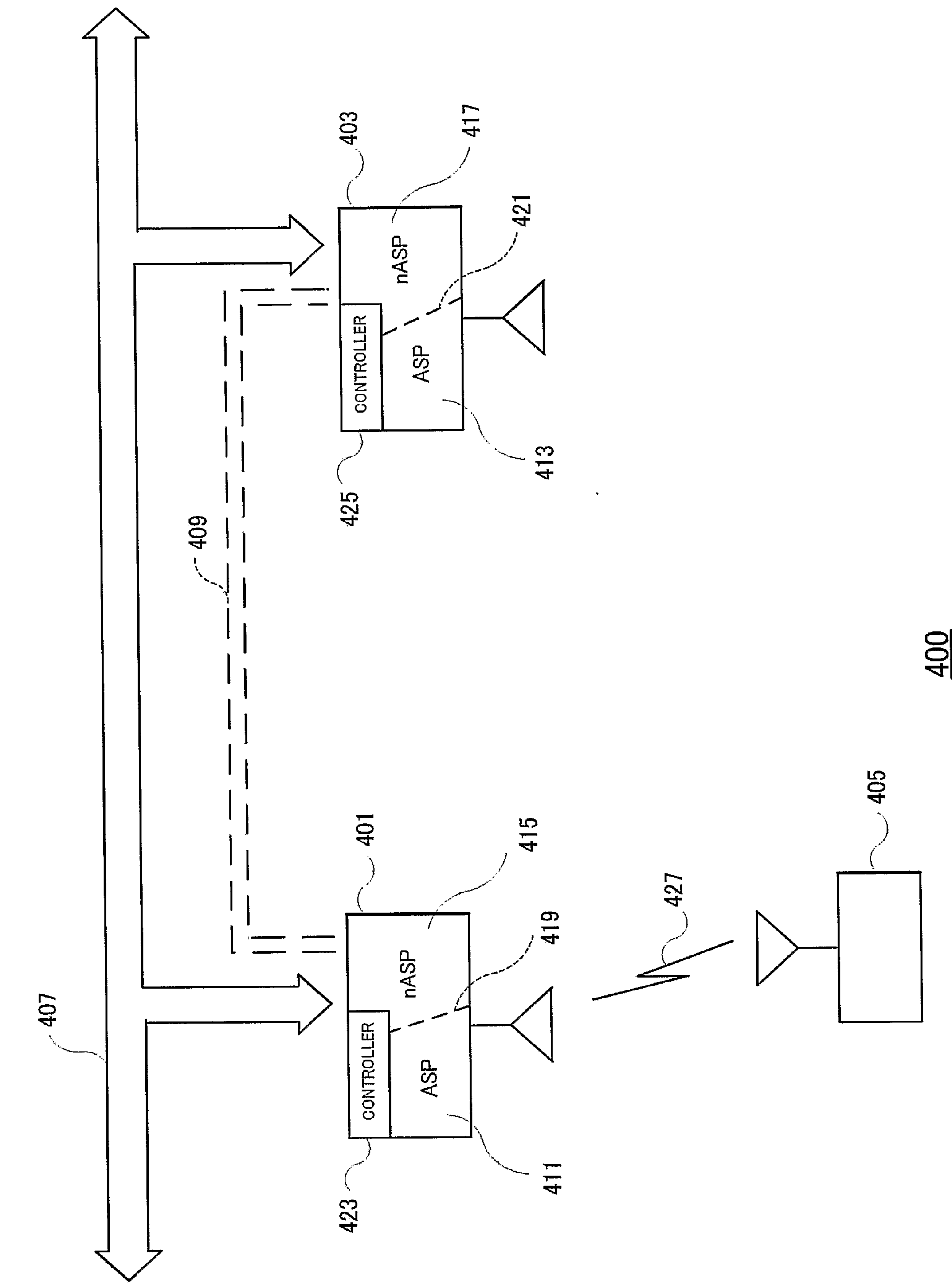
【図２】


START
201
WAP CONTROLLER DISCOVERS CNs
203
WAP CONTROLLER CHOOSES ONE AMONG DISCOVERED CNs WITH WHICH TO ASSOCIATE
205
WAP CONTROLLER AND CN CONTROLLER NEGOTIATE TO DETERMINE DIVISION OF WLAN FUNCTIONALITY
207
WAP CONTROLLER INITIATES NEGOTIATION BY SENDING CN CONTROLLER CAPABILITIES INFORMATION
CN CONTROLLER INITIATES NEGOTIAION BY REQUESTING FOR CAPABILITIES INFORMATION FROM WAP CONTROLLER
209
CN CONTROLLER DETERMINES A DIVISION OF WLAN FUNCTIONALITY BASED ON CAPABILITIES OF WAP AND SENDS TO WAP
215
WAP CONTROLLER SENDS NEGATIVE ACKNOWLEDGEMENT TO CN CONTROLLER WITH ADDITIONAL INFORMATION
NO
CHECK IF NEGOTIATIONS NEED TO BE TERMINATED BASED ON POLICIES
YES
219
211
WAP CONTROLLER CHECKS IF FUNCTIONALITY DIVISION IS FEASIBLE AND ACCEPTABLE
NO
YES
213
WAP CONTROLLER SENDS POSITIVE ACKNOWLEDGEMENT TO CN CONTROLLER
221
TERMINATE NEGOTIATIONS
217
CN CONTROLLER ESTABLISHES PROCESSING SCHEDULE FOR ASSOCIATED WAP
END
END

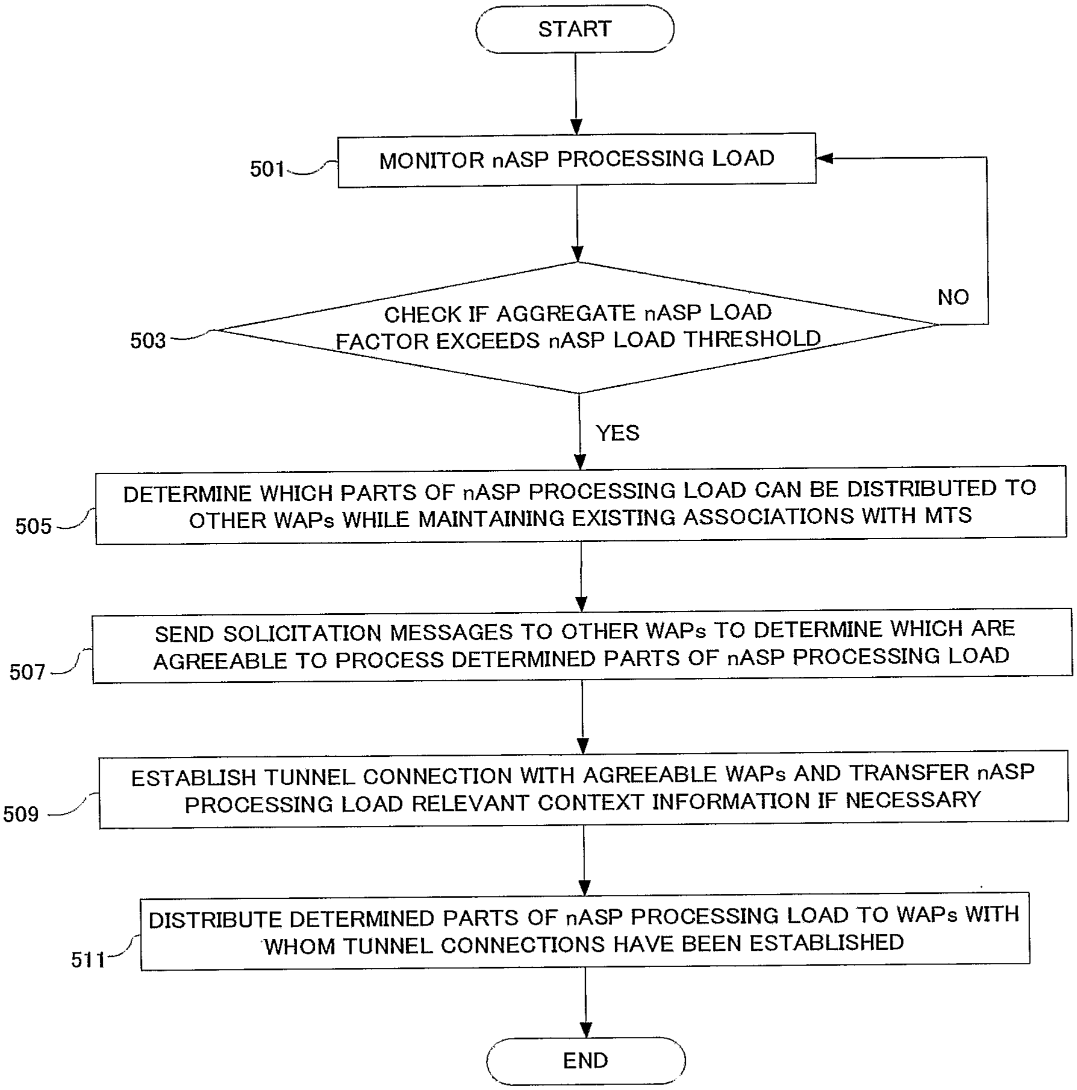
【図３】


311
307
305
CN CONTROLLER
307
307
301
307
307
WAP CONTROLLER
303
307
MT
MT
MT
309
309
309
300

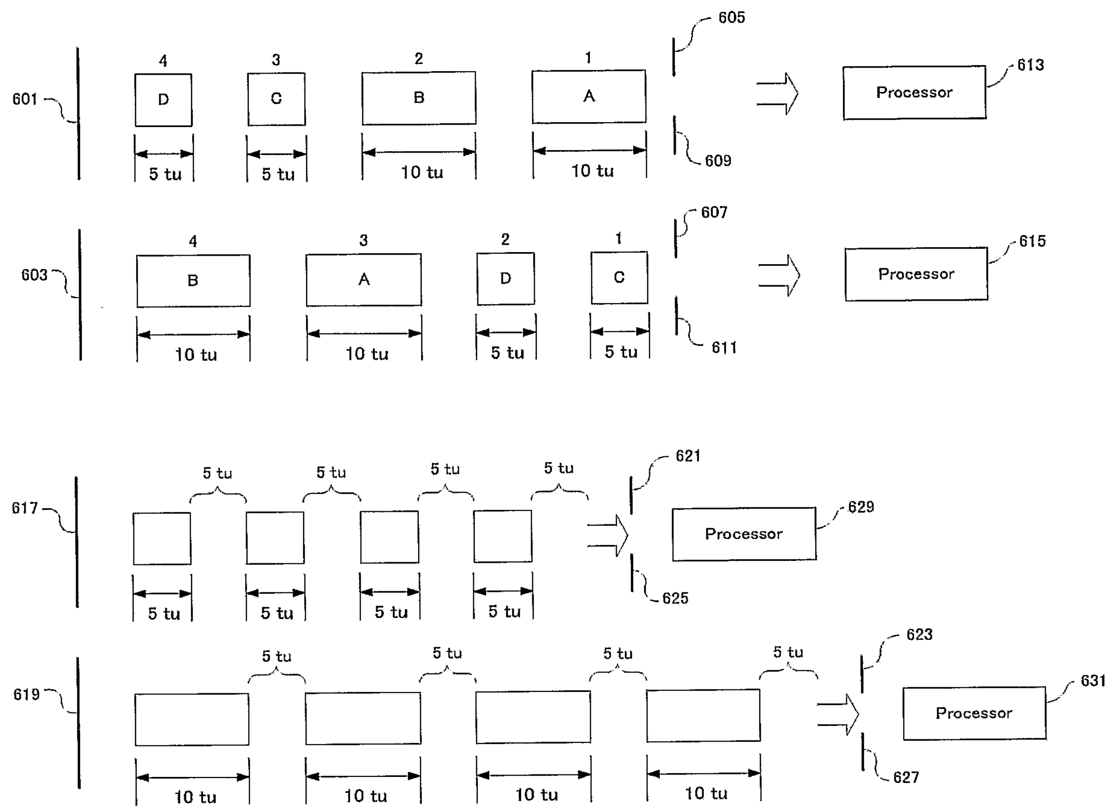
【図４】


403
417
421
nASP
CONTROLLER
ASP
413
425
409
400
401
415
419
427
405
407
nASP
CONTROLLER
ASP
423
411

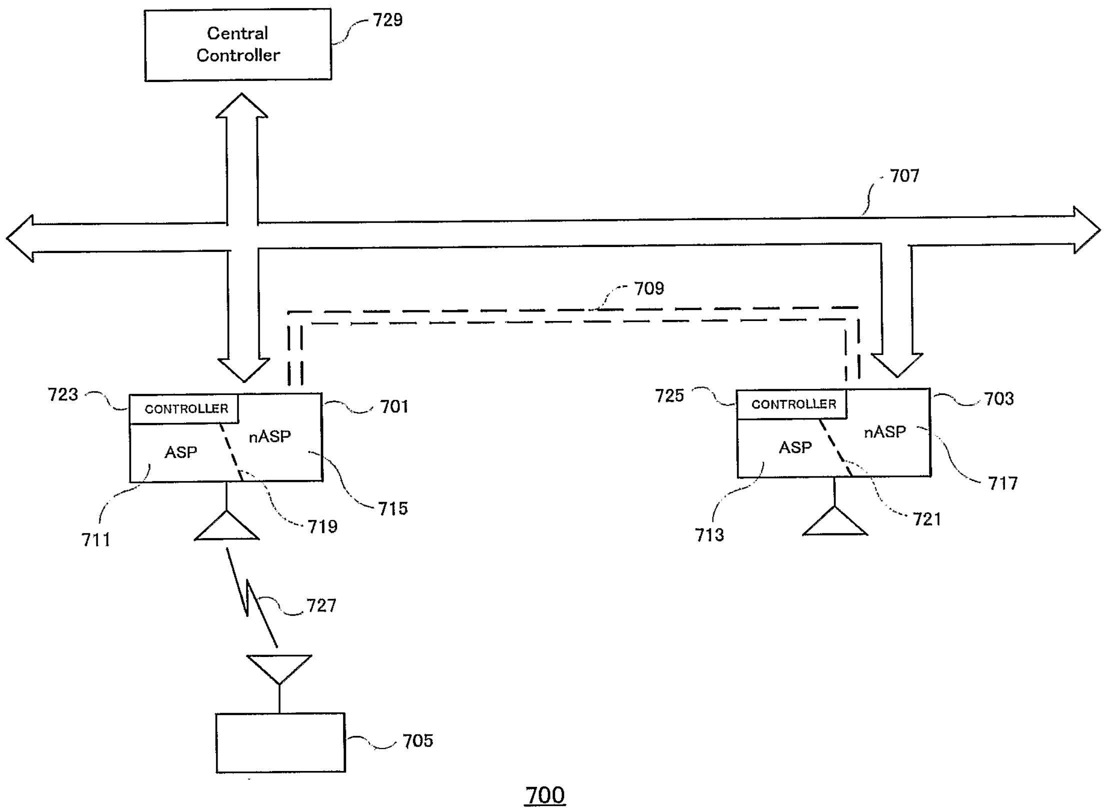
【図５】


START
501
MONITOR nASP PROCESSING LOAD
503
CHECK IF AGGREGATE nASP LOAD FACTOR EXCEEDS nASP LOAD THRESHOLD
NO
YES
505
DETERMINE WHICH PARTS OF nASP PROCESSING LOAD CAN BE DISTRIBUTED TO OTHER WAPs WHILE MAINTAINING EXISTING ASSOCIATIONS WITH MTS
507
SEND SOLICITATION MESSAGES TO OTHER WAPs TO DETERMINE WHICH ARE AGREEABLE TO PROCESS DETERMINED PARTS OF nASP PROCESSING LOAD
509
ESTABLISH TUNNEL CONNECTION WITH AGREEABLE WAPs AND TRANSFER nASP PROCESSING LOAD RELEVANT CONTEXT INFORMATION IF NECESSARY
511
DISTRIBUTE DETERMINED PARTS OF nASP PROCESSING LOAD TO WAPs WITH WHOM TUNNEL CONNECTIONS HAVE BEEN ESTABLISHED
END

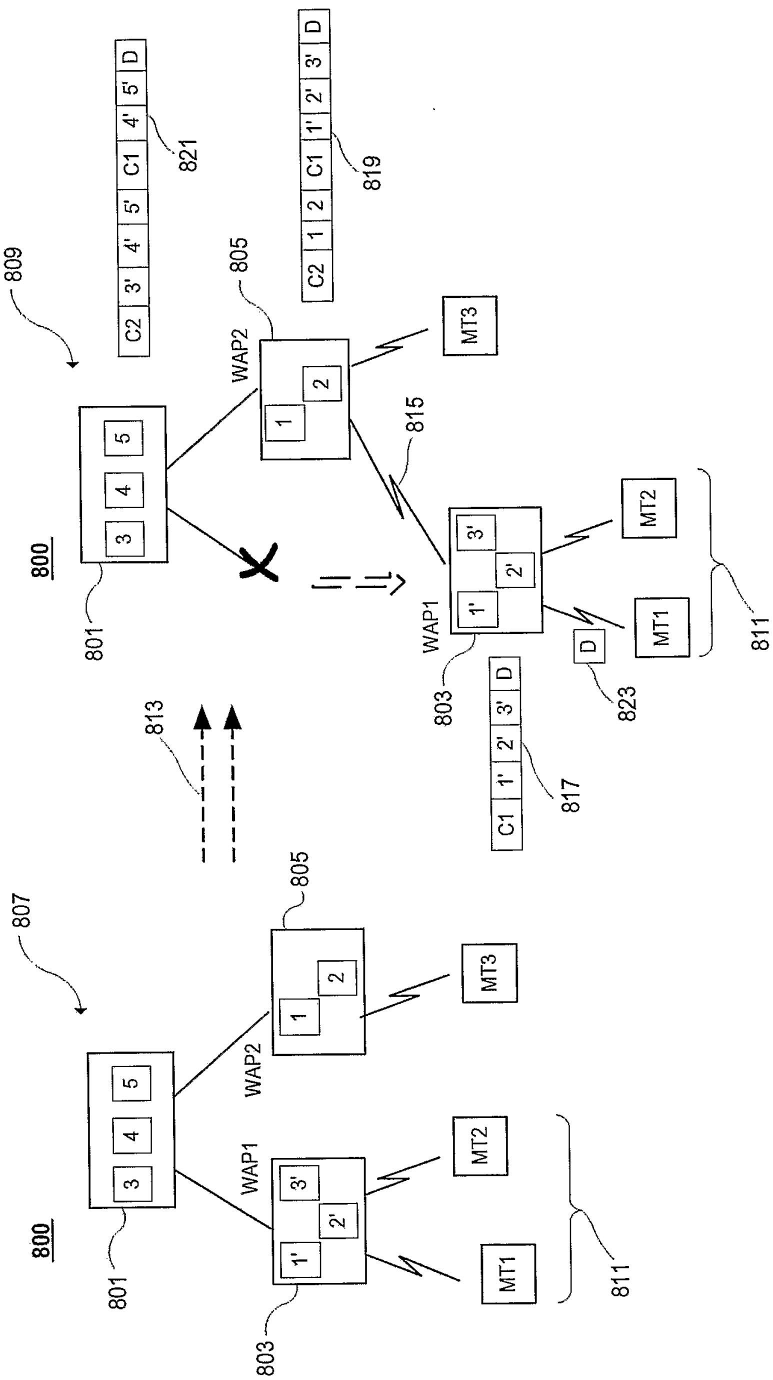
【図６】


605
4
3
2
1
601
D
C
B
A
Processor
613
5 tu
5 tu
10 tu
10 tu
609
607
4
3
2
1
603
B
A
D
C
Processor
615
10 tu
10 tu
5 tu
5 tu
611
617
5 tu
5 tu
5 tu
5 tu
621
Processor
629
5 tu
5 tu
5 tu
5 tu
625
619
5 tu
5 tu
5 tu
5 tu
623
Processor
631
10 tu
10 tu
10 tu
10 tu
627

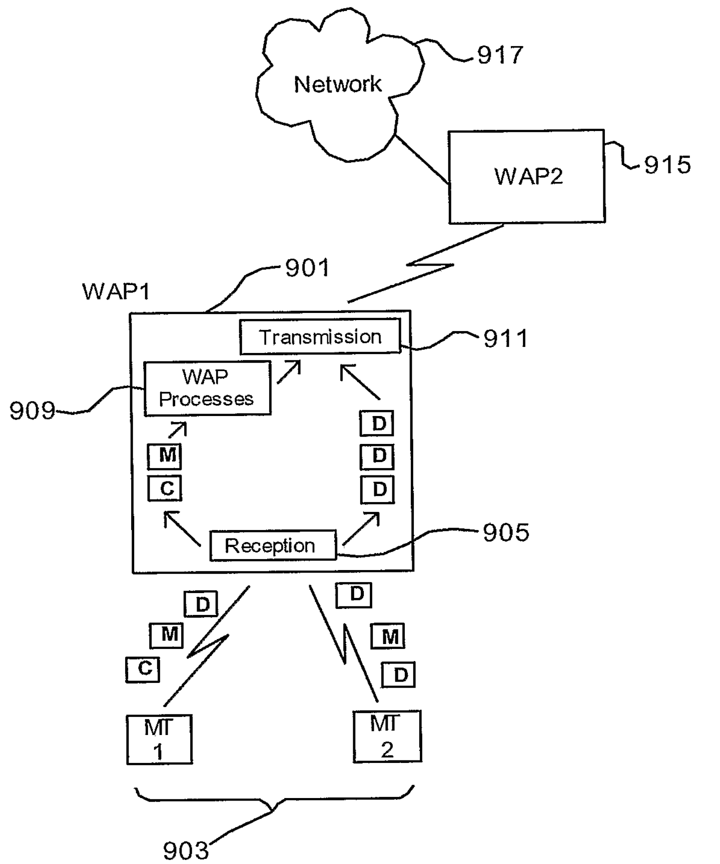
【図７】


Central Controller
729
707
709
723
CONTROLLER
701
nASP
ASP
715
719
711
725
CONTROLLER
703
nASP
ASP
717
721
713
727
705
700

【図８】


800
801
803
805
807
809
811
813
815
817
819
821
823
WAP1
WAP2
MT1
MT2
MT3
C2 3' 4' 5' C1 4' 5' D
C2 1 2 C1 1' 2' 3' D
C1 1' 2' 3' D
D

【図９】



907

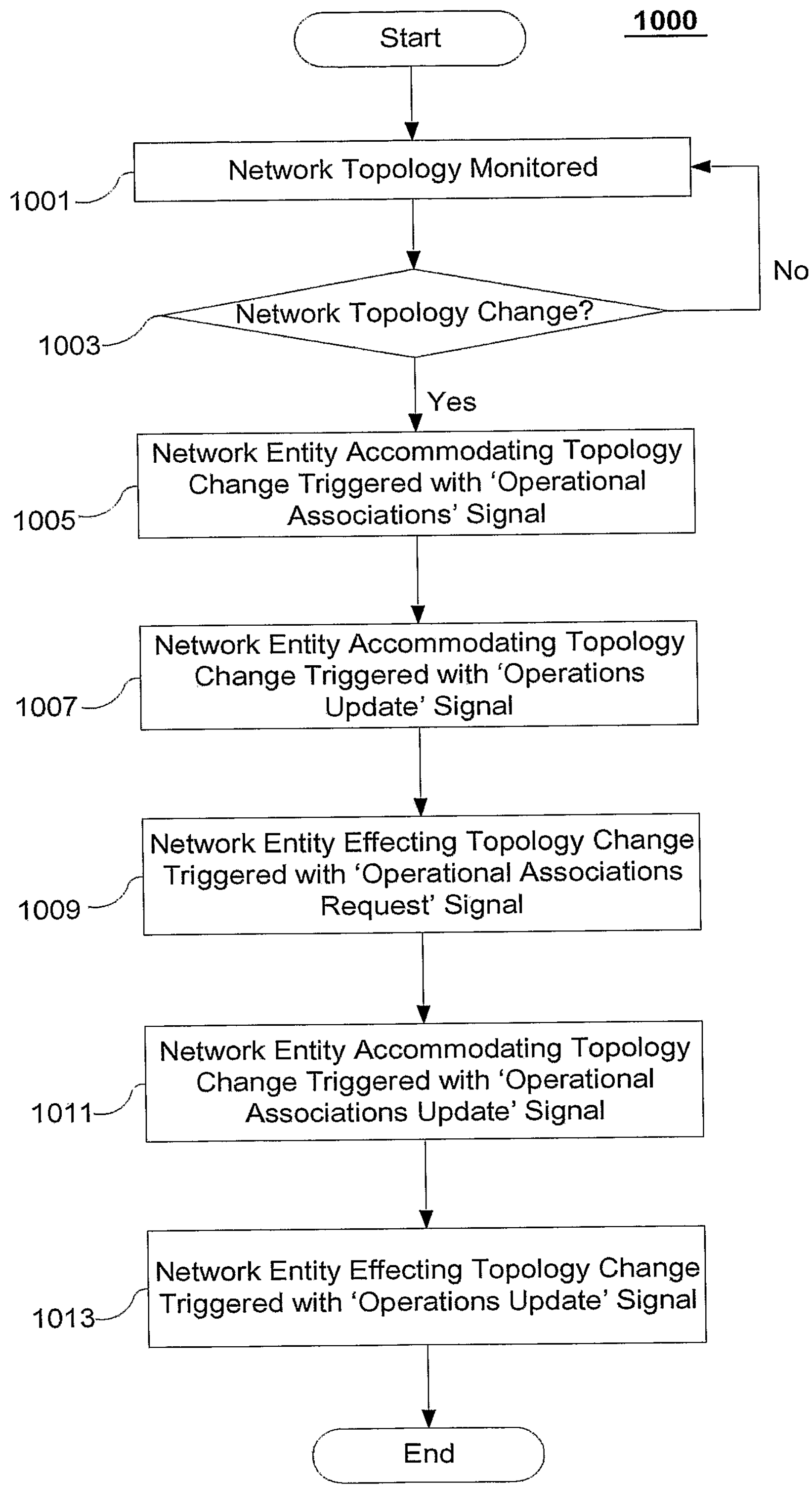
Destination Address	Action
...	...

BSSID	Action
...	...

FrameType	Action
FrameforACK	SignalProtocol_Cntrl
DataFrames	Send to TransmissionBlock
ManagementFrames	Process locally
ControlFrames	Process locally

913

【図１０】


1000
Start
Network Topology Monitored
1001
Network Topology Change?
No
1003
Yes
Network Entity Accommodating Topology Change Triggered with 'Operational Associations' Signal
1005
Network Entity Accommodating Topology Change Triggered with 'Operations Update' Signal
1007
Network Entity Effecting Topology Change Triggered with 'Operational Associations Request' Signal
1009
Network Entity Accommodating Topology Change Triggered with 'Operational Associations Update' Signal
1011
Network Entity Effecting Topology Change Triggered with 'Operations Update' Signal
1013
End

【書類名】外国語要約書

1　Abstract

A method for negotiations between various entities of a wireless local area network (WLAN) including negotiations between controlling nodes (CNs) and wireless access points (WAPs) and negotiations between WAPs is disclosed. These negotiations are used for the purpose of establishing the capabilities of the various entities, determining how such capabilities may be optimally divided among the negotiating entities and then dividing the capabilities among the entities based on this determination. The capabilities include those required for the operation, control and management of the WLAN entities and the encompassing WLAN. The disclosed method introduces means for flexibly accommodating the varying degrees of differences in capabilities among the WLAN entities between the WLAN entities including dynamic changes in WLAN topologies.

2　Representative Drawing　Figure 1

認定・付加情報

特許出願の番号	特願２００４－２０９４７０
受付番号	５０４０１２０４１２８
書類名	特許願
担当官	清野　俊介　　　　６９９７
作成日	平成１６年　９月２８日

＜認定情報・付加情報＞

【提出日】　平成16年 7月16日

出証特２００５－３０３１４７３

特願２００４－２０９４７０

出　願　人　履　歴　情　報

識別番号　［０００００５８２１］

１．変更年月日　１９９０年　８月２８日
　　［変更理由］　新規登録
　　　　住　所　大阪府門真市大字門真１００６番地
　　　　氏　名　松下電器産業株式会社

出証番号　出証特２００５－３０３１４７３

IAP5 Rec'd PCT/PTO 30 AUG 2006

FORM PTO-1390 (Modified) U.S. PATENT AND TRADEMARK OFFICE; U.S. DEPARTMENT OF COMMERCE
(REV. 7-2005)

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A SUBMISSION UNDER 35 U.S.C. 371

ATTORNEY'S DOCKET NUMBER
L8638.06115

U.S. APPLICATION NO. (If known, see 37 CFR 1.5)
10/591184

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/JP2005/003390	March 1, 2005	March 2, 2004 & July 16, 2004

TITLE OF INVENTION
SYSTEM AND METHOD FOR NEGOTIATION OF WLAN ENTITY

APPLICANT(S) FOR DO/EO/US
Hong CHENG
Pek Yew TAN

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a FIRST submission of items concerning a submission under 35 U.S.C. 371.
2. ☐ This is a SECOND or SUBSEQUENT submission of items concerning a submission under 35 U.S.C. 371.
3. ☒ This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include items (5), (6), (9) and (24) indicated below.
4. ☐ The US has been elected (Article 31).
5. ☒ A copy of the International Application as filed (35 U.S.C. 371 (c)(2))
   a. ☐ is attached hereto (required only if not communicated by the International Bureau).
   b. ☒ has been communicated by the International Bureau.
   c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☒ An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)).
   a. ☒ is attached hereto.
   b. ☐ has been previously submitted under 35 U.S.C. 154(d)(4).
7. ☐ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371 (c)(3))
   a. ☐ are attached hereto (required only if not communicated by the International Bureau).
   b. ☐ have been communicated by the International Bureau.
   c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
   d. ☐ have not been made and will not be made.
8. ☐ An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☐ An oath or declaration of the inventor(s) (35 U.S.C. 371 (c)(4)).
10. ☐ An English language translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371 (c)(5)).
11. ☐ A copy of the International Preliminary Examination Report (PCT/IPEA/409).
12. ☒ A copy of the International Search Report (PCT/ISA/210).

Items 13 to 23 below concern document(s) or information included:

13. ☒ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
14. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
15. ☐ A FIRST preliminary amendment.
16. ☐ A SECOND or SUBSEQUENT preliminary amendment.
17. ☐ A substitute specification.
18. ☐ A power of attorney and/or change of address letter.
19. ☐ A computer-readable form of the sequence listing in accordance with PCT Rule 13*ter*.2 and 37 CFR 1.821 - 1.825.
20. ☐ A second copy of the published International Application under 35 U.S.C. 154(d)(4).
21. ☐ A second copy of the English language translation of the International Application under 35 U.S.C. 154(d)(4).
22. ☐ Express Mail Label No.

IAP5 Rec'd PCT/PTO 30 AUG 2006

PTO-1390 (Rev. 07-2005)
Approved for use through 3/31/2007. OMB 0651-0021
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

U.S. APPLICATION NO. (if known, see 37 CFR 1.5)	INTERNATIONAL APPLICATION NO.	ATTORNEY'S DOCKET NUMBER
10/591184	PCT/JP2005/003390	L8638.06115

23. Other items or information:

Claim for Priority with PCT/IB/304
PCT/IB/308 (First Notice & Second & Supplementary Notice)
Partial Application Data Sheet

The following fees have been submitted:					CALCULATIONS	PTO USE
24. ☒ Basic national fee $300					$ $300.00	
25. ☒ Examination fee (37 CFR 1.492(c)) If the written opinion prepared by ISA/US or the international preliminary examination report prepared by IPEA/US indicates all claims satisfy provisions of PCT Article $0; All other situations........ $200					$ $200.00	
26. ☒ Search fee (37 CFR 1.492(b)) If the written opinionof the ISA/US or the international preliminary examination report by IPEA/US indicates all claims satisfy provisions of PCT Article 33(1)-(4)... $0; Search fee (37 CFR 1.445(a)(2)) has been paid on the international application to the as an International Searching Authority........ $100; International Search Report prepared by an ISA other than the US and provided to the previously communicated to the US by the IB........ $400; All other situations........ $600					$ $400.00	
TOTAL OF 24, 25 and 26 =					$ $900.00	
☐ Additional fee for specification and drawings filed in paper over 100 sheets (excluding sequence listing in compliance with 37 CFR 1.821(c) or (e) or computer program listing in an electronic medium) (37 CFR 1.492(j)). The fee is $250 for each additional 50 sheets of paper or fraction thereof.						
Total Sheets	Extra Sheets	Number of each additional 50 or fraction thereof (round up to a whole		RATE		
- 100 =	0 /50 =	0		x $250.00	$ $0.00	
Surcharge of $130.00 for furnishing any of the search fee, examination fee, or the oath or declaration after the date of commencement of the national stage (37 CFR 1.492(h)).					$	
CLAIMS	NUMBER FILED	NUMBER EXTRA		RATE		
Total claims	31 - 20 =	11	x	$50.00	$ $550.00	
Independent claims	13 - 3 =	10	x	$200.00	$ $2,000.00	
MULTIPLE DEPENDENT CLAIMS (if applicable)		☐	+	$360.00	$ $0.00	
TOTAL OF ABOVE CALCULATIONS =					$ $3,450.00	
☐ Applicant claims small entity status. See 37 CFR 1.27. Fees above are reduced by 1/2.					$ $0.00	
SUBTOTAL =					$ $3,450.00	
Processing fee of $130.00 for furnishing the English translation later than 30 months from the earliest claimed priority date (37 CFR 1.492(i)).					$ $0.00	
TOTAL NATIONAL FEE =					$ $3,450.00	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). $40 per property +					$ $0.00	
TOTAL FEES ENCLOSED =					$ $3,450.00	
					Amount to be	$
					Amount to be	$

10/591184

IAP5 Rec'd PCT/PTO 30 AUG 2006

PTO-1390 (Rev. 07-2005)
Approved for use through 3/31/2007. OMB 0651-0021
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

a. ☒ A check in the amount of $ __$3,450.00__ to cover the above fees is enclosed.

b. ☐ Please charge my Deposit Account No. ______ in the amount of $ ______ to cover the above fees. A duplicate copy of this sheet is enclosed.

c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. __19-4375__. A duplicate copy of this sheet is enclosed.

d. ☐ Fees are to be charged to a credit card. WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

NOTE: Where an appropriate time limit under 37 CFR 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the International Application to pending status.

SEND ALL CORRESPONDENCE TO:

James E. Ledbetter
STEVENS, DAVIS, MILLER & MOSHER, LLP
1615 L Street, NW, Suite 850
Washington, DC 20036

James E. Ledbetter
SIGNATURE

James E. Ledbetter
NAME

28,732
REGISTRATION NUMBER

August 30, 2006
DATE

PCTUS1/REV07

PATENT APPLICATION SERIAL NO. 10/591,184

U.S. DEPARTMENT OF COMMERCE
PATENT AND TRADEMARK OFFICE
FEE RECORD SHEET

09/06/2006 ATRAN1 00000093 10591184

01 FC:1631	300.00 OP
02 FC:1633	200.00 OP
03 FC:1642	400.00 OP
04 FC:1615	550.00 OP
05 FC:1614	2000.00 OP

05 FC:1614 -2000.00 OP

03/12/2007 VWALLACE 00000008 10591184

01 FC:1614 1800.00 OP

Refln. Ref: 03/12/2007 VWALLACE 0008503900
DA#:194375 Name/Number:10591184
FC: 9204
$200.00 CR

PTO-1556
(5/87)

*U.S. Government Printing Office: 2002 — 489-267/69033

BEST AVAILABLE COPY

PATENT APPLICATION FEE DETERMINATION RECORD
Effective December 8, 2004

Application or Docket Number
10/591,184

CLAIMS AS FILED - PART I

SMALL ENTITY TYPE ☐ OR OTHER THAN SMALL ENTITY

U.S. NATIONAL STAGE FEES	(Column 1)	(Column 2)	SMALL ENTITY RATE	SMALL ENTITY FEE		OTHER THAN SMALL ENTITY RATE	OTHER THAN SMALL ENTITY FEE
BASIC FEE	SMALL ENT. = $ 150	LARGE ENT. = $ 300	BASIC FEE		OR	BASIC FEE	300
EXAMINATION FEE	Satisfies PCT Article 33(1)-(4) = $ 50 / $ 100	All other situations = $ 100 / $ 200	EXAM. FEE			EXAM. FEE	200
SEARCH FEE	U.S. is ISA = $ 50 / $ 100 ALL other countries = $ 200 / $ 400	All other situations = $ 250 / $ 500	SEARCH FEE			SEARCH FEE	400
FEE FOR EXTRA SPEC. PGS.	minus 100 =	/ 50 =	X $ 125 =			X $ 250 =	
TOTAL CHARGEABLE CLAIMS	31 minus 20 =	* 11	X $ 25 =		OR	X $ 50 =	550
INDEPENDENT CLAIMS	12 minus 3 =	* 9	X $ 100 =		OR	X $ 200 =	1,800.00
MULTIPLE DEPENDENT CLAIM PRESENT ☐			+ $ 180 =		OR	+ $ 360 =	
			TOTAL		OR	TOTAL	

* If the difference in column 1 is less than zero, enter "0" in column 2

CLAIMS AS AMENDED - PART II

AMENDMENT A		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE	ADDITIONAL FEE	OR	OTHER THAN SMALL ENTITY RATE	ADDITIONAL FEE
	Total	*	Minus	**	=	X $ 25 =		OR	X $ 50 =	
	Independent	*	Minus	***	=	X $ 100 =		OR	X $ 200 =	
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM ☐					+ $ 180 =		OR	+ $ 360 =	
						TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

AMENDMENT B		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE	ADDITIONAL FEE	OR	RATE	ADDITIONAL FEE
	Total	*	Minus	**	=	X $ 25 =		OR	X $ 50 =	
	Independent	*	Minus	***	=	X $ 100 =		OR	X $ 200 =	
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM ☐					+ $ 180 =		OR	+ $ 360 =	
						TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than '20', enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than '3', enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

FORM PTO-875 (Rev. 02/2005) Patent and Trademark Office - U.S. DEPARTMENT OF COMMERCE

MULTIPLE DEPENDENT CLAIM FEE CALCULATION SHEET

(FOR USE WITH FORM PTO-875)

SERIAL NO. 10/591184

FILING DATE

APPLICANT(S)

CLAIMS

	AS FILED		AFTER 1st AMENDMENT		AFTER 2nd AMENDMENT	
	IND.	DEP.	IND.	DEP.	IND.	DEP.
1	1					
2		1				
3		1				
4		1				
5		1				
6		1				
7		1				
8		1				
9	1					
10		1				
11		1				
12		1				
13	1					
14		1				
15	1					
16	1					
17	1					
18		1				
19		1				
20		1				
21		1				
22		1				
23	1					
24	1					
25	1					
26		1				
27		1				
28	1					
29	1					
30		1				
31	1					
32						
33						
34						
35						
36						
37						
38						
39						
40						
41						
42						
43						
44						
45						
46						
47						
48						
49						
50						
TOTAL IND.	12					
TOTAL DEP.	19					
TOTAL CLAIMS	31					

	AS FILED		AFTER 1st AMENDMENT		AFTER 2nd AMENDMENT	
	IND.	DEP.	IND.	DEP.	IND.	DEP.
51						
52						
53						
54						
55						
56						
57						
58						
59						
60						
61						
62						
63						
64						
65						
66						
67						
68						
69						
70						
71						
72						
73						
74						
75						
76						
77						
78						
79						
80						
81						
82						
83						
84						
85						
86						
87						
88						
89						
90						
91						
92						
93						
94						
95						
96						
97						
98						
99						
100						
TOTAL IND.						
TOTAL DEP.						
TOTAL CLAIMS						

PTO-1360 (REV. 11/04)

U.S. DEPARTMENT of COMMERCE
Patent and Trademark Office

U.S NAT ?L STAGE WORKSHEET (EO)

U.S. APPL. NO. 10/591184 INTERNATIONAL APPL. JP05/003390

APPLICATION FILED BY: 20 MOS.. ____ OR 30 MOS. /____ SCREENED BY

INTERNATIONAL APPLICATION PAPERS IN THE APPLICATION FILE:

X International application
Article 19 amendments
X Priority Document(s) No. 2
__ Request Form PCT/RO/101
PCT/IB/302
X PCT/IB/304
PCT/IB/306
X PCT/IB/308
__ PCT/IB/331
__ OTHER PCT/IB/__________
__ PCT/IPEA/409 also 416

X 409 annexes to IPER
X PCT/ISA/210 (Search report)
____ Search report References
____ Other Papers filed

WIPO PUBLICATION
PUBLICATION NO. WO 05/083942
PUBLICATION DATE 09 Sep 05
PUBLICATION LANG. JAPANESE
NOT PUBLISHED
______U.S. only ______Requested

RECEIVED FROM THE APPLICANT: (other than checked above)

X National application basic fee paid
X Express Processing Requested
X Translation of the International Application
Used the IB copy of the IA
X Description
X Claims
X Drawings/10
Foreign Language in drawing
Article 19 Amendments
Amendment used in application
Article 34 Amendment
Amendment used in application
DNA
1194 transaction done

____ Preliminary Amendment(s) filed__________
____ second submission__________
X Information Disclosure Statement 30 AUG 2006
____ second submission__________
____ Assignment __________
____ Forward to Assignment Branch
____ Substitute Specification__________
____ Small Entity Statement __________
type__________
____ Oath/Declaration (date submitted__________)
____ Not executed
____ Executed
____ Power of Attorney
____ Change of Address

USC Receipt of Request (PTO – 1399 Transmittal Letter) 30 AUG 2006 data sheet
te Acceptable oath/declaration received
?(e) Date
te complete 35 USC 371 requirements met

DATE NOTICE COMPLETED

EO 903	Notice of Acceptance	
EO 905	Notice of Missing Requirements	
EO 917	Notice of A defective oath or declaration	
EO 916	Notice of defective response	

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

U.S. APPLICATION NUMBER NO.	FIRST NAMED APPLICANT	ATTY. DOCKET NO.
10/591,184	Hong Cheng	L8638.06115

INTERNATIONAL APPLICATION NO.	
PCT/JP05/03390	
I.A. FILING DATE	PRIORITY DATE
03/01/2005	03/02/2004

52989
STEVENS, DAVIS, MILLER & MOSHER, LLP
1615 L. STREET N.W.
SUITE 850
WASHINGTON, DC 20036

CONFIRMATION NO. 7759

371 FORMALITIES LETTER

OC000000022852564

Date Mailed: 03/12/2007

NOTIFICATION OF MISSING REQUIREMENTS UNDER 35 U.S.C. 371 IN THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US)

The following items have been submitted by the applicant or the IB to the United States Patent and Trademark Office as a Designated / Elected Office (37 CFR 1.495).

- Copy of the International Application filed on 08/30/2006
- English Translation of the IA filed on 08/30/2006
- Copy of the International Search Report filed on 08/30/2006
- Information Disclosure Statements filed on 08/30/2006
- Request for Immediate Examination filed on 08/30/2006
- U.S. Basic National Fees filed on 08/30/2006
- Priority Documents filed on 08/30/2006
- Specification filed on 08/30/2006
- Claims filed on 08/30/2006
- Abstracts filed on 08/30/2006
- Drawings filed on 08/30/2006

The applicant needs to satisfy supplemental fees problems indicated below.

The following items **MUST** be furnished within the period set forth below in order to complete the requirements for acceptance under 35 U.S.C. 371:

- Oath or declaration of the inventors, in compliance with 37 CFR 1.497(a) and (b), identifying the application by the International application number and international filing date.

- To avoid abandonment, a surcharge (for late submission of filing fee, search fee, examination fee or oath or declaration) as set forth in 37 CFR 1.492(h) of $130 for a non-small entity, must be submitted with the missing items identified in this letter.

SUMMARY OF FEES DUE:

Total additional fees required for this application is **$130** for a Large Entity:

- **$130** Surcharge.

ALL OF THE ITEMS SET FORTH ABOVE MUST BE SUBMITTED WITHIN TWO (2) MONTHS FROM THE DATE OF THIS NOTICE OR BY 32 MONTHS FROM THE PRIORITY DATE FOR THE APPLICATION, WHICHEVER IS LATER. FAILURE TO PROPERLY RESPOND WILL RESULT IN ABANDONMENT.

The time period set above may be extended by filing a petition and fee for extension of time under the provisions of 37 CFR 1.136(a).

Applicant is reminded that any communications to the United States Patent and Trademark Office must be mailed to the address given in the heading and include the U.S. application no. shown above (37 CFR 1.5)

Registered users of EFS-Web may alternatively submit their reply to this notice via EFS-Web.
https://sportal.uspto.gov/authenticate/AuthenticateUserLocalEPF.html

For more information about EFS-Web please call the USPTO Electronic Business Center at **1-866-217-9197** or visit our website at http://www.uspto.gov/ebc.

If you are not using EFS-Web to submit your reply, you must include a copy of this notice.

VONDA M WALLACE

Telephone: (703) 308-9140 EXT 225

PART 2 - OFFICE COPY

U.S. APPLICATION NUMBER NO.	INTERNATIONAL APPLICATION NO.	ATTY. DOCKET NO.
10/591,184	PCT/JP05/03390	L8638.06115

FORM PCT/DO/EO/905 (371 Formalities Notice)

IAP6 Rec'd PCT/PTO 14 MAY 2007

FORM PTO-1390 (Modified) U.S. PATENT AND TRADEMARK OFFICE; U.S. DEPARTMENT OF COMMERCE (REV. 9-2006) **TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A SUBMISSION UNDER 35 U.S.C. 371**		ATTORNEY'S DOCKET NUMBER L8638.06115 U.S. APPLICATION NO. (If known, see 37 CFR 1.5) 10/591,184
INTERNATIONAL APPLICATION NO. PCT/JP2005/003390	INTERNATIONAL FILING DATE March 1, 2005	PRIORITY DATE CLAIMED March 2, 2004 & July 16, 2004

TITLE OF INVENTION
SYSTEM AND METHOD FOR NEGOTIATION OF WLAN ENTITY

APPLICANT(S) FOR DO/EO/US
Hong CHENG
Pek Yew TAN and Saravanan GOVINDAN

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☐ This is a **FIRST** submission of items concerning a submission under 35 U.S.C. 371.
2. ☒ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a submission under 35 U.S.C. 371.
3. ☐ This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include items (5), (6), (9) and (25) indicated below.
4. ☐ The US has been elected (Article 31).
5. ☐ A copy of the International Application as filed (35 U.S.C. 371 (c)(2))
   a. ☐ is attached hereto (required only if not communicated by the International Bureau).
   b. ☐ has been communicated by the International Bureau.
   c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☐ An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)).
   a. ☐ is attached hereto.
   b. ☐ has been previously submitted under 35 U.S.C. 154(d)(4).
7. ☐ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371 (c)(3))
   a. ☐ are attached hereto (required only if not communicated by the International Bureau).
   b. ☐ have been communicated by the International Bureau.
   c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
   d. ☐ have not been made and will not be made.
8. ☐ An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371 (c)(4)).
10. ☐ An English language translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371 (c)(5)).
11. ☐ A copy of the International Preliminary Examination Report (PCT/IPEA/409).
12. ☐ A copy of the International Search Report (PCT/ISA/210).

Items 13 to 23 below concern document(s) or information included:

13. ☐ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
14. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
15. ☐ A **FIRST** preliminary amendment.
16. ☐ A **SECOND** or **SUBSEQUENT** preliminary amendment.
17. ☐ An Application Data Sheet under 37 CFR 1.76.
18. ☐ A substitute specification.
19. ☐ A power of attorney and/or change of address letter.
20. ☐ A computer-readable form of the sequence listing in accordance with PCT Rule 13*ter*.2 and 37 CFR 1.821 - 1.825.
21. ☐ A second copy of the published International Application under 35 U.S.C. 154(d)(4).
22. ☐ A second copy of the English language translation of the International Application under 35 U.S.C. 154(d)(4).
23. ☐ Express Mail Label No.

 PCTUS1/REV08

U.S. APPLICATION NO (if known, see 37 CFR 1.5)	INTERNATIONAL APPLICATION NO.	ATTORNEY'S DOCKET NUMBER
10/591,184	**PCT/JP2005/003390**	**L8638.06115**

24. Other items or information:

COVER LETTER
Submission Pursuant to MPEP 1893.01(e) & 37 CFR1.497(d) to Correct Inventorship with fee $130.00
Statement of Inventor

The following fees have been submitted:	CALCULATIONS	PTO USE
25. ☐ Basic national fee (37 CFR 1.492(a)) **$300**	$ **$0.00**	
26. ☐ Examination fee (37 CFR 1.492(c)) If the written opinion prepared by ISA/US or the international preliminary examination report prepared by IPEA/US indicates all claims satisfy provisions of PCT Article . . . **$0** All other situations **$200**	$ **$0.00**	
27. ☐ Search fee (37 CFR 1.492(b)) If the written opinion of the ISA/US or the International preliminary examination report prepared by IPEA/US indicates all claims satisfy provisions of PCT Article 33(1)-(4) . . . **$0** Search fee (37 CFR 1.445(a)(2)) has been paid on the international application to the USPTO as an International Searching Authority . . . . . **$100** International Search Report prepared by an ISA other than the US and provided to the Office or previously communicated to the US by the IB . . . . . **$400** All other situations **$500**	$ **$0.00**	
TOTAL OF 25, 26 and 27 =	$ **$0.00**	
☐ Additional fee for specification and drawings filed in paper over 100 sheets (excluding sequence listing in compliance with 37 CFR 1.821(c) or (e) in an electronic medium or computer program listing in an electronic medium) (37 CFR 1.492(j)). The fee is **$250** for each additional 50 sheets of paper or fraction thereof.		

Total Sheets	Extra Sheets	Number of each additional 50 or fraction thereof (round **up** to a whole	RATE	CALCULATIONS	PTO USE
- 100 =	0 /50 =	0	x $250.00	$ **$0.00**	

Surcharge of **$130.00** for furnishing any of the search fee, examination fee, or the oath or declaration after the date of commencement of the national stage (37 CFR 1.492(h)).	$	

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE	CALCULATIONS	PTO USE
Total claims	- 20 =	0	x $50.00	$ **$0.00**	
Independent claims	- 3 =	0	x $200.00	$ **$0.00**	
MULTIPLE DEPENDENT CLAIMS (if applicable)		☐	+ $360.00	$ **$0.00**	
TOTAL OF ABOVE CALCULATIONS =				$ **$0.00**	
☐ Applicant claims small entity status. See 37 CFR 1.27. Fees above are reduced by 1/2.				$ **$0.00**	
SUBTOTAL =				$ **$0.00**	
Processing fee of **$130.00** for furnishing the English translation later than 30 months from the earliest claimed priority date (37 CFR 1.492(i)).				$ **$130.00**	
TOTAL NATIONAL FEE =				$ **$130.00**	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). **$40** per property +				$ **$0.00**	
TOTAL FEES ENCLOSED = 05/16/2007 GFREY1				$ **$130.00** 00000011 10591184	
01 FC:1617 02 FC:1618				Amount to be	130.00 OP $130.00 OP
				Amount to be	$

a. ☒ A check in the amount of $ $260.00 to cover the above fees is enclosed.

b. ☐ Please charge my Deposit Account No. ______ in the amount of $ ______ to cover the above fees. A duplicate copy of this sheet is enclosed.

c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 19-4375. A duplicate copy of this sheet is enclosed.

d. ☐ Fees are to be charged to a credit card. **WARNING:** Information on this form may become public. **Credit card information should not be included on this form.** Provide credit card information and authorization on PTO-2038. The PTO-2038 should only be mailed or faxed to the USPTO. However, when paying the basic national fee, the PTO-2038 may NOT be faxed to the USPTO.

ADVISORY: If filing by EFS-Web, do **NOT** attach the PTO-2038 form as a PDF along with your EFS-Web submission. Please
be advised that this is **not** recommended and by doing so your **credit card information may be displayed via PAIR**. To

NOTE: Where an appropriate time limit under 37 CFR 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the International Application to pending status.

SEND ALL CORRESPONDENCE TO:

James E. Ledbetter
STEVENS, DAVIS, MILLER & MOSHER, LLP
1615 L. Street, NW, Suite 850
Washington, DC 20036

SIGNATURE

James E. Ledbetter
NAME

28,732
REGISTRATION NUMBER

May 14, 2007
DATE

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

U.S. APPLICATION NUMBER NO.	FIRST NAMED APPLICANT	ATTY. DOCKET NO.
10/591,184	Hong Cheng	L8638.06115

INTERNATIONAL APPLICATION NO.	
PCT/JP05/03390	
I.A. FILING DATE	PRIORITY DATE
03/01/2005	03/02/2004

52989
STEVENS, DAVIS, MILLER & MOSHER, LLP
1615 L. STREET N.W.
SUITE 850
WASHINGTON, DC 20036

RESPONSE DUE 5-12-07
DOCKETED DATE 3-13-07
BY 9B

CONFIRMATION NO. 7759
371 FORMALITIES LETTER
OC000000022852564

Date Mailed: 03/12/2007

NOTIFICATION OF MISSING REQUIREMENTS UNDER 35 U.S.C. 371 IN THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US)

The following items have been submitted by the applicant or the IB to the United States Patent and Trademark Office as a Designated / Elected Office (37 CFR 1.495).

- Copy of the International Application filed on 08/30/2006
- English Translation of the IA filed on 08/30/2006
- Copy of the International Search Report filed on 08/30/2006
- Information Disclosure Statements filed on 08/30/2006
- Request for Immediate Examination filed on 08/30/2006
- U.S. Basic National Fees filed on 08/30/2006
- Priority Documents filed on 08/30/2006
- Specification filed on 08/30/2006
- Claims filed on 08/30/2006
- Abstracts filed on 08/30/2006
- Drawings filed on 08/30/2006

The applicant needs to satisfy supplemental fees problems indicated below.

The following items **MUST** be furnished within the period set forth below in order to complete the requirements for acceptance under 35 U.S.C. 371:

- Oath or declaration of the inventors, in compliance with 37 CFR 1.497(a) and (b), identifying the application by the International application number and international filing date.

- To avoid abandonment, a surcharge (for late submission of filing fee, search fee, examination fee or oath or declaration) as set forth in 37 CFR 1.492(h) of $130 for a non-small entity, must be submitted with the missing items identified in this letter.

SUMMARY OF FEES DUE:

Total additional fees required for this application is **$130** for a Large Entity:

- **$130** Surcharge.

ALL OF THE ITEMS SET FORTH ABOVE MUST BE SUBMITTED WITHIN TWO (2) MONTHS FROM THE DATE OF THIS NOTICE OR BY 32 MONTHS FROM THE PRIORITY DATE FOR THE APPLICATION, WHICHEVER IS LATER. FAILURE TO PROPERLY RESPOND WILL RESULT IN ABANDONMENT.

The time period set above may be extended by filing a petition and fee for extension of time under the provisions of 37 CFR 1.136(a).

Applicant is reminded that any communications to the United States Patent and Trademark Office must be mailed to the address given in the heading and include the U.S. application no. shown above (37 CFR 1.5)

Registered users of EFS-Web may alternatively submit their reply to this notice via EFS-Web.
https://sportal.uspto.gov/authenticate/AuthenticateUserLocalEPF.html

For more information about EFS-Web please call the USPTO Electronic Business Center at **1-866-217-9197** or visit our website at http://www.uspto.gov/ebc.

If you are not using EFS-Web to submit your reply, you must include a copy of this notice.

VONDA M WALLACE

Telephone: (703) 308-9140 EXT 225

PART 1 - ATTORNEY/APPLICANT COPY

U.S. APPLICATION NUMBER NO.	INTERNATIONAL APPLICATION NO.	ATTY. DOCKET NO.
10/591,184	PCT/JP05/03390	L8638.06115

FORM PCT/DO/EO/905 (371 Formalities Notice)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of

Inventors: Hong CHENG, et al.

Appln. No.: 10/591,184

Filed: August 30, 2006

For: SYSTEM AND METHOD FOR NEGOTIATION OF WLAN ENTITY

SUBMISSION PURSUANT TO MPEP 1893.01(e) AND 37 CFR 1.497(d) TO CORRECT INVENTORSHIP

Assistant Commissioner of Patents
Washington, DC 20231

Sir:

Pursuant to MPEP 1893.01(e) and 37 CFR 1.497(d), inventorship is hereby corrected.

Attached are:

(1) A statement from the person being added as an inventor in this application that any error in inventorship in the international application occurred without deceptive intention on his part;

(2) The processing fee set forth in § 1.17(i); and

(3) A Declaration for Patent Application.

Early and favorable consideration of this application is respectfully requested.

Respectfully submitted,

Date: May 14, 2007

James E. Ledbetter
Registration No. 28,732

JEL/att
ATTORNEY DOCKET NO. L8638.06115
STEVENS, DAVIS, MILLER & MOSHER, L.L.P.
1615 L Street, NW, Suite 850
P.O. Box 34387
Washington, DC 20043-4387
Telephone: (202) 785-0100
Facsimile: (202) 408-5200

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of

Inventors: Hong CHENG, et al.

Appln. No.: 10/591,184

Filed: August 30, 2006

For: SYSTEM AND METHOD FOR NEGOTIATION OF WLAN ENTITY

STATEMENT OF INVENTOR

Assistant Commissioner of Patents
Washington, D.C. 20231

Dear Sir:

Although I was erroneously omitted from the inventive entity set forth in International Application PCT/JP2005/003390, of which the present application is the U.S. national phase, I am in fact an inventor in said international application and the present U.S. application. The error in inventorship in the international application occurred without deceptive intention on my part.

Respectfully submitted,

Saravanan GOVINDAN

Date: 3 May. , 2007

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of

Inventors: Hong CHENG, et al.

Appln. No.: 10/591,184

Filed: August 30, 2006

For: SYSTEM AND METHOD FOR NEGOTIATION OF WLAN ENTITY

COVER LETTER

Assistant Commissioner of Patents
Washington, DC 20231

Sir:

Pursuant to MPEP 602, this cover letter accompanies the attached Declaration for Patent Application in the above-captioned application. The attached Declaration identifies the title which was on the specification as filed. This cover letter accurately identifies the application for which the attached Declaration was intended as application number 10/591,184. A Submission in response to the Notification of Missing Requirements dated March 12, 2007 is attached.

Early and favorable consideration of this application is respectfully requested.

Respectfully submitted,

Date: May 14, 2007

James E. Ledbetter
Registration No. 28,732

JEL/att
ATTORNEY DOCKET NO. L8638.06115

STEVENS, DAVIS, MILLER & MOSHER, L.L.P.
1615 L Street, NW, Suite 850
P.O. Box 34387
Washington, DC 20043-4387
Telephone: (202) 785-0100
Facsimile: (202) 408-5200

Matsushita Ref*: P037562-02
(* must be filled)
Japan Firm Name: NIHEI AND ASSOCIATES
US Firm Name: SDM

Application Serial No. ____________
Japan Firm Ref: U62-0486PCT
US Firm Ref: L8638.06115

DECLARATION AND POWER OF ATTORNEY FOR U.S. PATENT APPLICATION

(a) ☒ Original (b) ☐ Supplemental (c) ☐ Substitute (d) ☐ PCT (e) ☐ Design

As a below named inventor, I hereby declare that: my residence, post office address and citizenship are as stated below next to my name; and I believe that I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural inventors are named below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

Title of Invention:
SYSTEM AND METHOD FOR NEGOTIATION OF WLAN ENTITY

which is described and claimed in *(if the following box is not checked, the specification of which is attached hereto)*:

1. For use when submitting this Declaration prior to U.S. application filing date				
(f) ☐ the attached specification, or				
2. For use when submitting this Declaration after U.S. application filing date				
(g) ☐ the specification in the U.S. Application:	Application No. *(if available)*		filed on *(must be filled)*	
	and with amendments (if applicable):		filed on	,or
3. For PCT-US national entry under 35 U.S.C. 371 (for use when filing this Declaration before and after the U.S. national entry date)				
(h) ☒ the specification in the International Application:	PCT Application No.	PCT/JP2005/003390	filed on *(international filing date)*	March 1, 2005
(Check here only for US national entry under 35 U.S.C. 371.)	and with amendments (if applicable):		filed on:	

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment(s) referred to above.

I acknowledge my duty to disclose to the U.S. Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, §1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, §119 (a-d), §172, or §365(b) of any foreign application(s) for patent or inventor's certificate, or §365(a) of any PCT international application which designated at least one country other than the United States of America, listed below, and have also identified below any foreign application for patent or inventor's certificate, or of any PCT international application having a filing date before that of the application on which priority is claimed:

(Foreign Priority Information)

COUNTRY	APPLICATION NO.	DATE OF FILING	PRIORITY CLAIMED
Japan	**2004-058245**	**March 2, 2004**	**Yes**
Japan	**2004-209470**	**July 16, 2004**	**Yes**

☐ Additional foreign or international application numbers are listed on a supplemental priority sheet attached hereto.

I hereby claim the benefit under Title 35, United States Code §119(e) of any United States Provisional application(s) listed below.

(US Provisional Application Information)

APPLICATION NO.	U.S. PROVISIONAL APPLICATION FILING DATE

□ Additional U.S. provisional application numbers are listed on a supplemental priority sheet attached hereto.

I hereby claim the benefit under Title 35, United States Code §120 of any United States application(s), or §365(C) of any PCT international application designating the United States of America, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT international application in the manner provided by the first paragraph of Title 35, United States Code §112, I acknowledge the duty to disclose information material to patentability as defined in Title 37, Code of Federal Regulations, §1.56 which occurred between the filing date of the prior application and the national or PCT international filing date of this application.

(Domestic Priority Information)

APPLICATION NO.	U.S. FILING DATE	STATUS: PATENTED, PENDING, ABANDONED

□ Additional U.S. or international application numbers are listed on a supplemental priority sheet attached hereto.

POWER OF ATTORNEY: As a named inventor, I hereby appoint the attorneys and agents associated with U.S. Patent and Trademark Office Customer Number identified bellow to prosecute this application and to transact all business in the U.S. Patent and Trademark Office connected therewith, and direct that all correspondence be addressed to that customer number.

I hereby authorize the U.S. attorneys and agents associated with the customer number to accept and follow instructions from Matsushita Electric Industrial Co., Ltd., and any affiliated or subsidiary company thereof, received via their corporate representatives and/or their foreign patent attorneys or agents, if any, as to any action to be taken in the U.S. Patent and Trademark Office regarding this application without direct communication between the U.S. attorneys or agents and myself.

Direct Correspondence to:
CUSTOMER NUMBER 52989

I further declare that all statements made herein of my own knowledge are true, and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

INVENTOR (s)

Full Name of Sole or First Inventor	**FIRST NAME** Hong	**LAST NAME** CHENG	**SIGNATURE** Cheng Hong	**DATE OF SIGNATURE** 03/05/2007
Residence & Citizenship	**CITY, STATE or COUNTRY** Singapore, SINGAPORE			**CITIZENSHIP** CHINA
Post office address	**ADDRESS** c/o Panasonic Singapore Laboratories Pte. Ltd. BLK 1022, Tai Seng Avenue, #06-3530 Tai Seng Industrial Estate Singapore 534415, THE REPUBLIC OF SINGAPORE	**CITY**	**STATE OR COUNTRY**	**ZIP CODE**

Full Name of Second Inventor	**FIRST NAME** Pek Yew	**LAST NAME** TAN	**SIGNATURE** [illegible]	**DATE OF SIGNATURE** 3/5/07
Residence & Citizenship	**CITY, STATE or COUNTRY** Singapore, SINGAPORE			**CITIZENSHIP** MALAYSIA
Post office address	**ADDRESS** c/o Panasonic Singapore Laboratories Pte. Ltd. BLK 1022, Tai Seng Avenue, #06-3530 Tai Seng Industrial Estate Singapore 534415, THE REPUBLIC OF SINGAPORE	**CITY**	**STATE OR COUNTRY**	**ZIP CODE**

INVENTOR (s)

Full Name of Third Inventor	FIRST NAME Saravanan	LAST NAME GOVINDAN	SIGNATURE [signature]	DATE OF SIGNATURE 3 May, 2007
Residence & Citizenship	CITY, STATE or COUNTRY Singapore, SINGAPORE			CITIZENSHIP INDIA
Post office address	ADDRESS c/o Panasonic Singapore Laboratories Pte. Ltd. BLK 1022, Tai Seng Avenue, #06-3530 Tai Seng Industrial Estate Singapore 534415, THE REPUBLIC OF SINGAPORE	CITY	STATE OR COUNTRY	ZIP CODE

Full Name of Fourth Inventor	FIRST NAME	LAST NAME	SIGNATURE	DATE OF SIGNATURE
Residence & Citizenship	CITY, STATE or COUNTRY			CITIZENSHIP
Post office address	ADDRESS	CITY	STATE OR COUNTRY	ZIP CODE

Full Name of Fifth Inventor	FIRST NAME	LAST NAME	SIGNATURE	DATE OF SIGNATURE
Residence & Citizenship	CITY, STATE or COUNTRY			CITIZENSHIP
Post office address	ADDRESS	CITY	STATE OR COUNTRY	ZIP CODE

Full Name of Sixth Inventor	FIRST NAME	LAST NAME	SIGNATURE	DATE OF SIGNATURE
Residence & Citizenship	CITY, STATE or COUNTRY			CITIZENSHIP
Post office address	ADDRESS	CITY	STATE OR COUNTRY	ZIP CODE

Full Name of Seventh Inventor	FIRST NAME	LAST NAME	SIGNATURE	DATE OF SIGNATURE
Residence & Citizenship	CITY, STATE or COUNTRY			CITIZENSHIP
Post office address	ADDRESS	CITY	STATE OR COUNTRY	ZIP CODE

Full Name of Eighth Inventor	FIRST NAME	LAST NAME	SIGNATURE	DATE OF SIGNATURE
Residence & Citizenship	CITY, STATE or COUNTRY			CITIZENSHIP
Post office address	ADDRESS	CITY	STATE OR COUNTRY	ZIP CODE

□ Check if additional paper(s) is/are attached. Total of ______pages are submitted.

Document code: WFEE

United States Patent and Trademark Office
Sales Receipt for Accounting Date: 07/31/2007

VWALLACE ADJ #00000006 Mailroom Dt: 05/14/2007
Seq No: 11 Sales Acctg Dt: 05/16/2007 10591184
02 FC : 1618 -130.00 OP

U.S NAT 'L STAGE WORKSHEET /EO)

U.S. APPL. NO. 10/591184 INTERNATIONAL APPL. JP05/003390

APPLICATION FILED BY: 20 MOS.,____ OR 30 MOS./____ SCREENED BY

INTERNATIONAL APPLICATION PAPERS IN THE APPLICATION FILE:

- X International application
- Article 19 amendments
- X Priority Document(s) No 2
- __ Request Form PCT/RO/101
- PCT/IB/302
- X PCT/IB/304
- PCT/IB/306
- X PCT/IB/308
- __ PCT/IB/331
- __ OTHER PCT/IB/________
- __ PCT/IPEA/409 also 416

- 409 annexes to IPER
- X PCT/ISA/210 (Search report)
- ____ Search report References
- ____ Other Papers filed

WIPO PUBLICATION

PUBLICATION NO. WO05/083942

PUBLICATION DATE 09-SEP-05

PUBLICATION LANG. JAPANESE

NOT PUBLISHED

_______U.S. only _______Requested

RECEIVED FROM THE APPLICANT: (other than checked above)

- X National application basic fee paid
- X Express Processing Requested
- X Translation of the International Application
- Used the IB copy of the IA
- X Description
- X Claims
- X Drawings/10
- Foreign Language in drawing
- Article 19 Amendments
- Amendment used in application
- Article 34 Amendment
- Amendment used in application
- DNA
- 1194 transaction done

- ____ Preliminary Amendment(s) filed__________
- ____ second submission__________
- X Information Disclosure Statement 30 AUG 2006
- X second submission 5-14-07
- ____ Assignment
- ____ Forward to Assignment Branch
- ____ Substitute Specification__________
- ____ Small Entity Statement __________
- type__________
- X Oath/Declaration (date submitted) 14 MAY 2007
- __ Not executed
- X Executed
- ____ Power of Attorney
- ____ Change of Address

data sheet

USC Receipt of Request (PTO — 1399 Transmittal Letter)	30 AUG 2006
te Acceptable oath/declaration received	14 MAY 2007
(e) Date	14 MAY 2007
te complete 35 USC 371 requirements met	14 MAY 2007

DATE NOTICE COMPLETED

/EO 903	Notice of Acceptance	
/EO 905	Notice of Missing Requirements	
/EO 917	Notice of A defective oath or declaration	
/EO 916	Notice of defective response	

IFW

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of

Inventors: Hong CHENG, et al.

Appln. No.: 10/591,184

Filed: August 30, 2006

For: SYSTEM AND METHOD FOR NEGOTIATION OF WLAN ENTITY

INFORMATION DISCLOSURE STATEMENT

Assistant Commissioner of Patents
Washington, DC 20231

Dear Sir:

Pursuant to Rules 56 and 99, Applicants hereby call the attention of the Patent Office to the art listed on the attached Form PTO 1449. US '464, US '579, US '881, the B. O'Hara, et al. document and the ANSI/IEEE document are discussed in the present application and cited on page 7, lines 4-16.

Applicants present this art so that the Patent Office may, in the first instance, determine any relevancy thereof to the presently claimed invention, see Beckman Instruments, Inc. v. Chemtronics, Inc., 439 F.2d 1369, 1380, 165 USPQ 355, 364 (5th Cir. 1970). Also see Patent Office Rules 104 and 106. Applicants respectfully request that this art be expressly considered during the prosecution of this application and made of record herein and appear among the "References Cited" on any patent to issue herefrom.

Respectfully submitted,

Date: July 10, 2007

James E. Ledbetter
Registration No. 28,732

JEL/ejw

ATTORNEY DOCKET NO. L8638.06115
STEVENS, DAVIS, MILLER & MOSHER, L.L.P.
1615 L STREET, NW, Suite 850
WASHINGTON, DC 20043-4387
Telephone: (202) 785-0100
Facsimile: (202) 408-5200

FORM PTO-1449 U.S. Department of Commerce
(Rev. 4/92) Patent and Trademark Office

INFORMATION DISCLOSURE STATEMENT BY APPLICANT
(Use several sheets if necessary)

OIPE IAP97 JUL 10 2007 PATENT & TRADEMARK OFFICE

ATTY. DOCKET NO.	SERIAL NO.
L8638.06115	10/591,184
APPLICANT	Hong CHENG, et al.
FILING DATE August 30, 2006	GROUP Unassigned

U.S. PATENT DOCUMENTS

EXAMINER INITIAL			DOCUMENT NUMBER							DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
	2003		0	0	3	5	4	6	4	02/2003	Dehner et al.			
	2003		0	1	6	3	5	7	9	08/2003	Knauerhase et al.			
			6	5	2	2	8	8	1	02/2003	Feder et al.			

FOREIGN PATENT DOCUMENTS

		DOCUMENT NUMBER							DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc.)

B. O'Hara, et al., "CAPWAP Problem Statement," draft-ietf-capwap-problem-statement-02, CAPWAP Working Group, Internet-Draft, pages 1-9, Aug. 20, 2004.

"Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications," Information Technology, Telecommunications and Information Exchange between Systems, Local and Metropolitan Area Networks, Specific Requirements, ANSI/IEEE Std 802.11, 1999 Edition (R2003), LAN MAN Standards Committee of the IEEE Company Society, 528 pages total, June 12, 2003.

EXAMINER	DATE CONSIDERED

EXAMINER: Initial if citation is considered, draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

(Form PTO-1449 [6-4])

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
10/591,184	05/14/2007	2616	3380	L8638.06115	31	12

CONFIRMATION NO. 7759

FILING RECEIPT

52989
STEVENS, DAVIS, MILLER & MOSHER, LLP
1615 L. STREET N.W.
SUITE 850
WASHINGTON, DC20036

Date Mailed: 08/01/2007

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please write to the Office of Initial Patent Examination's Filing Receipt Corrections. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Applicant(s)

Hong Cheng, Singapore, SINGAPORE;
Pek Yew Tan, Singapore, SINGAPORE;
Saravanan Govindan, Singapore, SINGAPORE;

Power of Attorney: The patent practitioners associated with Customer Number 52989

Domestic Priority data as claimed by applicant

This application is a 371 of PCT/JP05/03390 03/01/2005

Foreign Applications

JAPAN 2004-058245 03/02/2004
JAPAN 2004-209470 07/16/2004

If Required, Foreign Filing License Granted: 07/31/2007

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US10/591,184**

Projected Publication Date: 11/08/2007

Non-Publication Request: No

Early Publication Request: No

Title

System and Method for Negotiation of Wlan Entity

Preliminary Class

370

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at http://www.uspto.gov/web/offices/pac/doc/general/index.html.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, http://www.stopfakes.gov. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4158).

LICENSE FOR FOREIGN FILING UNDER

Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

GRANTED

The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign AssetsControl, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

U.S. APPLICATION NUMBER NO.	FIRST NAMED APPLICANT	ATTY. DOCKET NO.
10/591,184	Hong Cheng	L8638.06115

INTERNATIONAL APPLICATION NO.	
PCT/JP05/03390	
I.A. FILING DATE	PRIORITY DATE
03/01/2005	03/02/2004

52989
STEVENS, DAVIS, MILLER & MOSHER, LLP
1615 L. STREET N.W.
SUITE 850
WASHINGTON, DC 20036

CONFIRMATION NO. 7759

371 ACCEPTANCE LETTER

OC000000025119677

Date Mailed: 08/01/2007

NOTICE OF ACCEPTANCE OF APPLICATION UNDER 35 U.S.C 371 AND 37 CFR 1.495

The applicant is hereby advised that the United States Patent and Trademark Office in its capacity as a Designated / Elected Office (37 CFR 1.495), has determined that the above identified international application has met the requirements of 35 U.S.C. 371, and is ACCEPTED for national patentability examination in the United States Patent and Trademark Office.

The United States Application Number assigned to the application is shown above and the relevant dates are:

05/14/2007	05/14/2007
DATE OF RECEIPT OF 35 U.S.C. 371(c)(1), (c)(2) and (c)(4) REQUIREMENTS	DATE OF COMPLETION OF ALL 35 U.S.C. 371 REQUIREMENTS

A Filing Receipt (PTO-103X) will be issued for the present application in due course. **THE DATE APPEARING ON THE FILING RECEIPT AS THE " FILING DATE" IS THE DATE ON WHICH THE LAST OF THE 35 U.S.C. 371 (c)(1), (c)(2) and (c)(4) REQUIREMENTS HAS BEEN RECEIVED IN THE OFFICE. THIS DATE IS SHOWN ABOVE.** *The filing date of the above identified application is the international filing date of the international application (Article 11(3) and 35 U.S.C. 363).* Once the Filing Receipt has been received, send all correspondence to the Group Art Unit designated thereon.

The following items have been received:

- Copy of the International Application filed on 08/30/2006
- English Translation of the IA filed on 08/30/2006
- Copy of the International Search Report filed on 08/30/2006
- Information Disclosure Statements filed on 05/14/2007
- Oath or Declaration filed on 05/14/2007
- Request for Immediate Examination filed on 08/30/2006
- U.S. Basic National Fees filed on 08/30/2006
- Priority Documents filed on 08/30/2006
- Specification filed on 08/30/2006
- Claims filed on 08/30/2006
- Abstracts filed on 08/30/2006

- Drawings filed on 08/30/2006

Applicant is reminded that any communications to the United States Patent and Trademark Office must be mailed to the address given in the heading and include the U.S. application no. shown above (37 CFR 1.5).

VONDA M WALLACE
Telephone: (703) 308-9140 EXT 225

PART 3 - OFFICE COPY

FORM PCT/DO/EO/903 (371 Acceptance Notice)

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(c) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
10/591,184	05/14/2007	Hong Cheng	L8638.06115

CONFIRMATION NO. 7759

52989
STEVENS, DAVIS, MILLER & MOSHER, LLP
1615 L. STREET N.W.
SUITE 850
WASHINGTON, DC20036

Title: System and Method for Negotiation of Wlan Entity

Publication No. US-2007-0258414-A1
Publication Date: 11/08/2007

NOTICE OF PUBLICATION OF APPLICATION

The above-identified application will be electronically published as a patent application publication pursuant to 37 CFR 1.211, et seq. The patent application publication number and publication date are set forth above.

The publication may be accessed through the USPTO's publically available Searchable Databases via the Internet at www.uspto.gov. The direct link to access the publication is currently http://www.uspto.gov/patft/.

The publication process established by the Office does not provide for mailing a copy of the publication to applicant. A copy of the publication may be obtained from the Office upon payment of the appropriate fee set forth in 37 CFR 1.19(a)(1). Orders for copies of patent application publications are handled by the USPTO's Office of Public Records. The Office of Public Records can be reached by telephone at (703) 308-9726 or (800) 972-6382, by facsimile at (703) 305-8759, by mail addressed to the United States Patent and Trademark Office, Office of Public Records, Alexandria, VA 22313-1450 or via the Internet.

In addition, information on the status of the application, including the mailing date of Office actions and the dates of receipt of correspondence filed in the Office, may also be accessed via the Internet through the Patent Electronic Business Center at www.uspto.gov using the public side of the Patent Application Information and Retrieval (PAIR) system. The direct link to access this status information is currently http://pair.uspto.gov/. Prior to publication, such status information is confidential and may only be obtained by applicant using the private side of PAIR.

Further assistance in electronically accessing the publication, or about PAIR, is available by calling the Patent Electronic Business Center at 1-866-217-9197.

Pre-Grant Publication Division, 703-605-4283

AMENDMENT TRANSMITTAL LETTER (Large Entity) Applicant(s): **Hong CHENG et al.**	Docket No. **008638-06115**

Application No.	Filing Date	Examiner	Customer No.	Group Art Unit	Confirmation No.
10/591,184	**August 30, 2006**	**J. Byrd**	**52989**	**2617**	**7759**

Invention: **SYSTEM AND METHOD FOR NEGOTIATION OF WLAN ENTITY**

COMMISSIONER FOR PATENTS:

Transmitted herewith is an amendment in the above-identified application.

The fee has been calculated and is transmitted as shown below.

CLAIMS AS AMENDED

	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST # PREV. PAID FOR		NUMBER EXTRA CLAIMS PRESENT		RATE	ADDITIONAL FEE
TOTAL CLAIMS	32	-	31	=	1	x	$220.00	$220.00
INDEP. CLAIMS	14	-	13	=	1	x	$52.00	$52.00
Multiple Dependent Claims (check if applicable) ☐								$0.00
TOTAL ADDITIONAL FEE FOR THIS AMENDMENT								$272.00

- ☐ No additional fee is required for amendment.
- ☐ Please charge Deposit Account No. in the amount of
- ☐ A check in the amount of to cover the filing fee is enclosed.
- ☒ The Director is hereby authorized to charge payment of the following fees associated with this communication or credit any overpayment to Deposit Account **04-1061**
  - ☒ Any additional filing fees required under 37 C.F.R. 1.16.
  - ☒ Any patent application processing fees under 37 CFR 1.17.
- ☐ Payment by credit card. Form PTO-2038.

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

/James Edward Ledbetter/

Signature

Dated: **December 18, 2009**

James E. Ledbetter, Esq.
Reg. No. 28732
DICKINSON WRIGHT PLLC
1875 Eye Street, N.W., Suite 1200
Washington, D.C. 20006
Telephone: (202) 457-0160
Facsimile: (202) 659-1559

I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to "Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450" [37 CFR 1.8(a)] on

________________.
(Date)

Signature of Person Mailing Correspondence

Typed or Printed Name of Person Mailing Correspondence

cc:

P11LARGE/REV10

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of

Inventor:	Hong CHENG et al.	Art Unit 2617
Appln. No.:	10/591,184	Exr. J. Byrd
Filed:	August 30, 2006	Conf. No. 7759
For:	SYSTEM AND METHOD FOR NEGOTIATION OF WLAN ENTITY	

PRELIMINARY AMENDMENT UNDER 37 CFR § 1.115

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Please amend the above-captioned application as follows:

IN THE CLAIMS

The pending claims are set forth below:

Listing of Claims

1. (Original) A system for providing service in a wireless local area network comprising

i. a single or plurality of wireless access points (WAP) capable of processing a subset of complete functionality defined for the wireless local area network;

ii. a single or plurality of control nodes (CN) capable of providing a subset or complete functionalities defined for the wireless local area network; and

iii. negotiation means for the wireless access points to dynamically negotiate with the control node for a secure connections and function split arrangement;

whereby, in use, the control node would negotiate with the WAPs using the negotiation means and provide same or different complementary functionality for each of the WAPs to form a complete functionality defined for the wireless local area network according to decision of the negotiation means.

2. (Original) The system according to claim 1 wherein said wireless access point and control nodes further comprise logically independent functional components of the functionalities defined for the wireless local area network with predefined interface used between each functional components.

3. (Original) The system according to claim 2 wherein interfaces between said functional components could be used over remote connections between said wireless access point and control node.

4. (Original) The system according to claim 1 wherein each said control node further comprises a control node controller module and each said wireless access point further comprises a wireless access point controller module.

5. (Original) The system according to claim 4 wherein the controller module of control node further comprises a single or plurality of processing schedules composed of sequential lists of descriptors for subsets of functional components used for each wireless access point.

6. (Original) The system according to claim 4 wherein the controller module of wireless access point further comprises a single or plurality of processing schedules composed of sequential lists of descriptors for subsets of functional components used for each associated mobile terminal.

7. (Original) The system according to claim 1, wherein the wireless access point further comprises:

i. means for discovering the available control node within a specified domain; and

ii. means for negotiating secure connection with control node that could offer the desired functions;

whereby, in use, the wireless access point is able to locate the control node that provides necessary complementary functionalities with regard to a set of defined complete wireless local area network functions with the means for discovering and establishing secure connection with the control node with the means for negotiating.

8. (Original) The system according to claim 1, wherein the controller module of said control node is capable of generating data unit to resemble that from a mobile terminal.

9. (Original) A system for load balancing in a wireless local area network (WLAN) without requiring association handover at a mobile terminal comprising:

i. a single or plurality of mobile terminals, each said mobile terminal associated with and receiving services from a single or plurality of wireless access point (WAP);

ii. a single or plurality of wireless access point that are capable of processing data units received from the mobile terminal or other wireless access point using a subset of defined WLAN functions; and

iii. means for the wireless access points to exchange data units processed with a subset or complete defined WLAN functions;

whereby a data unit for a mobile terminal is processed with complete WLAN functions by a single or plurality of WAPs where each WAP processes the data unit with only a subset of complete WLAN functions.

10. (Original) The system according to claim 9 wherein the wireless access point further comprises a control module that is capable of negotiating with other wireless access points for a subset of the complete WLAN functions to be carried out at each wireless access point.

11. (Original) The system according to claim 9 wherein the wireless access point further comprising a local database that stores all the associations of the mobile terminals attached to said wireless access point and corresponding subset of the complete WLAN functions to be provided to the mobile terminal.

12. (Original) The system according to claim 1, wherein the functionalities of said WAP and CN collocate in a single network element.

13. (Original) A method for providing service in a wireless local area network (WLAN) that allows defined WLAN function split between wireless access point (WAP) and a single or plurality of Control Node (CN) comprising the steps in which:

i. a WAP discovers the CN that may provide complementary WLAN functions by sending a single or plurality of messages containing information about its own subset of WLAN functions to all the CN;

ii. a CN after receiving said discover message replies with a single or plurality of messages containing information about a subset of WLAN functions said CN could offer to the WAP; and

iii. said WAP chooses from all the replied CNs a proper CN based on local policy and establishes association with said chosen CN.

14. (Original) The method for the WAP to decide which CN to use according to claim 13 using information, the information comprising:

i. the subset of the WLAN functions offered by the CN;

ii. a cost of using the CN;

iii. a vendor of the CN;

iv. a characteristics of the connection to the CN; and

v. a weighted sum of the above factors.

15. (Original) A method for providing service in a wireless local area network (WLAN) that allows defined WLAN function split between wireless access point (WAP) and a single or plurality of Control Node (CN) comprising the steps in which:

i. a CN dynamically discovers the capability of a WAP by sending a single or plurality of messages to a WAP containing a section that emulates a data unit sent by a mobile terminal;

ii. a WAP receives said message, processes said section using the same procedure for processing data units received from a mobile terminal and sends data unit back to said CN in a reply message; and

iii. said CN obtains the capability information of said WAP by examining the processed data units in said reply message.

16. (Original) A method for providing service in a wireless local area network (WLAN) that allows defined WLAN function split between a wireless access point (WAP) and a single or plurality of Control Node (CN) comprising the steps in which:

i. a CN obtaining capability of the WAP; and

ii. said CN negotiating with another one or a plurality of CNs for the supplementary WLAN functions to be provided to the WAP.

17. (Original) A method for carrying out load balancing in a wireless local area network (WLAN) without requiring a mobile terminal to change association relationship with a wireless access point (WAP) comprising the steps in which:

i. the WAP separates the processing function provided to the mobile terminal into an association specific part and a non-association specific part;

ii. said WAP negotiates with another WAP of the non-association specific part and establishes a secure tunnel with said another WAP;

iii. said WAP tunnels the data unit from a mobile terminal to the said another WAP through the tunnel after processing data unit with the association specific part of functions; and

iv. said another WAP receiving the processed data unit through said tunnel and processing it with non-association specific part of functions.

18. (Original) The method according to claim 17 further comprising the step in which said WAP uses a wireless channel to establish direct connection with another WAP and sets up secure tunnel over the direct connection.

19. (Original) The method according claim 17 further comprising the step in which the WAP decides on whether to tunnel data unit from the mobile terminal to another WAP for non association specific processing by monitoring the load at WAP and comparing it with a preset threshold value.

20. (Original) The method according to claim 17 further comprising the step in which said WAP decides on which other WAPs should be used for non association specific processing by monitoring the loads at different WAPs it has connections with and compares them with a preset threshold value.

21. (Original) The method according to claim 17 further comprising the step in which a central control entity monitors the load status on all WAPs within a certain domain and mandates distribution of non-association processing function between different WAPs.

22. (Original) The method according to claim 17 for the WAP to determine the distribution of non-association specific function based on information, the information comprising:

i. a size of the data unit to be processed;

ii. an expected average time for the processing of the data unit;

iii. an overhead time for processing the data unit; and

iv. a weighted sum of above factors.

23. (Original) A method for providing service in a wireless local area network (WLAN) that allows defined WLAN function split between wireless access point (WAP) and a single or plurality of Control Node (CN) comprising the steps in which:

i. a subset of WAPs processes the total of its subset of functionality defined for the WLAN; and

ii. a CN provides distinct subsets of complementary functionality defined for the WLAN to each of the subset of WAPs.

24. (Original) A method for providing service in a wireless local area network (WLAN) that allows defined WLAN function split between wireless access point (WAP) and a single or plurality of Control Node (CN) comprising the steps in which:

i. a CN determines a common subset of functionality required for the WLAN available at a subset of the WAPs;

ii. each WAP of the subset processes the said determined common subset of functionality; and

iii. a CN provides similar subsets of complementary functionality to each of the subset of WAPs.

25. (Original) A method for accommodating variances in a wireless network topology comprising the step of dynamically adapting the operations logic of at least one network entity of said wireless network topology to alter processing of one or more functional sub-components.

26. (Original) The method according to claim 25 further comprising the step of altering the processing of selected functional sub-components at the at least one network entity by means of bypassing processing of said selected functional sub-components.

27. (Original) The method according to claim 25 further comprising the step of altering the processing of a selected functional sub-components at the at one or more network entity by means of selectively processing said selected functional sub-components.

28. (Original) A method for compensating variances in latency in a wireless network comprising the steps of;

bypassing processing of selected functional sub-components at a first network entity and;

performing processing of said bypassed functional sub-components at a second network entity.

29. (Original) A method for altering local-level functional semantics while maintaining system-wide functional semantics of a wireless network comprising the step of selectively activating functional sub-components of selected network entities such that the sum of activated functional sub-components across said wireless network corresponds to complete functional sub-components of said wireless network.

30. (Original) The method according to claim 29 further comprising the step of shifting the processing of said activated functional sub-components from a first network entity to a second network entity.

31. (Original) A method for determining topology of a wireless network, wherein a first network entity alters connectivity association with a second network entity by including one or more third network entities in the communication path of the alternate connectivity association, comprising the steps of;

exchanging information on neighbouring network entities among said network entities of said wireless network;

analyzing communication frames received by said network entities based on pre-established representations of topology of said wireless network;

analyzing association request frames received by said network entities based on pre-established representations of topology of said network.

32. (New) A wireless access point (WAP) in a wireless local area network (WLAN) that allows a defined WLAN function to be split between the wireless access point (WAP) and one or more Control Nodes (CNs), the WAP comprising:

a discovery function which initiates a discovery operation to discover a Control Node (CN) among said one or more CNs that may complement said WAP with respect to providing said defined WLAN function by sending a plurality of discover messages containing information about its own subset of the defined WLAN function, to the one or more CNs;

a receiving function which receives one or more reply messages from said one or more CNs in response to said discover message, said one or more reply messages including information about a subset of the defined WLAN function, said one or more CNs could offer to the WAP;

a choosing function which chooses from among said one or more CNs that sent said one or more reply messages a particular CN based on local policy.

REMARKS

Claim 32 has been newly added. Support for the subject matter of the new claim is provided at least in the original claims.

Early and favorable consideration of this application is respectfully requested.

Respectfully submitted,

/James Edward Ledbetter/

James E. Ledbetter
Registration No. 28,732

Date: December 18, 2009
JEL/DWW/att

Attorney Docket No. 008638-06115
Dickinson Wright PLLC
1875 Eye Street, NW, Suite 1200
Washington, DC 20006
Telephone: (202) 659-6966
Facsimile: (202) 659-1559

DC 8638-6115 147121

Electronic Patent Application Fee Transmittal

Application Number:	10591184
Filing Date:	14-May-2007
Title of Invention:	System and Method for Negotiation of Wlan Entity
First Named Inventor/Applicant Name:	Hong Cheng
Filer:	James Edward Ledbetter
Attorney Docket Number:	L8638.06115

Filed as Large Entity

U.S. National Stage under 35 USC 371 Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Claims in excess of 20	1615	1	52	52
Independent claims in excess of 3	1614	1	220	220
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
		Total in USD ($)		**272**

Electronic Acknowledgement Receipt	
EFS ID:	6674095
Application Number:	10591184
International Application Number:	
Confirmation Number:	7759
Title of Invention:	System and Method for Negotiation of Wlan Entity
First Named Inventor/Applicant Name:	Hong Cheng
Customer Number:	52989
Filer:	James Edward Ledbetter
Filer Authorized By:	
Attorney Docket Number:	L8638.06115
Receipt Date:	18-DEC-2009
Filing Date:	14-MAY-2007
Time Stamp:	20:00:56
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	$272
RAM confirmation Number	5806
Deposit Account	
Authorized User	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)

1	Preliminary Amendment	amendment.pdf	330547 a25eec1867337451781095b849ff4b6d7b61a18b	no	14
Warnings:					
Information:					
2	Fee Worksheet (PTO-875)	fee-info.pdf	31376 239291ad23ced668fbc8d04fc8bd6712955e1ce8	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	361923		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

<u>New Applications Under 35 U.S.C. 111</u>
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

<u>National Stage of an International Application under 35 U.S.C. 371</u>
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

<u>New International Application Filed with the USPTO as a Receiving Office</u>
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PTO/SB/06 (07-06)
Approved for use through 1/31/2007. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

PATENT APPLICATION FEE DETERMINATION RECORD
Substitute for Form PTO-875

Application or Docket Number: 10/591,184
Filing Date: 05/14/2007
☐ To be Mailed

APPLICATION AS FILED – PART I

FOR	NUMBER FILED (Column 1)	NUMBER EXTRA (Column 2)	SMALL ENTITY ☐ RATE ($)	SMALL ENTITY FEE ($)		OTHER THAN SMALL ENTITY RATE ($)	OTHER THAN SMALL ENTITY FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =		OR	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =			X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $250 ($125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							
			TOTAL			TOTAL	

* If the difference in column 1 is less than zero, enter “0” in column 2.

APPLICATION AS AMENDED – PART II

AMENDMENT 12/18/2009	CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	SMALL ENTITY RATE ($)	SMALL ENTITY ADDITIONAL FEE ($)		OTHER THAN SMALL ENTITY RATE ($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	* 32	Minus	** 31	= 1	X $ =		OR	X $52=	52
Independent (37 CFR 1.16(h))	* 13	Minus	***12	= 1	X $ =		OR	X $220=	220
☐ Application Size Fee (37 CFR 1.16(s))									
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	272

AMENDMENT	CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	RATE ($)	ADDITIONAL FEE ($)		RATE ($)	ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =		OR	X $ =	
Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =		OR	X $ =	
☐ Application Size Fee (37 CFR 1.16(s))									
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
					TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write “0” in column 3.
** If the “Highest Number Previously Paid For” IN THIS SPACE is less than 20, enter “20”.
*** If the “Highest Number Previously Paid For” IN THIS SPACE is less than 3, enter “3”.
The “Highest Number Previously Paid For” (Total or Independent) is the highest number found in the appropriate box in column 1.

Legal Instrument Examiner:
/TAMMY ACREE/

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/591,184	05/14/2007	Hong Cheng	L8638.06115	7759

52989 7590 01/26/2010

Dickinson Wright PLLC
James E. Ledbetter, Esq.
International Square
1875 Eye Street, N.W., Suite 1200
Washington, DC 20006

EXAMINER	
BYRD JR., JOHN B	

ART UNIT	PAPER NUMBER
2617	

MAIL DATE	DELIVERY MODE
01/26/2010	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

PTOL-90A (Rev. 04/07)

Office Action Summary	Application No.	Applicant(s)
	10/591,184	CHENG ET AL.
	Examiner	Art Unit
	JOHN B. BYRD JR.	2617

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *30 August 2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-31* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-31* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *30 August 2006* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date *7/10/2007, 08/30/2006*.

4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claims 1-16, and 23-31 are rejected under 35 U.S.C. 102(b) as being anticipated by *Dehner et al* (2003/0035464 A1) (hereinafter *Dehner)*.

Regarding **claim 1**, *Dehner* discloses a system for providing service in a wireless local area network comprising:

i. a single or plurality of wireless access points (WAP) capable of processing a subset of complete functionality defined for the wireless local area network (=see Fig. 1, and par.[0012]);

ii. a single or plurality of control nodes (CN) capable of providing a subset or complete functionalities defined for the wireless local area network (=see Fig. 1, items 143, and 163; and par.[0017]); and

iii. negotiation means for the wireless access points to dynamically negotiate with the control node for a secure connections and function split arrangement (=see par.[0019] and par.[0020], wherein being established as the “master and slave” reads on negotiation means, and NAP, item 103, reads on negotiation means);

whereby, in use, the control node would negotiate with the WAPs using the negotiation means and provide same or different complementary functionality for each of the WAPs to form a complete functionality defined for the wireless local area network according to decision of the negotiation means (=see par.[0019], par.[0020], and par.[0039] wherein the “NAP” and “controller” different complementary functionality is taught).

Regarding **claim 2**, *Dehner* discloses a system according to claim 1 wherein said wireless access point and control nodes further comprise logically independent functional components of the functionalities defined for the wireless local area network with predefined interface used between each functional components (=see par.[0039]).

Regarding **claim 3**, *Dehner* discloses a system according to claim 2 wherein interfaces between said functional components could be used over remote connections between said wireless access point and control node (=see par.[0023], wherein the “NAP" reads on the wireless access point and the “controller 143” reads on the controller).

Regarding **claim** 4, *Dehner* discloses a system according to claim 1 wherein each said control node further comprises a control node controller module (=see Fig.1, item 143 reads on control node, and item 111, reads on control node controller) and

each said wireless access point further comprises a wireless access point controller module (=see Fig.1, item 103, reads on wireless access point, and item 143, reads on a wireless access point controller module).

Regarding **claim 5**, *Dehner* discloses a system according to claim 4 wherein the controller module of control node further comprises a single or plurality of processing schedules composed of sequential lists of descriptors for subsets of functional components used for each wireless access point (=see Fig.7, wherein the flowchart of tasks reads on the lists of descriptors).

Regarding **claim 6**, *Dehner* discloses a system according to claim 4 wherein the controller module of wireless access point further comprises a single or plurality of processing schedules composed of sequential lists of descriptors for subsets of functional components used for each associated mobile terminal (=see Fig.7, wherein the “signal quality” versus the listed threshold is and example stated herein that reads on the descriptors for subsets).

Regarding **claim 7**, *Dehner* discloses a system according to claim 1, wherein the wireless access point further comprises:

i. means for discovering the available control node within a specified domain (=see par.[0019] and par.[0020]); and

ii. means for negotiating secure connection with control node that could offer the desired functions (=see par.[0022], wherein the “ID” provides a means for secure connection);

whereby, in use, the wireless access point is able to locate the control node that provides necessary complementary functionalities with regard to a set of defined complete wireless local area network functions with the means for discovering and establishing secure connection with the control node with the means for negotiating (=see par.[0024]).

Regarding **claim 8**, *Dehner* discloses a system according to claim 1, wherein the controller module of said control node is capable of generating data unit to resemble that from a mobile terminal (=see par.[0020], wherein the CU reads on the mobile terminal).

Regarding **claims 9 and 25**, *Dehner* discloses a system for load balancing in a wireless local area network (WLAN) without requiring association handover at a mobile terminal comprising:

i. a single or plurality of mobile terminals, each said mobile terminal associated with and receiving services from a single or plurality of wireless access point (WAP) (=see par.[0012], wherein the CU reds on the mobile terminal);

ii. a single or plurality of wireless access point that are capable of processing data units received from the mobile terminal or other wireless access point using a subset of defined WLAN functions (=see par.[0012], wherein it is understand to perform the communication cited herein reads on subset of defined WLAN functions); and

iii. means for the wireless access points to exchange data units processed with a subset or complete defined WLAN functions (=see par.[0047], wherein the CU and the WAP exchange data);

whereby a data unit for a mobile terminal is processed with complete WLAN functions by a single or plurality of WAPs where each WAP processes the data unit with only a subset of complete WLAN functions (=see par.[0047], wherein the CU and the WAP exchange data).

Regarding **claims 10 and 26**, *Dehner* discloses a system according to claim 9 wherein the wireless access point further comprises a control module that is capable of negotiating with other wireless access points for a subset of the complete WLAN functions to be carried out at each wireless access point (=see par.[0017]).

Regarding **claims 11 and 27**, *Dehner* discloses a system according to claim 9 wherein the wireless access point further comprising a local database that stores all the associations of the mobile terminals attached to said wireless access point and corresponding subset of the complete WLAN functions to be provided to the mobile terminal (=see par.[0034]).

Regarding **claim 12**, *Dehner* discloses a system according to claim 1, wherein the functionalities of said WAP and CN collocate in a single network element (=see Fig.1, and par.[0017]).

Regarding **claims 13 and 29**, *Dehner* discloses a method for providing service in a wireless local area network (WLAN) that allows defined WLAN function split between wireless access point (WAP) and a single or plurality of Control Node (CN) comprising the steps in which:

i. a WAP discovers the CN that may provide complementary WLAN functions by sending a single or plurality of messages containing information about its own subset of WLAN functions to all the CN (=see Fig.7, and par.[0011]);

ii. a CN after receiving said discover message replies with a single or plurality of messages containing information about a subset of WLAN functions said CN could offer to the WAP (=see Fig.7, item 713); and

iii. said WAP chooses from all the replied CNs a proper CN based on local policy and establishes association with said chosen CN (=see Fig.7, item 717).

Regarding **claims 14 and 30**, *Dehner* discloses a method for the WAP to decide which CN to use according to claim 13 using information, the information comprising:

i. the subset of the WLAN functions offered by the CN (=see Fig.7);

ii. a cost of using the CN (=see Fig.7);

iii. a vendor of the CN (=see Fig.7);

iv. a characteristics of the connection to the CN (=see Fig.7); and

V. a weighted sum of the above factors (=see Fig.7).

Regarding **claim 15**, *Dehner* discloses a method for providing service in a wireless local area network (WLAN) that allows defined WLAN function split between wireless access point (WAP) and a single or plurality of Control Node (CN) comprising the steps in which:

i. a CN dynamically discovers the capability of a WAP by sending a single or plurality of messages to a WAP containing a section that emulates a data unit sent by a mobile terminal (=see par.[0019], wherein the “respond with message” reads on the message to WAP);

ii. a WAP receives said message, processes said section using the same procedure for processing data units received from a mobile terminal and sends data unit back to said CN in a reply message (=see par.[0019] and par.[0020]); and

iii. said CN obtains the capability information of said WAP by examining the processed data units in said reply message (=see par.[0019] and par.[0020]).

Regarding **claims 16, 28, and 31;** *Dehner* discloses a method for providing service in a wireless local area network (WLAN) that allows defined WLAN function split between a wireless access point (WAP) and a single or plurality of Control Node (CN) comprising the steps in which:

i. a CN obtaining capability of the WAP (=see par.[0038] and Fig 2, item 211);

ii. said CN negotiating with another one or a plurality of CNs for the supplementary WLAN functions to be provided to the WAP (=see Fig.1, and par.[0016]).

Regarding **claim 24**, *Dehner* discloses a method for providing service in a wireless local area network (WLAN) that allows defined WLAN function split between wireless access point (WAP) and a single or plurality of Control Node (CN) comprising the steps in which:

i. a CN determines a common subset of functionality required for the WLAN available at a subset of the WAPs (=see par.[0030] and par.[0040]);

ii. each WAP of the subset processes the said determined common subset of functionality (=see par.[0040]); and

iii. a CN provides similar subsets of complementary functionality to each of the subset of WAPs (=see par.[0041]).

Regarding **claim 28**, *Dehner* discloses a method for compensating variances in latency in a wireless network comprising the steps of;

bypassing processing of selected functional sub-components at a first network entity and;

performing processing of said bypassed functional sub-components at a second network entity.

3. Claims 17-22 are rejected under 35 U.S.C. 102(a) as being unpatentable over *Knauerhase et al* (2003/0163579 A1) (hereinafter *Knauerhase*).

Regarding **claim 17**, *Knauerhase* discloses a method for carrying out load balancing in a wireless local area network (WLAN) without requiring a mobile terminal to change association relationship with a wireless access point (WAP) comprising the steps in which:

i. the WAP separates the processing function provided to the mobile terminal into an association specific part and a non-association specific part (=see Fig.3, item 302, reads on association, and item 304, reads on non-association);

ii. said WAP negotiates with another WAP of the non-association specific part, and establishes a secure tunnel with said another WAP (=see par.[0016]);

iii. said WAP tunnels the data unit from a mobile terminal to the said another WAP through the tunnel after processing data unit with the association specific part of functions (=see par.[0028]); and

iv. said another WAP receiving the processed data unit through said tunnel and processing it with non-association specific part of functions (=see par.[0028] and par.[0029]).

Regarding **claim 18**, *Knauerhase* discloses a method according to claim 17 further comprising the step in which said WAP uses a wireless channel to establish direct connection with another WAP and sets up secure tunnel over the direct connection (=see par.[0037], wherein the"…send information" reads on direct connection).

Regarding **claim 19**, *Knauerhase* discloses a method according claim 17 further comprising the step in which the WAP decides on whether to tunnel data unit from the mobile terminal to another WAP for non association specific processing by monitoring the load at WAP and comparing it with a preset threshold value (=see Fig.2, item 202, wherein the "Reduced" is understood to be based on the threshold).

Regarding **claim 20**, *Knauerhase* discloses a method according to claim 17 further comprising the step in which said WAP decides on which other WAPs should be used for non association specific processing by monitoring the loads at different WAPs it has connections with and compares them with a preset threshold value (=see par.[0042], wherein the load is monitored at "t" with reads on different WAPs).

Regarding **claim 21**, *Knauerhase* discloses a method according to claim 17 further comprising the step in which a central control entity monitors the load status on all WAPs within a certain domain and mandates distribution of non-association processing function between different WAPs (=see Fig.1, item 118 and 112).

Regarding **claim 22**, *Knauerhase* discloses a method according to claim 17 for the WAP to determine the distribution of non-association specific function based on information, the information comprising:

i. a size of the data unit to be processed (=see Fig.2, item 202, wherein the "LOAD" reads on data size);

ii. an expected average time for the processing of the data unit (=see par.[0042]);

iii. an overhead time for processing the data unit (=see par.[0042]); and

iv. a weighted sum of above factors (=see Fig.2, item 202, wherein the "LOAD" reads on weighted sum).

Conclusion

4. Any inquiry concerning this communication or earlier communications from the examiner should be directed to JOHN B. BYRD JR. whose telephone number is (571)270-7463. The Examiner can normally be reached on M-F, 7:30am - 5:00pm, EST.

The supervisor, Charles Appiah, can be reached on 571-272-7904, if you are unable to resolve the matter with the assigned Examiner. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/JOHN B BYRD JR./
Examiner, Art Unit 2617

/Charles N. Appiah/
Supervisory Patent Examiner, Art Unit 2617

# Notice of References Cited	Application/Control No. 10/591,184	Applicant(s)/Patent Under Reexamination CHENG ET AL.	
	Examiner JOHN B. BYRD JR.	Art Unit 2617	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-2003/0035464 A1	02-2003	Dehner et al.	375/132
*	B	US-2003/0163579 A1	08-2003	Knauerhase et al.	709/230
	C	US-			
	D	US-			
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

10591184 - GAU: 2617 SHEET 1 OF 1

FORM PTO-1449 (Rev. 4/92) U.S. Department of Commerce Patent and Trademark Office

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use several sheets if necessary)

OIPE IAP 07 JUL 10 2007 PATENT & TRADEMARK OFFICE

ATTY. DOCKET NO.	SERIAL NO.
L8638.06115	10/591,184
APPLICANT	Hong CHENG, et al.
FILING DATE August 30, 2006	GROUP Unassigned

U.S. PATENT DOCUMENTS

EXAMINER INITIAL		DOCUMENT NUMBER								DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
/J.B./	2003	0	0	3	5	4	6	4		02/2003	Dehner et al.			
/J.B./	2003	0	1	6	3	5	7	9		08/2003	Knauerhase et al.			
/J.B./		6	5	2	2	8	8	1		02/2003	Feder et al.			

FOREIGN PATENT DOCUMENTS

		DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO

		OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc.)
/J.B./		B. O'Hara, et al., "CAPWAP Problem Statement," draft-ietf-capwap-problem-statement-02, CAPWAP Working Group, Internet-Draft, pages 1-9, Aug. 20, 2004.
/J.B./		"Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications," Information Technology, Telecommunications and Information Exchange between Systems, Local and Metropolitan Area Networks, Specific Requirements, ANSI/IEEE Std 802.11, 1999 Edition (R2003), LAN MAN Standards Committee of the IEEE Company Society, 528 pages total, June 12, 2003.

EXAMINER /John Byrd Jr./	DATE CONSIDERED 01/16/2010

EXAMINER: Initial if citation is considered, draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

(Form PTO-1449 [6-4])

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /J.B./

Index of Claims	Application/Control No. 10591184	Applicant(s)/Patent Under Reexamination CHENG ET AL.
	Examiner JOHN B BYRD JR.	Art Unit 2617

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	01/16/2010								
	1	✓								
	2	✓								
	3	✓								
	4	✓								
	5	✓								
	6	✓								
	7	✓								
	8	✓								
	9	✓								
	10	✓								
	11	✓								
	12	✓								
	13	✓								
	14	✓								
	15	✓								
	16	✓								
	17	✓								
	18	✓								
	19	✓								
	20	✓								
	21	✓								
	22	✓								
	23	✓								
	24	✓								
	25	✓								
	26	✓								
	27	✓								
	28	✓								
	29	✓								
	30	✓								
	31	✓								

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	10591184	CHENG ET AL.
	Examiner	**Art Unit**
	JOHN B BYRD JR.	2617

SEARCHED

Class	Subclass	Date	Examiner
370	338	01/16/2010	/J.B.B./

SEARCH NOTES

Search Notes	Date	Examiner
SEE EAST HISTORY	01/16/2010	/J.B.B./

INTERFERENCE SEARCH

Class	Subclass	Date	Examiner
370	338	01/16/2010	/J.B.B./

/JOHN B BYRD JR./ Examiner.Art Unit 2617	

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S1	5	"591184".AP.	US-PGPUB; USPAT	ADJ	ON	2010/01/16 14:00
S2	3	("20030035464" | "20030163579" | "6522881").PN.	US-PGPUB; USPAT	OR	ON	2010/01/16 14:09
S3	6807	370/338.ccls.	US-PGPUB; USPAT	ADJ	ON	2010/01/16 15:41
S4	5067014	@rlad<="20040302" or @ad<="20040302"	US-PGPUB; USPAT	ADJ	ON	2010/01/16 15:44
S5	3510	S3 and S4	US-PGPUB; USPAT	ADJ	ON	2010/01/16 15:44
S6	105	(CN or controller) with (search or find$3) with (access point or AP or WAP)	US-PGPUB; USPAT	ADJ	ON	2010/01/16 19:30
S7	0	S6 and "L4"	US-PGPUB; USPAT	ADJ	ON	2010/01/16 19:30
S8	5067014	@rlad<="20040302" or @ad<="20040302"	US-PGPUB; USPAT	ADJ	ON	2010/01/16 19:31
S9	42	S8 and S6	US-PGPUB; USPAT	ADJ	ON	2010/01/16 19:31
S10	31950	(wireless adj access adj point) or (WAP)	US-PGPUB; USPAT	ADJ	ON	2010/01/16 19:47
S11	59	S10 with (search$3 or find$3 or discover$3) with (CN or (control node) or control$3)	US-PGPUB; USPAT	ADJ	ON	2010/01/16 19:49
S12	25	S11 and S8	US-PGPUB; USPAT	ADJ	ON	2010/01/16 19:50
S13	103	S10 with ((control node) or CN)	US-PGPUB; USPAT	ADJ	ON	2010/01/16 19:56
S14	77	S13 and S8	US-PGPUB; USPAT	ADJ	ON	2010/01/16 19:56
S15	70	("5361258" | "5583866" | "5594731" | "5793765" | "5969678" | "5987062" | "6002918" | "6111867" | "6259898").PN. OR ("6522881").URPN.	US-PGPUB; USPAT; USOCR	ADJ	ON	2010/01/16 20:03
S16	6807	370/338.ccls.	US-PGPUB; USPAT	ADJ	ON	2010/01/16 20:23
S17	3510	S16 and S8	US-PGPUB; USPAT	ADJ	ON	2010/01/16 20:23

S18	223	S17 and S10 and ((control$3 adj node) or controller) and (LAN or WLAN)	US-PGPUB; USPAT	ADJ	ON	2010/01/16 20:23
S19	901	(control node).ab.	US-PGPUB; USPAT	ADJ	ON	2010/01/16 20:42
S20	15	S19 and S8 and S16	US-PGPUB; USPAT	ADJ	ON	2010/01/16 20:43

1/16/2010 11:48:03 PM
C:\Documents and Settings\jbyrd\My Documents\EAST\Workspaces\10591184.wsp

10591184 - GAU: 2617

FORM PTO-1449 (Rev. 4/92) U.S. Department of Commerce Patent and Trademark Office

IAP5 Rec'd PCT/PTO 30 AUG 2006

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use several sheets if necessary)

ATTY. DOCKET NO. L8638.06115	SERIAL NO. New PCT National Stage Application 10/591184
APPLICANT Hong CHENG, et al.	
FILING DATE August 30, 2006	GROUP Unassigned

U.S. PATENT DOCUMENTS

EXAMINER INITIAL		DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE

FOREIGN PATENT DOCUMENTS

		DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO
		~~2000 0 6 9 0 5 0~~	~~03/2000~~	~~JP~~				
		~~1 0 0 4 1 0 6 0~~	~~02/1998~~	~~JP~~				

		OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc.)
/J.B./		**PCT International Search Report dated May 17, 2005.**

EXAMINER: Initial if citation is considered, draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

(Form PTO-1449 [6-4])

/John Byrd Jr./ 01/21/2010

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /J.B./

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

BIB DATA SHEET

CONFIRMATION NO. 7759

SERIAL NUMBER	FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
10/591,184	05/14/2007 **RULE**	370	2617	L8638.06115

APPLICANTS
Hong Cheng, Singapore, SINGAPORE;
Pek Yew Tan, Singapore, SINGAPORE;
Saravanan Govindan, Singapore, SINGAPORE;

** **CONTINUING DATA** *************************
This application is a 371 of PCT/JP05/03390 03/01/2005

** **FOREIGN APPLICATIONS** *************************
JAPAN 2004-058245 03/02/2004
JAPAN 2004-209470 07/16/2004

** **IF REQUIRED, FOREIGN FILING LICENSE GRANTED** **
07/31/2007

		STATE OR COUNTRY	SHEETS DRAWINGS	TOTAL CLAIMS	INDEPENDENT CLAIMS
Foreign Priority claimed ☑ Yes ☐ No 35 USC 119(a-d) conditions met ☑ Yes ☐ No Verified and Acknowledged /JOHN B BYRD JR./ Examiner's Signature	☐ Met after Allowance Initials	SINGAPORE	10	31	12

ADDRESS
Dickinson Wright PLLC
James E. Ledbetter, Esq.
International Square
1875 Eye Street, N.W., Suite 1200
Washington, DC 20006
UNITED STATES

TITLE
System and Method for Negotiation of Wlan Entity

FILING FEE RECEIVED		
3652	FEES: Authority has been given in Paper No.___________ to charge/credit DEPOSIT ACCOUNT No.___________ for following:	☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other _______________ ☐ Credit

BIB (Rev. 05/07).

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of

Inventor:	Hong CHENG et al.	Art Unit 2617
Appln. No.:	10/591,184	Exr. J. Byrd
Filed:	August 30, 2006	Conf. No. 7759
For:	SYSTEM AND METHOD FOR NEGOTIATION OF WLAN ENTITY	

AMENDMENT UNDER 37 CFR § 1.111

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

In response to the non-final rejection dated January 26, 2010, the following amendments and remarks are respectfully submitted:

IN THE CLAIMS

The pending claims are set forth below:

Listing of Claims

1. (Currently Amended) A system for providing service in a wireless local area network comprising:

[[i.]] a single or plurality of wireless access points (WAP) for ~~capable of~~ processing a subset of complete functionality defined for the wireless local area network;

[[ii.]] a single or plurality of control nodes (CN) for ~~capable of~~ providing a subset or complete functionalities defined for the wireless local area network; and

[[iii.]] a negotiation unit ~~means~~ for the single or plurality of WAPs ~~wireless access points~~ to dynamically negotiate with the control node for a secure connection ~~connections~~ and function split arrangement;

whereby~~, in use,~~ the control node negotiates ~~would negotiate~~ with the single or plurality of WAPs using the negotiation unit ~~means~~ and provides ~~provide same or different~~ complementary functionality for the single or plurality of ~~each of~~ the WAPs to form a complete functionality defined for the wireless local area network according to a decision of the negotiation unit ~~means~~.

2. (Currently Amended) The system according to claim 1, wherein said WAPs ~~wireless access point~~ and CNs ~~control nodes~~ further comprise logically independent functional components of the functionalities defined for the wireless local area network with predefined interfaces ~~interface~~ used between each functional components.

3. (Currently Amended) The system according to claim 2, wherein said predefined interfaces used between said functional components are ~~could be~~ used over remote connections between said WAPs ~~wireless access point~~ and said CNs ~~control node~~.

4. (Currently Amended) The system according to claim 1, wherein each of said CNs ~~control node~~ further comprises a control node controller module and each of said WAPs ~~wireless access point~~ further comprises a wireless access point controller module.

5. (Currently Amended) The system according to claim 4, wherein the controller module of said CN ~~control node~~ further comprises a single or plurality of processing schedules comprising ~~composed of~~ sequential lists of descriptors for subsets of said functional components used for each wireless access point.

6. (Currently Amended) The system according to claim 4, wherein the controller module of said WAP ~~wireless access point~~ further comprises a single or plurality of processing schedules each comprising ~~composed of~~ sequential lists of descriptors for subsets of said functional components used for each associated mobile terminal.

7. (Currently Amended) The system according to claim 1, wherein each of the WAPs ~~wireless access point~~ further comprises:

[[i.]] a discovering unit ~~means~~ for discovering an ~~the~~ available CN ~~control node~~ within a specified domain; and [[ii.]] a secure connection negotiating unit ~~means~~ for negotiating a secure connection with a CN ~~control node~~ that may provide the complementary functionality ~~could offer the desired functions~~ desired by the WAP;

whereby~~, in use,~~ the WAP ~~wireless access point~~ locates ~~is able to locate~~ the CN ~~control node~~ that provides the ~~necessary~~ complementary functionality ~~functionalities~~ with regard to ~~a set of~~ defined complete wireless local area network functions with the ~~means for~~ discovering unit and establishes a ~~establishing~~ secure connection with the CN that provides the complementary functionality ~~control node~~ with the ~~means for~~ secure connection negotiating unit.

8. (Currently Amended) The system according to claim 1, wherein the controller module of said CN generates ~~control node is capable of generating~~ a data unit which resembles a data unit of ~~to resemble that from~~ a mobile terminal.

9. (Currently Amended) A system for providing service ~~load balancing~~ in a wireless local area network (WLAN) ~~without requiring association handover at a mobile terminal~~ comprising:

[[i.]] a single or plurality of mobile terminals, each of said mobile terminals ~~terminal~~ associated with and receiving services from a single or plurality of wireless access points ~~point~~ (WAP);

[[ii.]] a single or plurality of WAPs to process ~~wireless access point that are capable of processing~~ data units received from the single or plurality of mobile terminals ~~terminal~~ or the single or plurality of WAPs ~~other wireless access point~~ using a subset of defined WLAN functions; and [[iii.]] an exchanging unit ~~means~~ for the WAPs ~~wireless access points~~ to exchange data units processed with a subset of ~~or complete defined~~ WLAN functions;

wherein each of the WAPs further processes the processed data units received from other WAPs with complementary functionality among the subset of defined WLAN functions, and

whereby a data unit for a mobile terminal is processed with complete WLAN functions by a ~~single or~~ plurality of said WAPs ~~where each WAP processes the data unit with only a subset of complete WLAN functions~~.

10. (Currently Amended) The system according to claim 9, wherein each of the WAPs ~~wireless access point~~ further comprises a control module for ~~that is capable of~~ negotiating with other of said WAPs ~~wireless access points~~ for a subset of the complete WLAN functions to be carried out at each of said WAPs ~~wireless access point~~.

11. (Currently Amended) The system according to claim 9, wherein each of the WAPs ~~wireless access point~~ further comprises ~~comprising~~ a local database that stores all ~~the~~ associations of the mobile terminals attached to said WAP ~~wireless access point~~ and a corresponding subset of the complete WLAN functions to be provided to the mobile terminals ~~terminal~~.

12. (Currently Amended) The system according to claim 1, wherein the functionalities of said WAP and CN are collocated ~~collocate~~ in a single network element.

13. (Currently Amended) A method for providing service in a wireless local area

network (WLAN) that allows a defined WLAN function split between a wireless access point (WAP) and a single or plurality of Control Nodes ~~Node~~ (CN) comprising the steps in which:

[[i.]] ~~a~~ the WAP discovers ~~the~~ CNs ~~CN~~ that may provide complementary WLAN functions by sending a single or plurality of messages containing information about a ~~its own~~ subset of WLAN functions of the WAP to all of the CNs in the plurality of CNs ~~CN~~;

[[ii.]] ~~a CN~~ after receiving said discover message, at least one of the CNs replies with a single or plurality of messages containing information about a subset of WLAN functions said CN has available for ~~could offer to~~ the WAP; and

[[iii.]] said WAP chooses from all the replied CNs a proper CN based on local policy and establishes an association with said chosen CN.

14. (Currently Amended) The method according to claim 13, wherein the choosing of the proper CN by said WAP comprises choosing the proper CN ~~for the WAP to decide which CN to use according to claim 13~~ using information, the information comprising:

i. the subset of the WLAN functions offered by the CN;

ii. a cost of using the CN;

iii. a vendor of the CN;

iv. ~~a~~ characteristics of a ~~the~~ connection to the CN; and

v. a weighted sum of the above factors.

15. (Currently Amended) A method for providing service in a wireless local area network (WLAN) that allows a defined WLAN function split between wireless access point (WAP) and a single or plurality of Control Nodes ~~Node~~ (CN) comprising the steps in which:

[[i.]] a CN dynamically discovers a ~~the~~ capability of a WAP by sending a single or plurality of messages to the ~~a~~ WAP, each of the messages containing a section that emulates a data unit sent by a mobile terminal;

[[ii.]] the ~~a~~ WAP receives at least one of said messages ~~message~~, processes said section using a ~~the~~ same procedure for processing data units received from the ~~a~~ mobile terminal and sends another data unit back to said CN in a reply message; and

[[iii.]] said CN obtains ~~the~~ capability information of said WAP by examining the processed data unit ~~units~~ in said reply message.

16. (Currently Amended) A method for providing service in a wireless local area network (WLAN) that allows a defined WLAN function split between a wireless access point (WAP) and a single or plurality of Control Nodes ~~Node~~ (CN) comprising the steps in which:

[[i.]] a CN obtains a ~~obtaining~~ capability of the WAP; and

[[ii.]] said CN negotiates ~~negotiating~~ with another CN ~~one~~ or a plurality of other CNs for ~~the~~ supplementary WLAN functions to be provided to the WAP.

17. (Currently Amended) A method for carrying out load balancing in a wireless local area network (WLAN) without requiring a mobile terminal to change an association relationship with a wireless access point (WAP) comprising the steps in which:

[[i.]] the WAP separates a ~~the~~ processing function provided to the mobile terminal into an association specific part and a non-association specific part;

[[ii.]] said WAP negotiates with another WAP regarding ~~of~~ the non-association specific part and establishes a secure tunnel with said another WAP;

[[iii.]] said WAP tunnels a ~~the~~ data unit from a mobile terminal to the said another WAP through the tunnel after processing said data unit with functions of the association specific part ~~of functions~~; and

[[iv.]] said another WAP receiving the processed data unit through said tunnel processes said data unit ~~and processing it~~ with functions of the non-association specific part ~~of functions~~.

18. (Currently Amended) The method according to claim 17 further comprising a ~~the~~ step in which said WAP uses a wireless channel to establish a direct connection with said another WAP and sets up said secure tunnel over the direct connection.

19. (Currently Amended) The method according claim 17 further comprising a ~~the~~ step in which the WAP decides on whether to tunnel said data unit from the mobile terminal to said another WAP for said non association specific processing by monitoring a ~~the~~ load at said WAP and comparing it with a preset threshold value.

20. (Currently Amended) The method according to claim 17 further comprising a ~~the~~ step in which said WAP decides on which other WAPs should be used for said non association specific processing by monitoring ~~the~~ loads at said other ~~different~~ WAPs said WAP ~~it~~ has connections with and compares said loads ~~them~~ with a preset threshold value.

21. (Currently Amended) The method according to claim 17 further comprising ~~the~~ step in which a central control entity monitors a ~~the~~ load status on all WAPs within a certain domain and mandates distribution of said non-association specific processing functions ~~function~~ between

different WAPs from among said all WAPs.

22. (Currently Amended) The method according to claim 17 for the WAP to determine a ~~the~~ distribution of said non-association specific processing functions ~~function~~ based on information, the information comprising:

[[i.]] a size of the data unit to be processed;

[[ii.]] an expected average time for the processing of the data unit;

[[iii.]] an overhead time for the processing of the data unit; and

[[iv.]] a weighted sum of the above factors.

23. (Currently Amended) A method for providing service in a wireless local area network (WLAN) that allows a defined WLAN function split between a wireless access point (WAP) and a single or plurality of Control Nodes ~~Node~~ (CN) comprising the steps in which:

[[i.]] a subset of WAPs processes a ~~the~~ total of its subset of functionality defined for the WLAN; ~~and~~

the WAP dynamically negotiates with a CN for a secure connection and function split arrangement; and

the ~~ii. a~~ CN provides complementary functionality for each of the WAPs to form a complete functionality defined for the wireless local area network according to a decision in the negotiation step ~~distinct subsets of complementary functionality defined for the WLAN to each of the subset of WAPs~~.

24. (Cancelled)

25. (Currently Amended) A method for accommodating variances in a wireless network topology comprising a ~~the~~ step of dynamically adapting an ~~the~~ operations logic of at least one network entity of said wireless network topology to alter processing of one or more functional sub-components.

26. (Currently Amended) The method according to claim 25 further comprising a ~~the~~ step of altering ~~the~~ processing of selected functional sub-components at the at least one network entity by ~~means of~~ bypassing said processing of said selected functional sub-components.

27. (Currently Amended) The method according to claim 25 further comprising a ~~the~~ step of altering ~~the~~ processing of a selected functional sub-components at the at least one ~~or more~~ network entity by ~~means of~~ selectively processing said selected functional sub-components.

28-30. (Cancelled)

31. (Currently Amended) A method for determining a topology of a wireless network, wherein a first network entity alters a connectivity association with a second network entity by including one or more third network entities in a ~~the~~ communication path of an ~~the~~ alternate connectivity association, comprising the steps of:~~;~~

exchanging information on neighbouring network entities among said network entities of said wireless network;

analyzing communication frames received by said network entities based on pre-established representations of said topology of said wireless network; and

analyzing association request frames received by said network entities based on said pre-established representations of said topology of said network.

32. (Currently Amended) A wireless access point (WAP) in a wireless local area network (WLAN) that allows a defined WLAN function to be split between the wireless access point (WAP) and one or more Control Nodes (CNs), the WAP comprising:

a discovery function which initiates a discovery operation to discover a Control Node (CN) among said one or more CNs that may complement said WAP with respect to providing said defined WLAN function by sending a plurality of discover messages containing information about its own subset of the defined WLAN function, to the one or more CNs;

a receiving function which receives one or more reply messages from said one or more CNs in response to said discover messages ~~message~~, said one or more reply messages including information about a subset of the defined WLAN function, said one or more CNs have available for ~~could offer to~~ the WAP;

a choosing function which chooses from among said one or more CNs that sent said one or more reply messages a particular CN based on local policy.

REMARKS

Reconsideration and allowance of this application are respectfully requested in light of the above amendments and the following remarks.

Claims 1-23, 25-27, and 31-32 have been amended, and claims 24 and 28-30 have been cancelled without prejudice or disclaimer. Support for the amendments can be found, for example, at paragraph [0027] of the specification. No new matter is entered. (It should be noted that references herein to the specification and drawings are for illustrative purposes only and are not intended to limit the scope of the invention to any particular aspect of the referenced embodiments.)

Claims 1-16 and 23-31 stand rejected under 35 U.S.C. § 102(b) as being anticipated by Dehner et al (2003/0035464 A1) (hereinafter, "Dehner"). Claims 17-22 stand rejected under 35 U.S.C. § 102(b) as being unpatentable over Knauerhase et al. (2003/0163579 A1) (hereinafter, "Knauerhase"). It is further noted that new claim 32 was added by preliminary amendment on December 18, 2009, and that the Office Action has not yet addressed the patentability of this claim. Accordingly, it is respectfully requested that claim 32 be considered in the next Office Action.

It is respectfully submitted that the rejections of claims 1-31 should be withdrawn for at least the following reasons.

By way of review, in the methods and apparatuses recited by claims 1-32, it is presumed that a Wireless Access Point (WAP) does not have complete functionality defined for a wireless local area network, and instead has only a subset of complete functionality. Therefore, the methods and apparatuses recited by claims 1-32 have as an objective to provide complementary functionality to a WAP which has only a subset of complete functionality to form complete functionality.

In the methods and apparatuses recited by claims 1-32, it is presumed that each WAP has a different set of functional components. Similarly, each Control Node (CN) has a different set of functional components. Therefore, an important purpose of the methods and apparatuses recited by claims 1-32 is to provide complementary functionality to a WAP from some other network entity, such that the WAP is enabled to provide services in the wireless local area network, given that the WAP does not have complete functionality defined for the wireless local area network.

Also, in the methods and apparatuses recited by claims 1-32, the term "providing complementary functionality" can be understood to mean providing some functionalities which a given WAP does not have from another entity which has those functionalities. (See the Specification, paragraph [0027]). More specifically, the term "providing complementary functionality" can be understood to mean providing service in a wireless local area network to a radio communication terminal by forming complete functionality defined for the wireless local area network by negotiation and cooperation between WAPs, between a WAP and a CN, and so on.

Claims 1-8, 12 and 23

By way of review, according to Dehner, all Network Access Points ("NAP", see FIG. 1, 103 and 105) have the same and complete functionality. Dehner discloses shifting a NAP, which provides a service to a Communication Unit ("CU", see FIG. 1, 111) to another NAP based on the received signal strength (RSSI) or load.

On the contrary, according to the "system for providing service in a wireless local area network" defined by claim 1, a WAP has a <u>subset</u> of complete functionality and a CN <u>provides complementary functionality</u> for each of the WAPs. Specifically, the system of claim 1 recites the feature of:

> "...the control node negotiates with the single or plurality of WAPs using the negotiation unit and <u>provides complementary functionality for the single or plurality of the WAPs</u> to form a complete functionality defined for the wireless local area network according to a decision of the negotiation unit (emphasis added)."

As a result of this and other recited features, the system of claim 1 solves various problems associated with the prior art, including the problem of incompatibility of WAPs of different functionalities, WLAN operations in dynamic topology environments, and accommodating dissimilar volumes of processing loads over time. Specification, par. [0040].

Dehner fails to disclose, either expressly or inherently, each of the recited features of claim 1. For example, Dehner discloses that a provider to provide some functionality to a radio communication terminal is shifted from one NAP to another NAP, but fails to disclose that a CN <u>provides complementary functionality</u> for each of the WAPs by providing functionality to a WAP which <u>the WAP does not have</u>. Although the Office Action cites to paragraphs [0019], [0020] and [0039] of Dehner to anticipate these recited features of claim 1, none of these paragraphs disclose, either expressly or inherently, these features. Instead, these paragraphs simply refer to how a radio communication terminal may be shifted from one NAP, e.g., NAP 203 (FIG. 1), to another NAP, e.g., NAP 205 (FIG. 1).

Therefore, Dehner fails to disclose, either expressly or inherently, each of the features recited by claim 1, and the rejection of claim 1 and all dependent claims therefrom should be withdrawn for at least this reason.

Claim 23 recites substantially similar features to the features recited by claim 1 discussed above. Accordingly, it is respectfully submitted that the rejection of claim 23 should be withdrawn for substantially the same reasons that the rejection of claim 1 should be withdrawn.

Claims 9-11

According to the "system for providing service in a wireless local area network (WLAN)" recited by claim 9, a first wireless access point processes a data packet from a mobile terminal by a predetermined subset of functionality and exchanges the processed data packet with a second wireless access point, and then the second wireless access point processes the data packet received from the first wireless access point by complementary functionality, whereby the data packet can be processed by complete WLAN functionality.

On the contrary, as explained above, Dehner discloses that a provider to provide some functionality to a radio communication terminal is shifted from one WAP to another WAP. However, Dehner fails to disclose that a plurality of wireless access points cooperatively provide complementary functionality with a subset of complete functionality defined for the wireless local area network. Thus, Dehner fails to disclose, either expressly or inherently, each of the recited features of claim 9, including, for example, the features of: "...wherein each of the WAPs further processes the processed data units received from other WAPs with complementary functionality among the subset of defined WLAN functions..." and "...whereby a data unit for a mobile terminal is processed with complete WLAN functions by a plurality of said WAPs," as recited by claim 9.

The Office Action alleges that paragraph [0047] of Dehner discloses the feature of "...whereby a data unit for a mobile terminal is processed with complete WLAN functions by a plurality of said WAPs," among other features recited by claim 9. Paragraph [0047] of Dehner discusses how "[t]he CU 111 or 211 [FIG. 3] is suited for the received to receive from either the first NAP 103, 203 or the second NAP 105, 205, a message instructing the CU to establish a second connection using the second frequency hopping pattern with the second NAP 305." However, nothing in this paragraph discloses, either expressly or inherently, that a "data unit for a mobile terminal is <u>processed with complete WLAN functions by a plurality of said WAPs</u>," as recited by claim 9. Instead, the paragraph simply relates to how the CU may establish a second connection with the second NAP 305.

Therefore, Dehner fails to disclose, either expressly or inherently, each of the features recited by claim 9, and the rejection of claim 9 and all dependent claims therefrom should be withdrawn for at least this reason.

<u>Claims 13, 14 and 32</u>

Claim 13 is directed towards a "method for providing service in a wireless local area network (WLAN) that allows a defined WLAN function split between a wireless access point (WAP) and a single or plurality of Control Nodes (CN)" and recites the technical feature of "...the WAP discovers CNs that may <u>provide complementary WLAN functions</u> (emphasis added)."

The Office Action alleges that FIG. 7 of Dehner discloses this recited feature of claim 9. Office Action, pg. 6. However, FIG. 7 of Dehner discloses a method where a NAP stores IDs of each neighbor NAP to which handoff service can be shifted based on received signal strength (RSSI) or load. Thus, FIG. 7 fails to disclose that a NAP discovers a neighboring NAP that "...may <u>provide complementary WLAN functions</u>," as recited by claim 7.

Therefore, Dehner fails to disclose, either expressly or inherently, each of the features recited by claim 13, and the rejection of claim 13 and all dependent claims therefrom should be withdrawn for at least this reason.

Claim 32 recites substantially similar features to the features recited by claim 9 discussed above. Accordingly, it is respectfully submitted that the rejection of claim 32 should be withdrawn for substantially the same reasons that the rejection of claim 1 should be withdrawn.

Claims 15 and 16

Claim 15 is directed towards a "method for providing service in a wireless local area network (WLAN) that allows a defined WLAN function split between wireless access point (WAP) and a single or plurality of Control Nodes (CN)" and recites the technical feature of "...a CN dynamically discovers a capability of a WAP by sending a single or plurality of messages to the WAP, each of the messages containing a section that emulates a data unit sent by a mobile terminal." This feature is necessary for the CN to know each WAP's functionality, since it is assumed that each WAP has a different set of functional components (e.g., WAPs are manufactured by various vendors).

On the contrary, it is assumed in Dehner that all WAPs have the same and complete functionality. Therefore, Dehner fails to disclose the recited feature of "...a CN dynamically discovers a capability of a WAP by sending a single or plurality of messages to the WAP, each of the messages containing a section that emulates a data unit sent by a mobile terminal."

The Office Action alleges that this above-recited feature of claim 15 is disclosed at par. [0019] of Dehner, and more specifically, that the "respond with message" disclosed in par.

[0019] reads on the messages sent to the WAPs in claim 15. However, nothing in paragraph [0019] indicates that the "respond with message" has a section that "emulates a data unit sent by a mobile terminal," as recited by claim 15.

Therefore, Dehner fails to disclose, either expressly or inherently, each of the features recited by claim 15, and the rejection of claim 15 should be withdrawn for at least this reason.

Claim 16 recites the technical feature of "...a CN obtains a capability of the WAP." As explained above with respect to claim 15, Dehner fails to teach or suggest this recited feature of claim 16 because in Dehner, it is assumed that all WAPs have the same and complete functionality. Accordingly, it is respectfully submitted that the rejection of claim 16 should be withdrawn for substantially the same reasons that the rejection of claim 15 should be withdrawn.

Claims 17-22

Claim 17 is directed towards a "method for carrying out load balancing in a wireless local area network (WLAN) without requiring a mobile terminal to change an association relationship with a wireless access point (WAP)" and recites the feature of: "...said WAP tunnels a data unit from a mobile terminal to the said another WAP through the tunnel after processing said data unit with functions of the association specific part."

By way of review, Knauerhase discloses a technology for adaptive load-balancing by increasing a beacon interval corresponding to a first access point in order to detract clients. (Knaurhase, Abstract). However, Knauerhase fails to disclose the feature of "...said WAP tunnels a data unit from a mobile terminal to the said another WAP through the tunnel after processing said data unit with functions of the association specific part," as recited by claim 17.

The Office Action, page 9, alleges that Knauerhase discloses this recited feature at par. [0028], which describes how a "beacon interval" of "at least one second access point in the network may optionally be decreased." However, nothing in paragraph [0028] discloses, or even relates, to the recited feature of a WAP that "tunnels a data unit from a mobile terminal to the said another WAP through the tunnel after processing said data unit with functions of the association specific part," as recited by claim 17. Paragraph [0028] of Knauerhase does not even mention a tunnel, nor does it mention that a WAP processes a data unit with functions of an association specific part.

Therefore, Knauerhase fails to disclose, either expressly or inherently, each of the features recited by claim 17, and the rejection of claim 17 and all dependent claims therefrom should be withdrawn for at least this reason.

Claims 25-27 and 31

Claim 25 is directed towards a "method for accommodating variances in a wireless network topology" and recites the feature of "...dynamically adapting an operations logic of at least one network entity of said wireless network topology to alter processing of one or more functional sub-components." Thus, claim 25 is related to accommodating variances in a network topology or determining a network topology.

Dehner fails to disclose to accommodate variances in a network topology or determine a network topology.

The Office Action alleges that Dehner discloses this recited feature at paragraphs [0012] and [0047]. However, neither paragraph [0012] nor [0047] mention accommodating variances in a network topology, or otherwise determining a network topology. Furthermore, neither paragraph [0012] nor [0047] disclose, either expressly or inherently, the recited feature of altering "processing of one or more functional subcomponents," as recited by claim 25. Instead, par. [0012] describes how the disclosure of Dehner relates to providing "continuous service to communication units (CUs) operating therein or therewith," but makes no mention of altering the processing of one or more functional subcomponents. Par. [0047] describes how the CU 111 "is suited for the received to received from either the first NAP 103, 203 or the second NAP 105, 205, a message instructing the CU to establish a second connection using the second frequency hopping pattern with the second NAP 305." Again, this paragraph of Dehner does not disclose, either expressly or inherently, the recited features of claim 25.

Therefore, Dehner fails to disclose, either expressly or inherently, each of the features recited by claim 25, and the rejection of claim 25, and all dependent claims therefrom should be withdrawn for at least this reason.

Claim 31 recites the feature of "a first network entity alters a connectivity association with a second network entity by including one or more third network entities in a communication path of an alternate connectivity association." As explained above with respect to claim 25, Dehner does not disclose this recited feature. Accordingly, the rejection of claim 31 should be withdrawn for substantially the same reasons that the rejection of claim 25 should be withdrawn.

In view of the above, it is submitted that this application is in condition for allowance and a notice to that effect is respectfully solicited.

If any issues remain, which may best be resolved through a telephone communication, the Examiner is requested to telephone the undersigned at the local Washington, D.C. telephone number listed below.

Respectfully submitted,

/James Edward Ledbetter/

James E. Ledbetter
Registration No. 28,732

Date: June 28, 2010
JEL/DEA/att

Attorney Docket No. 008638-06115
Dickinson Wright PLLC
1875 Eye Street, NW, Suite 1200
Washington, DC 20006
Telephone: (202) 457-0160
Facsimile: (202) 659-1559
DC 8638-6115 154895

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of

Inventor:	Hong CHENG et al.	Art Unit 2617
Appln. No.:	10/591,184	Exr. J. Byrd
Filed:	August 30, 2006	Conf. No. 7759
For:	SYSTEM AND METHOD FOR NEGOTIATION OF WLAN ENTITY	

REQUEST FOR CONSIDERATION OF INFORMATION DISCLOSURE STATEMENT

Assistant Commissioner of Patents
Alexandria, VA 22314

Dear Sir:

With respect to the Information Disclosure Statement filed August 30, 2006, the Examiner returned a copy of the PTO-1449 in which foreign patent references JP 2000-069050 and JP 10-041969 were not indicated as having been considered. Applicants respectfully request the Examiner to initial and return a copy of the Form PTO-1449 indicating consideration of these two foreign patent references. The references in question were cited in the PCT International Search Report (ISR) dated May 17, 2005, and should be considered pursuant to MPEP 1893.03(g); for the Examiner's convenience, these two documents were loaded onto PAIR along with a Form PTO-1449 listing only these references via EFS on June 28, 2010. It is noted that PAIR contains a copy of the IDS, as well as a copy of the ISR.

If any fee is due it may be charged to Deposit Account 04-1061.

Respectfully submitted,

/James Edward Ledbetter/

Date: June 28, 2010
JEL/eks

James E. Ledbetter
Registration No. 28,732

ATTORNEY DOCKET NO. 008638-06115
Dickinson Wright PLLC
1875 Eye Street, N.W., Suite 1200
Washington, D.C. 20006
Telephone: 202.457.0160
Facsimile: 202.659.1559

DC 8638-6115 156149

SUBSTITUTE FOR FORM PTO-1449 U.S. Department of Commerce Patent and Trademark Office **INFORMATION DISCLOSURE STATEMENT BY APPLICANT** (Use several sheets if necessary)	ATTY. DOCKET NO. **008638-06115**	SERIAL NO. **10/591,184**
	APPLICANT **Hong CHENG, et al.**	
	FILING DATE **August 30, 2006**	GROUP **2617**

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CORRESPONDENT	DISCUSSED AND CITED IN SPEC? (insert page and line number where cited)

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CORRESPONDENT	TRANSLATION?	DISCUSSED AND CITED IN SPEC? (insert page and line number where cited)
	2000-069050	**03/2000**	**JP**		**Abstract**	
	10-041969	**02/1998**	**JP**		**Abstract**	

	OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc.)	DISCUSSED AND CITED IN SPEC?

EXAMINER: Initial if citation is considered, draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

(Form PTO-1449 [6-4])

DC 8638-6115 156150

PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2000-069050
(43)Date of publication of application : 03.03.2000

(51)Int.Cl. H04L 12/28
H04B 7/26
H04Q 7/38
H04L 12/56

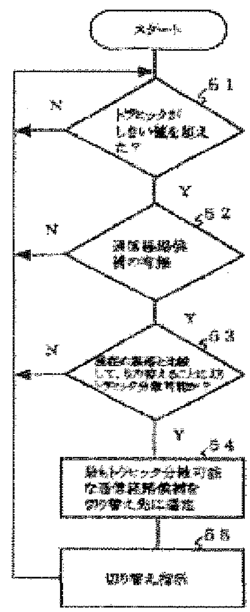
(21)Application number : 10-251775
(22)Date of filing : 24.08.1998

(71)Applicant : NIPPON TELEGR & TELEPH CORP <NTT>

(72)Inventor : KENGAKU AKIHIKO
ICHIKAWA TAKEO
TAKANASHI HITOSHI
MORIKURA MASAHIRO

(54) CENTRALIZED CONTROL ROUTE SWITCHING METHOD AND RADIO BASE STATION USING THE SAME

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a centralized control route switching method and a radio base station using the same with which the throughput of an entire system is improved on a radio network having a radio base station and a managing server when the throughput is lowered by the increase of traffic to the specified radio base station selected as a communication route at present by this managing server.
SOLUTION: The managing server has a first stage 51 for deciding traffic (Sa) of any radio base station (a) exceeds a threshold value and a second stage S5 for deciding whether traffic can be dispersed by switching to any communication route candidate when the traffic exceeds this threshold value and indicating switching to the communication route candidate to the said radio base station (b) when the traffic can be dispersed.



(19)日本国特許庁（ＪＰ）　(12) 公開特許公報（Ａ）　(11)特許出願公開番号
特開2000－69050
(P2000－69050A)
(43)公開日　平成12年３月３日(2000.3.3)

(51)Int.Cl.[7]	識別記号	ＦＩ		テーマコード*(参考)
Ｈ０４Ｌ　12/28		Ｈ０４Ｌ　11/00	３１０Ｂ	５Ｋ０３０
Ｈ０４Ｂ　7/26		Ｈ０４Ｂ　7/26	Ｋ	５Ｋ０３３
Ｈ０４Ｑ　7/38			Ｍ	５Ｋ０６７
Ｈ０４Ｌ　12/56			１０９Ｍ	
		Ｈ０４Ｌ　11/20	１０２Ｄ	

審査請求　未請求　請求項の数８　ＦＤ　（全　８　頁）

(21)出願番号　特願平10－251775

(22)出願日　平成10年８月24日(1998.8.24)

(71)出願人　000004226
日本電信電話株式会社
東京都千代田区大手町二丁目３番１号

(72)発明者　見学　昭彦
東京都新宿区西新宿三丁目19番２号　日本電信電話株式会社内

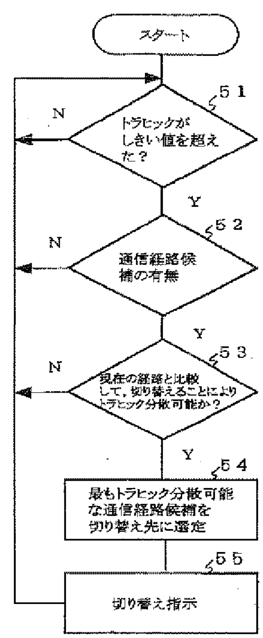
(72)発明者　市川　武男
東京都新宿区西新宿三丁目19番２号　日本電信電話株式会社内

(74)代理人　100074930
弁理士　山本　恵一

最終頁に続く

(54)【発明の名称】　集中制御経路切替方法及び該方法を用いた無線基地局

(57)【要約】
【課題】　無線基地局と管理サーバとを有する無線ネットワークで、該管理サーバが、現在通信経路として選択している特定の無線基地局へのトラヒックの増加によってスループットが低下している場合に、システム全体のスループットを改善させる集中制御経路切替方法及び該方法を用いた無線基地局を提供する。
【解決手段】　管理サーバが、いずれかの無線基地局ａのトラヒックＳａがしきい値を超えたことを判定する第１の段階と、該しきい値を越えた際に、通信経路候補への切替によりトラヒック分散が可能かどうかを判定し、トラヒック分散可能であれば、前記無線基地局ｂに通信経路候補への切替を指示する第２の段階とを有する。



【特許請求の範囲】
【請求項１】　無線基地局と、該無線基地局の一群を制御する管理サーバとを有する無線ネットワークであって、該管理サーバは、予め、現在通信経路を設定している無線基地局と、現在通信経路を設定していないが通信経路の候補となりうる無線基地局とを把握しており、必要に応じて現在通信経路を設定している無線基地局を、通信経路の候補へ切り替える指示を与える集中制御経路切替方法において、
前記管理サーバは、
前記無線基地局が転送するトラヒックを監視し、いずれかの無線基地局ａが転送するトラヒックＳａがしきい値を超えたことを判定する第１の段階と、
前記第１の段階で、トラヒックＳａがしきい値を越えた際に、無線基地局ａに通信経路を設定している無線基地局ｂついて、該無線基地局ｂが現在通信経路として設定している該無線基地局ａ以外の通信経路候補となりうる無線基地局がある場合、通信経路候補への切替によりトラヒック分散が可能かどうかを判定し、トラヒック分散可能であれば、前記無線基地局ｂに通信経路候補への切替を指示する第２の段階とを有することを特徴とする集中制御経路切替方法。
【請求項２】　無線基地局と、該無線基地局の一群を制御する管理サーバとを有する無線ネットワークであって、該管理サーバは、予め、現在通信経路を設定している無線基地局と、現在通信経路を設定していないが通信経路の候補となりうる無線基地局とを把握しており、必要に応じて現在通信経路を設定している無線基地局を、通信経路の候補へ切り替える指示を与える集中制御経路切替方法において、
前記管理サーバは、
前記無線基地局が転送するトラヒックを監視し、いずれかの無線基地局ａが転送するトラヒックＳａがしきい値を超えたことを判定する第１の段階と、
前記第１の段階で、前記無線基地局ｂの通信経路候補となりうる無線基地局ｃのトラヒックをＳｃ、前記無線基地局ｂが無線基地局ａへ転送するトラヒックをＳｂａ、及び予め定められたしきい値をαとした際に、Ｓａ－Ｓｂａ－Ｓｃ≧αを満足するならば、前記無線基地局ｂの前記無線基地局ａに対する通信経路を前記無線基地局ｃへ切替指示を与える第２の段階とを有することを特徴とする集中制御経路切替方法。
【請求項３】　前記第２の段階について、前記Ｓａ－Ｓｂａ－Ｓｃ≧αを満足する前記無線基地局ｂ及び前記無線基地局ｃの組み合わせが複数存在する場合に、Ｓａ－Ｓｃが最大となる前記無線基地局ｂに前記無線基地局ｃへの切替を指示し、Ｓａ－Ｓｃが最大の前記無線基地局ｂ及び前記無線基地局ｃの組み合わせが複数存在する場合に、更にＳｂａが最大の前記無線基地局ｂに前記無線基地局ｃへの切替を指示することを特徴とする請求項２に記載の集中制御経路切替方法。
【請求項４】　無線基地局と、該無線基地局の一群を制御する管理サーバとを有する無線ネットワークであって、該管理サーバは、予め、現在通信経路を設定している無線基地局と、現在通信経路を設定していないが通信経路の候補となりうる無線基地局とを把握しており、必要に応じて現在通信経路を設定している無線基地局を、通信経路の候補へ切り替える指示を与える集中制御経路切替方法において、
前記管理サーバは、前記無線基地局が現在設定している通信経路の有線ネットワークまでの中継無線基地局数に比べて、通信経路候補を介した通信経路の方がより中継無線基地局数が少ない場合、前記無線基地局に前記通信経路候補への切替を指示することを特徴とする集中制御経路切替方法。
【請求項５】　前記無線基地局は、現在通信経路に選択している無線基地局と、通信経路の候補となりうる無線基地局との情報を前記管理サーバに通知し、該管理サーバは、該情報を管理することを特徴とする請求項１又は４に記載の集中制御経路切替方法。
【請求項６】　前記無線基地局は、通信経路設定時に、他の無線基地局が周期的に報知するビーコンを受信して１つ以上の該ビーコンを選択し、選択した前記ビーコンの中からどれか１つのビーコンの送信元の無線基地局配下に帰属して、通信経路を開設し、
前記無線基地局は、選択したビーコン送信元の無線基地局を通信経路として管理サーバに通知し、その他のビーコン送信元無線基地局を通信経路の候補として前記管理サーバに通知し、
前記管理サーバは、前記通知された、前記無線基地局の現在通信経路に選択している無線基地局と、現在通信経路には選択されていない通信経路の候補となる無線基地局との情報を管理することを特徴とする請求項１又は４に記載の集中制御経路切替方法。
【請求項７】　前記無線基地局にネットワーク管理プロトコルにおけるエージェントを実装し、前記管理サーバにネットワーク管理プロトコルにおけるマネージャを実装し、該エージェントと該マネージャとの間の通信はネットワーク管理プロトコルにより行い、前記無線基地局と前記管理サーバとの間の通信は、該エージェントと該マネージャとを介して行うことを特徴とする請求項１から６のいずれか１項に記載の集中制御切替方法。
【請求項８】　前記請求項１から７のいずれか１項に記載の集中制御経路切替方法を有することを特徴とする無線基地局。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】本発明は、無線基地局と管理サーバとを有する無線ネットワークであって、該管理サーバが、必要に応じて現在通信経路を設定している無線

基地局を、通信経路の候補へ切り替える指示を与える集中制御経路切替方法に関する。

【０００２】

【従来の技術】図１は、ＩＥＥＥ８０２．１１において標準化が進められている無線ＬＡＮを用いたネットワーク構成図である。ＩＥＥＥ８０２．１１とは、物理層にＣＤＭＡ方式を、ＭＡＣ層にＣＳＭＡ／ＣＤ方式を採用した、１～２Ｍｂｐｓ程度の中速無線ＬＡＮの規格である。

【０００３】該図１には、有線ネットワークに接続されたホストコンピュータ、ＳＮＭＰ(Simple Network Management Protocol)マネージャと、Ｐｏｒｔａｌ１及び２と、該Ｐｏｒｔａｌと無線通信を行うＡＰ１、２及び３と、該ＡＰと無線通信を行うＳＴＡ１、２及び３とが構成されている。

【０００４】無線基地局であるＡＰ（アクセスポイント）は基本サービスエリアを構成しており、Ｐｏｒｔａｌは、有線ネットワークと無線ネットワークとを接続する機能を有するＡＰである。従って、ＡＰは特定のＰｏｒｔａｌの配下に帰属して、通信経路を設定する。該図１では、ＡＰ１及びＡＰ２はＰｏｒｔａｌ１に、ＡＰ３はＰｏｒｔａｌ２に帰属している。

【０００５】ＳＴＡは無線端末であり、基本サービスエリア内でＡＰと自由に移動して通信を行うことが可能である。ＳＴＡは、他の基本サービスエリア内のＳＴＡ、又は有線ネットワークに接続されている端末と通信を行うためにはＰｏｒｔａｌを介して通信を行う。以下、本発明においてはＡＰ，Ｐｏｒｔａｌの動作に関するため、ＳＴＡの動作については説明を省略する。

【０００６】従来のＡＰは、Ｐｏｒｔａｌに一旦帰属した後は、同じＰｏｒｔａｌに帰属し続ける。例えばＡＰ２からホストへのアクセスは、ＡＰ２→Ｐｏｒｔａｌ１→ホストという通信経路を選択している。

【０００７】

【発明が解決しようとする課題】しかしながら、図１の例において、有線ネットワークの伝送容量にはまだ十分に余裕があるにもかかわらず、ＡＰ１のトラヒックが急増し、周波数ｆ１の使用率が大きくなった場合、ｆ１の容量（無線帯域）不足がボトルネックとなり、Ｐｏｒｔａｌ１配下に帰属しているＡＰ１、ＡＰ２は十分なスループットが得られないケースが生じる。

【０００８】本発明の目的は、前述の不都合を回避することにあり、ＡＰとＰｏｒｔａｌとの通信経路を自動的に切り替え、トラヒックを分散することにより、システム全体のスループットを向上させることにある。

【０００９】

【課題を解決するための手段】本発明による集中制御経路切替方法は、管理サーバが、無線基地局が転送するトラヒックを監視し、いずれかの無線基地局ａが転送するトラヒックＳａがしきい値を超えたことを判定する第１の段階と、該第１の段階で、トラヒックＳａがしきい値を越えた際に、無線基地局ａに通信経路を設定している無線基地局ｂにいて、該無線基地局ｂが現在通信経路として設定している該無線基地局ａ以外の通信経路候補となりうる無線基地局がある場合、通信経路候補への切替によりトラヒック分散が可能かどうかを判定し、トラヒック分散可能であれば、前記無線基地局ｂに通信経路候補への切替を指示する第２の段階とを有するものである。

【００１０】本発明による他の集中制御経路切替方法は、管理サーバが、無線基地局が転送するトラヒックを監視し、いずれかの無線基地局ａが転送するトラヒックＳａがしきい値を超えたことを判定する第１の段階と、該第１の段階で、無線基地局ｂの通信経路候補となりうる無線基地局ｃのトラヒックをＳｃ、無線基地局ｂが無線基地局ａへ転送するトラヒックをＳｂａ、及び予め定められたしきい値をαとした際に、Ｓａ－Ｓｂａ－Ｓｃ≧αを満足するならば、無線基地局ｂの無線基地局ａに対する通信経路を無線基地局ｃへ切替指示を与える第２の段階とを有するものである。

【００１１】本発明による他の実施形態において、第２の段階について、Ｓａ－Ｓｂａ－Ｓｃ≧αを満足する無線基地局ｂ及び無線基地局ｃの組み合わせが複数存在する場合に、Ｓａ－Ｓｃが最大となる無線基地局ｂに無線基地局ｃへの切替を指示し、Ｓａ－Ｓｃが最大の無線基地局ｂ及び無線基地局ｃの組み合わせが複数存在する場合に、更にＳｂａが最大の無線基地局ｂに無線基地局ｃへの切替を指示するものである。

【００１２】本発明による他の集中制御経路切替方法は、管理サーバが、無線基地局が現在設定している通信経路の有線ネットワークまでの中継無線基地局数に比べて、通信経路候補を介した通信経路の方がより中継無線基地局数が少ない場合、無線基地局に通信経路候補への切替を指示するものである。

【００１３】本発明による他の実施形態において、無線基地局は、現在通信経路に選択している無線基地局と、通信経路の候補となりうる無線基地局との情報を管理サーバに通知し、該管理サーバは、該情報を管理するものである。

【００１４】本発明による他の実施形態において、無線基地局は、通信経路設定時に、他の無線基地局が周期的に報知するビーコンを受信して１つ以上の該ビーコンを選択し、選択したビーコンの中からどれか１つのビーコンの送信元の無線基地局配下に帰属して、通信経路を開設する段階と、無線基地局は、選択したビーコン送信元の無線基地局を通信経路として管理サーバに通知し、その他のビーコン送信元無線基地局を通信経路の候補として前記管理サーバに通知し、管理サーバは、通知された無線基地局の現在通信経路に選択している無線基地局と、現在通信経路には選択されていない通信経路の候補

となる無線基地局の情報を管理するものである。

【００１５】本発明による他の実施形態において、無線基地局にネットワーク管理プロトコルにおけるエージェントを実装し、管理サーバにネットワーク管理プロトコルにおけるマネージャを実装し、該エージェントと該マネージャとの間の通信はネットワーク管理プロトコルにより行い、無線基地局と管理サーバとの間の通信は、該エージェントと該マネージャとを介して行うものである。

【００１６】本発明による他の実施形態として、前述した集中制御経路切替方法を有する無線基地局がある。

【００１７】

【発明の実施の形態】前述した図１を用いて、Ｐｏｒｔａｌ１配下のＡＰ１のトラヒックの増加によって、Ｐｏｒｔａｌ１のトラヒック負荷が増加した場合に、本発明を適用した実施形態を説明する。本発明では、このような場合、現在選択している通信経路（ＡＰ２→Ｐｏｒｔａｌ１）を他のトラヒックの少ない経路（ＡＰ２→Ｐｏｒｔａｌ２）へと切り替えることにより、トラヒックの分散を図ることが可能である。

【００１８】ここで、Ｐｏｒｔａｌ及びＡＰには、ＳＮＭＰエージェントが実装されており、ＳＮＭＰマネージャによりＳＮＭＰを使ったネットワーク管理又はシステム管理が行われている。また、Ｐｏｒｔａｌ及びＡＰは装置固有アドレス（ＭＡＣアドレス）を有している。

【００１９】このような経路切替時に使用するトポロジマップを作成又は更新する方法について、以下に説明する。

【００２０】図２は、本発明における第１のトポロジマップ作成更新シーケンス図である。

【００２１】最初に、ＡＰが起動する（２１）と、周波数をスキャンして（２２）、Ｐｏｒｔａｌや他のＡＰが周期的に報知するビーコン信号を１つ又は複数受信し、例えば電界強度最大のＰｏｒｔａｌ／ＡＰを帰属先Ｐｏｒｔａｌ／ＡＰとして選択し（２３）、配下に帰属して（２４）通信路を開設すると共に、ビーコンの送信を開始する。このとき、周期的に報知する１つ又は複数のビーコン信号を受信し、例えば電界強度最大のＰｏｒｔａｌ／ＡＰを帰属先Ｐｏｒｔａｌ／ＡＰとして選択し（２５）、配下に帰属して通信路を開設する。

【００２２】次に、ＡＰは、マネージャにトポロジ変更を通知するＴＲＡＰメッセージを送信する（２６）。該マネージャは、ＴＲＡＰメッセージを受信すると、トポロジ情報を得るためのＧＥＴメッセージをＡＰに送信する（２７）。ＧＥＴメッセージを受信したＡＰは、トポロジ情報を含んだＧＥＴ応答メッセージを返信し（２８）、これを受信したマネージャではトポロジマップを作成更新する（２９）。

【００２３】トポロジ情報はＳＮＭＰにおける管理オブジェクトとして予め定義されており、装置種別（Ｐｏｒｔａｌ／ＡＰ）、通信経路アドレス、及び通信経路候補アドレスから構成される。該通信経路とは、帰属中のＰｏｒｔａｌ／ＡＰのＮＭＡＣアドレスを示す。通信経路候補とは、帰属していないＰｏｒｔａｌ／ＡＰのＭＡＣアドレスを示す。

【００２４】図３は、本発明の第２のトポロジマップ作成更新シーケンス図である。

【００２５】最初に、ＡＰが起動する（３１）と、周波数をスキャンして（３２）、ビーコンの送信を開始する（３３）。

【００２６】次に、ＡＰは、マネージャにトポロジ変更を通知するＴＲＡＰメッセージを送信する（３４）。該マネージャは、ＴＲＡＰメッセージを受信すると、トポロジ情報を得るためのＧＥＴメッセージをＡＰに送信する（３５）。ＧＥＴメッセージを受信したＡＰは、トポロジ情報を含んだＧＥＴ応答メッセージを返信し（３６）、これを受信したマネージャではトポロジマップを作成更新する（３７）。

【００２７】図４は、本発明におけるトポロジマップを表している。ＡＰ２は現在設定している経路Ｐｏｒｔａｌ１の他に、通信経路候補Ｐｏｒｔａｌ２を有している。マネージャは、Ｐｏｒｔａｌ１のスループットがしきい値を超えたとき、Ｐｏｒｔａｌ１とＰｏｒｔａｌ２とのトラヒックを比較し、経路を切り替えることによってトラヒックの分散が図られるかどうかを判定し、トラヒック分散可能と判定すると、ＡＰ２に対してＰｏｒｔａｌ２への切替の指示を行う。その後、ＡＰ２が指示に従い、経路をＰｏｒｔａｌ１からＰｏｒｔａｌ２へ切り替える。

【００２８】図５は、マネージャの経路切り替えにおける第１の実施形態のフローチャートである。最初に、トラヒックがしきい値を越えたかどうか（５１）を判定する。マネージャは、ＳＮＭＰを用いてＡＰから定期的に通知されるトラヒック情報（受信パケット数、送信パケット数など）と、予め定めたしきい値を超えた場合にＡＰより通知されるＴＲＡＰとに基づいてトラヒックを知ることができる。該しきい値を越えていれば、次にトポロジマップを参照し、通信経路候補の有無（５２）を判定する。該通信経路候補が有れば、次に現在の経路と比較して、切り替えることによりトラヒック分散可能かどうか（５３）を判定する。該トラヒック分散可能であれば、最もトラヒック分散可能な通信経路候補を切り替え先に選定（５４）し、該選定された通信経路候補に切り替え指示（５５）される。

【００２９】図６は、マネージャの経路切り替えにおける第２の実施形態のフローチャートである。最初に、トラヒックがしきい値を越えたがどうか（６１）を判定する。該しきい値を越えていれば、次に$Sa-Sba-Sc \geqq \alpha$を満足するかどうか（６２）を判定する。該αがそれを満足するならば、次に$Sa-Sba-Sc \geqq \alpha$を

満足する切替経路候補が複数あるかどうか（６３）を判定する。該候補が１つしかなければ、その切替経路候補に切り替え指示（６７）をする。該候補が複数あれば、次にＳａ－Ｓｃが最大となる通信経路候補を選択する（６４）。次に該Ｓａ－Ｓｃが最大となる通信経路候補が複数あるかどうか（６５）を判定する。該候補が１つしかなければ、その切替経路候補に切り替え指示（６７）をする。該候補が複数あれば、次にＳｂａが最大の通信経路候補を選択する（６６）。そして、選択されたその切替経路候補に切り替え指示（６７）をする。

【００３０】図には記載していないが、マネージャの経路切り替えにおける第３の実施形態として、管理サーバが、無線基地局が現在設定している通信経路の有線ネットワークまでの中継無線基地局数に比べて、通信経路候補を介した通信経路の方がより中継無線基地局数が少ない場合、無線基地局に通信経路候補への切替を指示することもできる。

【００３１】以上詳細に説明した実施形態について、本発明の技術思想及び見地の範囲の種々の変更、修正及び省略は、当業者によれば容易に行うことができる。従って、前述した実施形態では、あくまで例であって、何等制約しようとするものではない。本発明は、特許請求の範囲及びその均等物として限定するものだけに制約される。

【００３２】

【発明の効果】以上に述べたように、本発明によれば、有線ネットワークの容量には十分余裕があるにもかかわらず、現在通信経路として選択している特定のＡＰへの＊＊トラヒックの増加がボトルネックとなり、スループットが低下している場合に、トラヒックの集中を分散させ、システム全体のスループットが改善されるようにする。これは、トポロジマップを参照し、現在通信経路に選択しているＡＰと、現在通信経路には選択していないが周辺の他のトラヒックの少ないＡＰとの通信経路を切り替えることにより行われる。

【００３３】また、周辺のＡＰのトラヒックが多く、切り替えてもトラヒック分散の効果がない場合は、切替指示をしない。従って、無駄な切替起動を防止できる。

【００３４】更に、αの値を調整することにより、切替回数を抑制することも可能である。

【００３５】更に、現在設定している通信経路より、有線ネットワークへのホップ数の少ない通信経路がある場合、マネージャから切り替え指示をすることにより、よりホップ数の少ない経路への切り替えが可能である。

【図面の簡単な説明】

【図１】従来の無線ＬＡＮを用いたＩＥＥＥ８０２．１１のネットワーク構成図である。

【図２】本発明による第１の実施形態におけるトポロジマップ作成更新シーケンス図である。

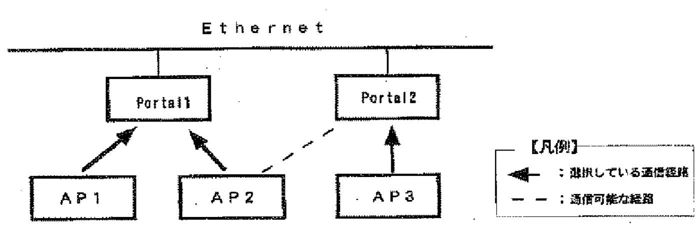
【図３】本発明による第２の実施形態におけるトポロジマップ作成更新シーケンス図である。

【図４】本発明によるトポロジマップである。

【図５】本発明によるマネージャの経路切り替えの第１の実施形態のフローチャートである。

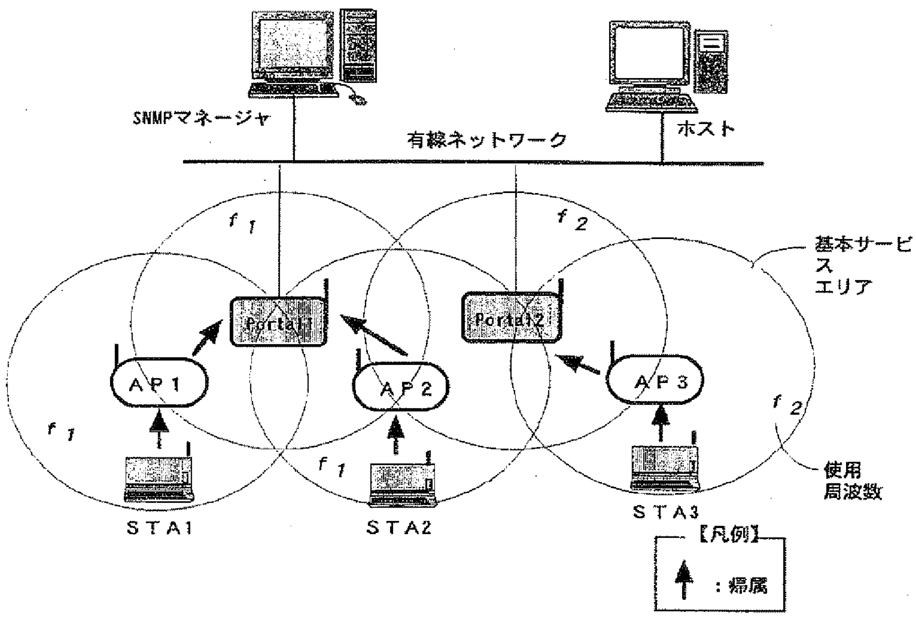
【図６】本発明によるマネージャの経路切り替えの第２の実施形態のフローチャートである。

【図４】

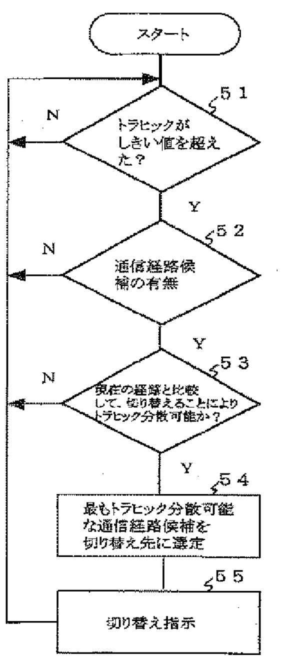


トポロジマップ

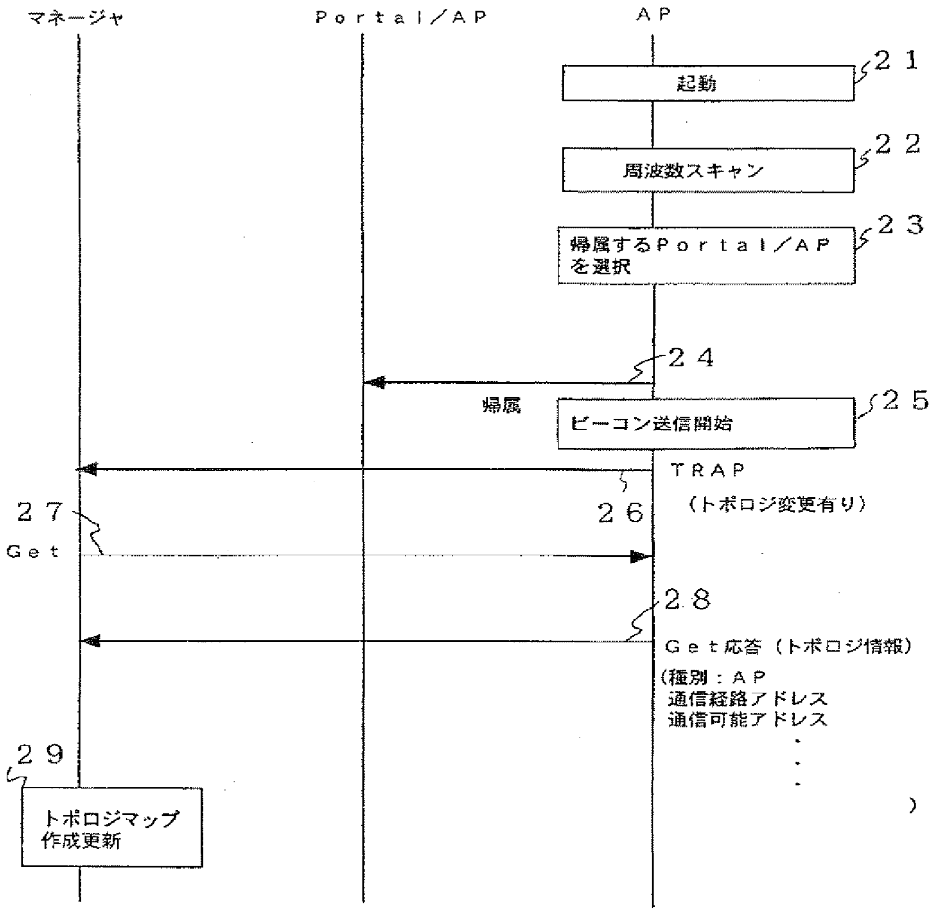
【図1】


SNMPマネージャ
有線ネットワーク
ホスト
f1
f2
基本サービス
エリア
Portal1
Portal2
AP1
AP2
AP3
f1
f1
f2
使用
周波数
STA1
STA2
STA3
【凡例】
：帰属

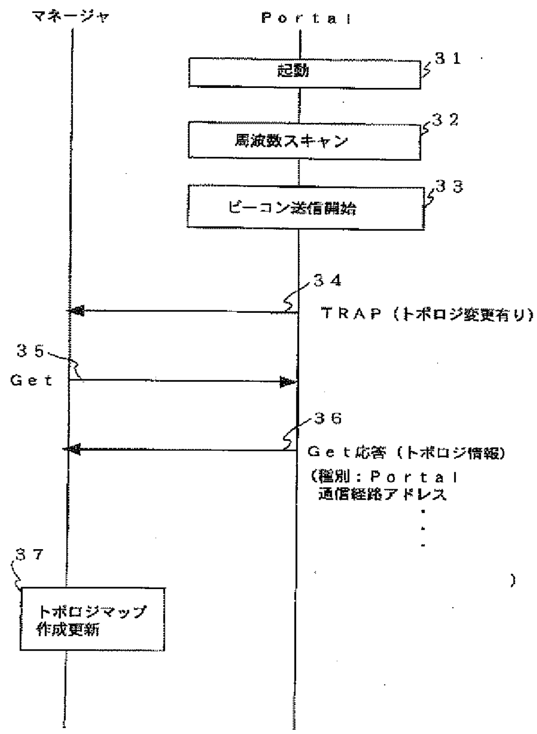
【図5】


スタート
51
トラヒックがしきい値を超えた？
N
Y
52
通信経路候補の有無
N
Y
53
現在の経路と比較して、切り替えることによりトラヒック分散可能か？
N
Y
54
最もトラヒック分散可能な通信経路候補を切り替え先に選定
55
切り替え指示

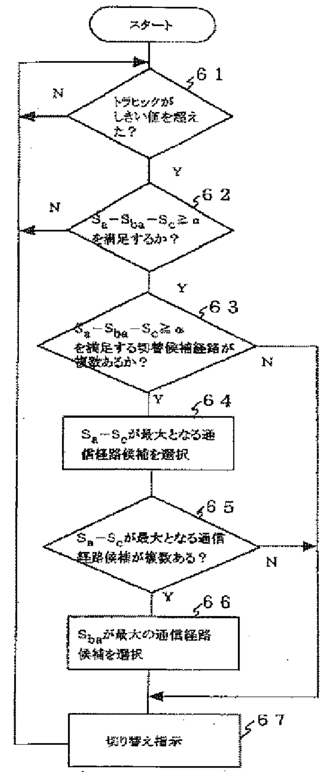
【図２】


マネージャ
Ｐｏｒｔａｌ／ＡＰ
ＡＰ
２１
起動
２２
周波数スキャン
２３
帰属するＰｏｒｔａｌ／ＡＰを選択
２４
帰属
２５
ビーコン送信開始
ＴＲＡＰ
（トポロジ変更有り）
２６
２７
Ｇｅｔ
２８
Ｇｅｔ応答（トポロジ情報）
（種別：ＡＰ
通信経路アドレス
通信可能アドレス
・
・
・
）
２９
トポロジマップ作成更新

【図３】



【図６】



フロントページの続き

(72)発明者　高梨　斉
東京都新宿区西新宿三丁目19番２号　日本
電信電話株式会社内
(72)発明者　守倉　正博
東京都新宿区西新宿三丁目19番２号　日本
電信電話株式会社内

Ｆターム(参考)　5K030 GA13 HA08 HB14 JA11 JL01
JT06 LB07 LB09 LC11 LE03
MB02 MB09 MB16
5K033 AA03 CB06 CB08 DA03 DA19
DB01 DB18 EA07
5K067 AA12 BB21 DD19 DD57 EE01
EE02 EE10 HH22 JJ71

PATENT ABSTRACTS OF JAPAN

(11)Publication number : 10-041969
(43)Date of publication of application : 13.02.1998

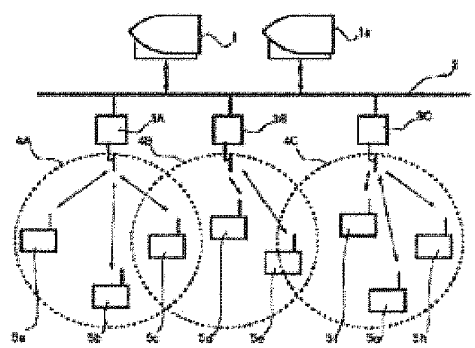
(51)Int.Cl. H04L 12/46
H04L 12/28
H04Q 7/38
H04L 12/40
H04Q 7/34

(21)Application number : 08-190273
(22)Date of filing : 19.07.1996

(71)Applicant : NEC ENG LTD
(72)Inventor : NOMURA YOJIRO

(54) RADIO LAN SYSTEM

(57)Abstract:
PROBLEM TO BE SOLVED: To efficiently assign radio terminal equipments to be contained in a radio base station.
SOLUTION: A plurality of radio base stations 3A-3C are connected via a wired LAN 2. A management terminal equipment 1a to assign radio terminal equipments to be contained in each of the radio base stations 3A-3C is connected to the wired LAN 2. Radio terminal equipments 5a-5h send a connection request signal to all the radio base stations 3A-3C. The radio base stations 3A-3C transfer the connection request signal sent from the radio terminal equipments together with its signal level to the management terminal equipment 1a. The management terminal equipment 1a assigns a proper number of radio terminal equipments to be connected to the radio base stations based on the connection request signal and its signal level.



(19)日本国特許庁（ＪＰ）　　(12) **公開特許公報**（Ａ）　　(11)特許出願公開番号

特開平10－41969

(43)公開日　平成10年(1998) ２月13日

(51)Int.Cl.⁶	識別記号	庁内整理番号	ＦＩ		技術表示箇所
Ｈ０４Ｌ　12/46			Ｈ０４Ｌ　11/00	３１０Ｃ	
12/28			Ｈ０４Ｂ　7/26	１０９Ｍ	
Ｈ０４Ｑ　7/38			Ｈ０４Ｌ　11/00	３２１	
Ｈ０４Ｌ　12/40			Ｈ０４Ｑ　7/04	Ｃ	
Ｈ０４Ｑ　7/34					

審査請求　未請求　請求項の数４　ＯＬ　（全 ７ 頁）

(21)出願番号　特願平8－190273

(22)出願日　平成８年(1996) ７月19日

(71)出願人　000232047
日本電気エンジニアリング株式会社
東京都港区芝浦三丁目18番21号

(72)発明者　野村　洋二郎
東京都港区芝浦三丁目18番21号　日本電気エンジニアリング株式会社内

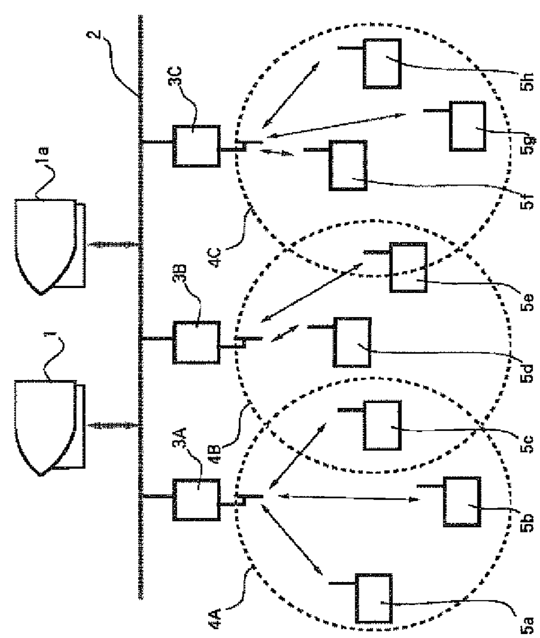
(74)代理人　弁理士　鈴木　正剛

(54)【発明の名称】　無線ＬＡＮシステム

(57)【要約】　（修正有）

【課題】　無線基地局に収容される無線端末の効率的な割り付けを行う。

【解決手段】複数の無線基地局３Ａ～３Ｃを有線ＬＡＮ２を介して接続する。有線ＬＡＮ２には個々の無線基地局３Ａ～３Ｃに収容される無線端末の割り付けを行うための管理端末１ａが接続される。各無線端末５ａ～５ｈは、全ての無線基地局３Ａ～３Ｃに対して接続要求信号を送信する。無線基地局３Ａ～３Ｃは、無線端末から送信されてきた接続要求信号をその信号レベルとともに管理端末１ａに転送する。管理端末１ａは、接続要求信号、該信号レベルに基づいて、無線基地局に、接続すべき無線端末の適正台数を割り付ける。



【特許請求の範囲】

【請求項１】　複数の無線基地局が有線ＬＡＮを介して接続され、各無線基地局に任意の無線端末が収容される無線ＬＡＮシステムにおいて、
前記無線端末は、各無線基地局と接続するための全てのネットワークＩＤを有して、稼働時に各無線基地局に接続要求信号を送信する手段を備えてなり、
前記無線基地局は、前記無線端末から送信されてくる前記接続要求信号を受信するとともに該接続要求信号を前記有線ＬＡＮに送出する手段を備えてなることを特徴とする無線ＬＡＮシステム。

【請求項２】　前記無線基地局は、さらに、前記無線端末から送信されてくる前記接続要求信号を受信したときの信号レベルを計測する手段と、前記接続要求信号とともに前記信号レベルを前記有線ＬＡＮへ送出する手段とを備えてなることを特徴とする請求項１記載の無線ＬＡＮシステム。

【請求項３】　複数の前記無線基地局のそれぞれから転送されてくる前記接続要求信号、前記信号レベル、及び各無線基地局に収容される適正無線端末台数値に基づいて、それぞれの無線端末が収容されるべき無線基地局を割り付ける管理端末を備えることを特徴とする請求項２記載の無線ＬＡＮシステム。

【請求項４】　前記管理端末は、前記無線基地局の基本サービスエリアを識別するエリアＩＤ、該無線基地局に収容される適正無線端末台数値、無線端末識別ＩＤ、及び前記信号レベルを格納したエリア管理テーブルを備えてなることを特徴とする請求項３記載の無線ＬＡＮシステム。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、無線ローカル・エリア・ネットワーク（以下、無線ＬＡＮ）システムに係り、特に、無線ＬＡＮを構成する無線基地局に配置される無線端末の割り当て方式に関する。

【０００２】

【従来の技術及び発明が解決しようとする課題】近年、パーソナルコンピュータ（以下、ＰＣ）をＬＡＮで接続して使用することが一般的になってきている。現在、ＬＡＮは、ケーブルを敷設してＰＣを結ぶ有線方式が大半であるが、無線装置間を結ぶ無線ＬＡＮも普及し始めている。この無線ＬＡＮの場合、電波が届く範囲が限られているため、ネットワークの全てを無線ＬＡＮで結ぶことは困難である。このため、有線ローカル・エリア・ネットワーク（以下、有線ＬＡＮ）を併用して無線ＬＡＮシステムを構築することが一般的に行われている。この有線ＬＡＮを併用した無線ＬＡＮシステムでは、図７に示すように、広い範囲をカバーする基幹回線として、有線ＬＡＮ１２が用いられる。この有線ＬＡＮ１２には、少なくとも一つのＰＣ１１と、無線ＬＡＮとの橋渡しをする無線基地局１３Ａ，１３Ｂ，１３Ｃとが接続される。それぞれの無線基地局１３Ａ，１３Ｂ，１３Ｃを中心に無線データ通信が行える範囲が無線ＬＡＮの基本サービスエリア（以下、ＢＳＡ）である。ＢＳＡ内にある無線端末、例えば、ＢＳＡ４Ａ内にある無線端末５ａ，５ｂ，５ｃは、互いに無線により通信を行うことができる。しかし、異なるＢＳＡにある無線端末装置、例えば、無線端末５ａと無線端末５ｈとは、無線基地局１３Ａ、無線基地局１３Ｃと有線ＬＡＮ１２を経由しなければ通信できない。

【０００３】また、隣接するＢＳＡ間、例えば、図示のＢＳＡ４ＡとＢＳＡ４Ｂとの間、あるいはＢＳＡ４ＢとＢＳＡ４Ｃとの間では、電波の混信を避けるため、データのパケット単位にネットワークＩＤを付加したり、使用する電波の周波数を変えたりするのが一般的である。しかし、上記方式による無線端末装置の所属する無線基地局の決定は、無線基地局からの応答の正しさと早さにより機械的に決まってしまい、ＢＳＡ内の無線端末装置の多い少ないのバランスは考慮されない。さらに、最も近い無線基地局が、他の無線端末装置との通信を行っていたことにより応答が遅れ、次に近い無線基地局に所属してしまうという不合理が生じる場合もある。通常、ＢＳＡはオーバーラップしており、厳密にどちらのＢＳＡでなければならないということがいえないエリアが存在する。

【０００４】本発明は、かかる問題点を解消し、複数の無線基地局に接続する無線端末を適正信号レベルで適正台数割り付けることができる、改良された無線ＬＡＮシステムを提供することにある。

【０００５】

【課題を解決するための手段】本発明は、複数の無線基地局が有線ＬＡＮを介して接続され、各無線基地局には任意の無線端末が収容される無線ＬＡＮシステムに適用される。無線端末には、各無線基地局と接続するための全てのネットワークＩＤを割り当てる。そして稼動時に各無線基地局に接続要求信号を送信する手段を設ける。また、各無線基地局には、各無線端末から送信されてくる接続要求信号を受信するとともに該接続要求信号を有線ＬＡＮへ送出する手段を設ける。

【０００６】無線基地局には、さらに、各無線端末から送信されてくる接続要求信号を受信したときの信号レベルを計測する手段と、接続要求信号とともに前記信号レベルを有線ＬＡＮへ送出する手段を備え、前記管理端末は、前記複数の無線基地局のそれぞれから転送されてくる接続要求信号と前記信号レベルと各無線基地局に収容される適正無線端末台数値とに基づいて、それぞれの無線端末が収容されるべき無線基地局を割り付ける手段と、前記無線基地局の基本サービスエリア（以下、ＢＳＡ）を識別するエリアＩＤと該無線基地局に収容される適正無線端末台数値と無線端末識別ＩＤと前記信号レベ

ルとからなるエリア管理テーブルを備えたことを特徴とする。

【０００７】

【発明の実施の形態】以下、図面を参照して本発明の実施の形態を説明する。図１は、本発明の一実施形態の無線ＬＡＮシステムの構成図である。この無線ＬＡＮシステムは、有線ＬＡＮ２に、少なくとも一つのＰＣ１と、３つの無線基地局３Ａ，３Ｂ，３Ｃとが接続されている。符号４Ａ、４Ｂ、４Ｃは、無線基地局３Ａ、３Ｂ、３Ｃに対応するＢＳＡであり、便宜上、図７に示したものと同一のものとする。各ＢＳＡの識別は、ネットワークＩＤ（以下、ＮＷＩＤ）により行われる。また、各ＢＳＡとその範囲に存する無線端末５ａ～５ｈは、図７に示したものと同一のものであり、後述の管理端末１ａによって管理されている。なお、管理端末１ａは、図示のように単独に設けず、ＰＣ１が管理端末１ａの機能を併有するように構成してもよい。

【０００８】図２は、本実施形態によるＢＳＡと電波伝搬範囲との関係を示す図である。一点鎖線で示される各ＢＳＡ４ａ，４ｂ，４ｃ内にある無線端末は、それぞれのＢＳＡ内の無線基地局と安定した通信を行うことができるようになっている。その範囲内での信号レベルは“１”から“９”のように表され、大きい値ほど信号レベルが高い。

【０００９】また、破線で示されるエリア６Ａ、６Ｂ、６Ｃは、それぞれ無線基地局３Ａ、３Ｂ、３Ｃとは安定した通信は行えないが、他の通信の妨害となる微弱電波が届く範囲であり、その範囲内の信号レベルは“０．１”から“０．９”のように表され、大きい値ほど信号レベルが高い。

【００１０】図３は、無線端末５ａ～５ｈが管理端末１ａからＢＳＡ決定通知を受信するまでの通信手順を示した図である。各無線端末は、何れの無線基地局３Ａ～３Ｃとも通信できるように、この無線ＬＡＮシステムで使用する全てのＮＷＩＤ（ＮＷＩＤ１、ＮＷＩＤ２、ＮＷＩＤ３）を保持している。ＮＷＩＤ１は、無線基地局３Ａが、ＮＷＩＤ２は無線基地局３Ｂが、ＮＷＩＤ３は無線基地局３Ｃに対応するＮＷＩＤである。

【００１１】ある無線端末、例えば無線端末５ａは、稼働の際、保持している各ＮＷＩＤにより逐次無線基地局３Ａ，３Ｂ，３Ｃに接続要求信号を送る。無線基地局３Ａ，３Ｂ，３Ｃは、自局に対応したＮＷＩＤにより送信されてくる要求信号のみを受信し、これをその受信レベルの情報と共に有線ＬＡＮ２経由で管理端末１ａへ通知する。例えば、ＮＷＩＤ１で送った接続要求は、無線基地局３Ａが受信し、その接続要求に、受信レベルを付加して管理端末１ａに転送する。また、ＮＷＩＤ２で送った接続要求は、無線基地局３Ｂが、これに受信レベルを付加して管理端末１ａへ転送する。ＮＥＩＤ３で送った接続要求は、安定した電波の到達範囲外であるため、無

線基地局３Ｃでも受信できず、管理端末１ａには到達しない。

【００１２】管理端末１ａは、各無線端末３Ａ，３Ｂから接続要求を受信すると、一定時間内に該当無線端末から送られてくる全ての接続要求を加味してＢＳＡを決定し、そのＮＷＩＤを接続要求を発した無線端末に通知する。図示の例では、無線基地局３ＡのＢＳＡが適当と判断し、ＮＷＩＤ１を無線基地局３Ａ経由で無線端末５ａに通知している。

【００１３】管理端末１ａは、各ＢＳＡ内の無線端末を管理するため、例えば図５及び図６に示す内容のエリア管理テーブルを保持する。これらの図において、「エリアＩＤ」はＢＳＡを識別するものであり、この例ではＮＷＩＤである。「適正台数」は、例えば、システム内に存在する無線端末の最大数をＢＳＡの数で割った値（切り上げ）である。本例では３つのＢＳＡに８台の無線端末が存在するので、適正台数は“３”である。

【００１４】「稼働台数」は、現時点でＢＳＡ内に存在する無線端末台数を示す。図示の例では３台の無線端末が接続されているので“３”となる。「端末ＩＤ」は、接続している無線端末の識別子である。本実施形態では、便宜上、図１に示した各無線端末５ａ～５ｈの符号をそのまま当該無線端末の識別子とする。「信号レベル」は、該当する無線端末より接続要求があった時の無線基地局が検出した信号レベルであり、図示の例では、端末ＩＤが５ａの無線端末の信号レベル“８”が最も強く、端末ＩＤが５ｂの無線端末の信号レベルが“４”で最も弱いものとなっている。「他エリア情報」は、他の無線基地局が、該当無線端末の接続要求を受信したときの信号レベルを示すものであり、信号レベルの強いものから順に格納される。図５の例では、端末ＩＤ５ａ、５ｂの各無線端末が、エリアＩＤがＮＷＩＤ２の無線基地局で信号レベル０．５の接続要求を受信している様子を示している。なお、エリア管理テーブルは、システム内に存在するＢＳＡ毎に設けられる。

【００１５】次に、図４に基づいて、管理端末１ａにおけるＢＳＡ決定手順を各ステップ順に説明する。

（ステップＳ１）　無線端末から接続要求がくるとその端末の端末ＩＤ、受信した無線基地局のエリアＩＤ、受信した受信レベルを記録し、一定時間待機する。その間、他の無線基地局から該当する無線端末の接続要求通知が送られてくると、そのエリアＩＤと受信レベルを記録する。図５に示す例の場合、端末ＩＤが５ａの無線端末については、ＮＷＩＤ１で信号レベル“８”、ＮＷＩＤ２で信号レベル“０．３”である。

【００１６】（ステップＳ２）一定時間待って、無線端末が全てのＮＷＩＤで接続要求を送り終わったと判断すると、記録した接続要求の各無線基地局が受信した信号レベルを調べ、最も受信レベルの高いエリアＩＤのエリア管理テーブルをチェックする。例えば端末ＩＤが５ａ

の無線端末の場合は、エリアＩＤがＮＷＩＤ１であるから、ＮＷＩＤ１のエリア管理テーブルを調べる。

【００１７】（ステップＳ３） エリア管理テーブル内の接続台数を調べる。接続台数≦適正台数であるならば、ステップＳ４へ進み、そうでなければステップＳ５に進む。

【００１８】（ステップＳ４） 最も信号レベルの高い無線基地局に、現在接続している端末台数が適正台数以下である場合はこの無線基地局のＢＳＡをその無線端末のＢＳＡとして決定し、そのＢＳＡのエリア管理テーブルに、ステップＳ１で記録していた端末ＩＤと各無線基地局のエリアＩＤ、信号レベルを格納し、登録したエリア管理テーブルのエリアＩＤを端末に通知する。

【００１９】（ステップＳ５） 調べたエリア管理テーブルより、該当するＢＳＡには適正台数以上の無線端末が既に存在する場合は、調べたＢＳＡ以外で次に正常受信できるＢＳＡがないかをステップＳ１で記録したデータを元に調べる。ステップＳ１で記録した各無線基地局の受信信号レベルが“１”以上であれば、正常に受信できるＢＳＡであると判断してステップＳ６に進み、なければステップＳ７へ進む。

【００２０】（ステップＳ６） ステップＳ５において受信信号レベルが“１”以上の無線基地局がある場合は、次に高い受信レベルの無線ＢＳＡに該当するエリア管理テーブルを調べ、ステップＳ３に戻る（Ｓ６）。

【００２１】（ステップＳ７）ステップＳ５において受信信号レベルが“１”以上の無線基地局がない場合は、最も受信レベルが高いＢＳＡのエリア管理テーブルより、既に登録されている無線端末の中で、他のエリア情報として信号レベルが“１”以上の端末がないかを調べる。図５の例では、端末ＩＤが５ｂのエリアＩＤ、ＮＷＩＤ２がそれに該当する。そこで、さらにその信号レベルが“１”以上のＢＳＡのエリア管理テーブルを調べ、接続台数≦適正台数であるか否かを調べる。接続台数が少なければＢＳＡを変更できる無線端末であると判断する。本例では、図５における端末ＩＤが５ｂの無線端末に対応するのエリアＩＤ、ＮＷＩＤ２のエリア管理テーブルの内容は図６に示される。この場合の接続台数は“２”であるから変更可能となる。

【００２２】（ステップＳ８） ステップＳ７のチェックの際、ＢＳＡを変更できる無線端末があればステップＳ１２へ、なければステップＳ９へ進む。

【００２３】（ステップＳ９） 前回調べたＢＳＡの次に受信レベルの高い正常受信できるＢＳＡがあるを調べ、あればそのＢＳＡエリア管理テーブルより、既に登録されている無線端末のなかで、他エリア情報として信号レベルが“１”以上の無線端末があるか調べる。もしあれば、さらにその信号レベルが“１”以上のＢＳＡのエリア管理テーブルを調べ、接続台数≦適正台数であるか否かを調べる。接続台数が少なければＢＳＡを変更できる無線端末であると判断する。

【００２４】（ステップＳ１０）ステップＳ９のチェックにおいてＢＳＡを変更できる無線端末があればステップＳ１２へ、なければステップＳ１１へ進む。

【００２５】（ステップＳ１１）調整の余地がないため、最も信号レベルが高い無線基地局のＢＳＡを要求のあった無線端末のＢＳＡに決定する。そのＢＳＡのエリア管理テーブルにステップＳ１で記録していた端末ＩＤと各無線基地局のエリアＩＤ、信号レベルを格納し、ステップＳ１４に進む。

【００２６】（ステップＳ１２）既に登録してあった無線端末のＢＳＡを変更する。移せる無線端末のエリア管理情報内の情報を全てのＢＳＡのエリア管理テーブルに登録し直す。その上で、該当する無線端末に新しいエリアＩＤを通知する。

【００２７】（ステップＳ１３）空きのできたＢＳＡを接続要求のあった無線端末のＢＳＡに決定する。そのＢＳＡの管理テーブルにステップＳ１で記録した端末ＩＤと各無線基地局のエリアＩＤ、信号レベルを格納する。

【００２８】（ステップＳ１４） 登録したエリア管理テーブルのエリアＩＤを接続要求のあった無線端末に通知する。

【００２９】このように、本実施形態の無線ＬＡＮシステムでは、無線端末５ａ～５ｈの所属するＢＳＡが従来のように固定的でなく、負荷に応じて柔軟に決められるため、無線基地局間の負荷分散を図ることができる。

【００３０】なお、本実施形態では、エリアＩＤとしてＮＷＩＤを例示したが、ＢＳＡを他のＢＳＡと分別するのは、無線周波数、変調コード等数多くあるが、いずれの場合でも本発明に適用することができる。

【００３１】

【発明の効果】以上の説明から明らかなように、本発明によれば、複数の無線基地局に接続する無線端末を適正信号レベルで適正台数割り付けることができる。これにより、負荷の分散が図られ、無線ＬＡＮシステムの運用の効率化が可能になる。

【図面の簡単な説明】

【図１】本発明の一実施形態に係る無線ＬＡＮシステムの構成図。

【図２】基本サービスエリア（ＢＳＡ）と伝搬範囲との関係を示す説明図。

【図３】本実施形態の管理端末が各無線基地局を経由して無線端末の接続要求信号を受信するまでの手順を示す説明図。

【図４】本実施形態によるＢＳＡの決定手順説明図。

【図５】本実施形態によるエリア管理テーブルの内容例を示す説明図。

【図６】本実施形態によるエリア管理テーブルの内容例を示す説明図。

【図７】従来の無線ＬＡＮシステムの構成図。

【符号の説明】

１，１１ ＰＣ

１ａ　管理端末

２，１２ 有線ＬＡＮ

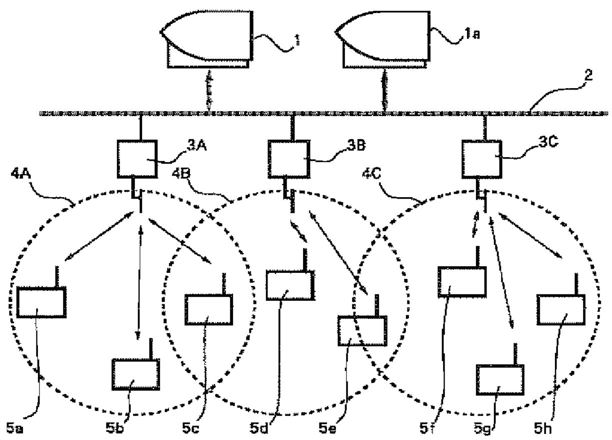
３Ａ～３Ｃ，１３Ａ～１３Ｃ　無線基地局　＊

＊４Ａ～４Ｃ　基本サービスエリア（ＢＳＡ）

５ａ～５ｈ　無線端末

６Ａ～６Ｃ　各無線ブリッジとの通信はできないが、他の通信の妨害となる微

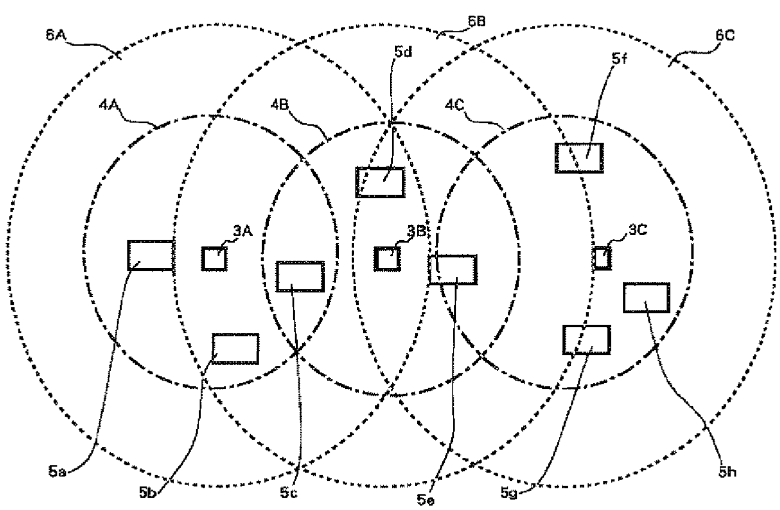
【図１】



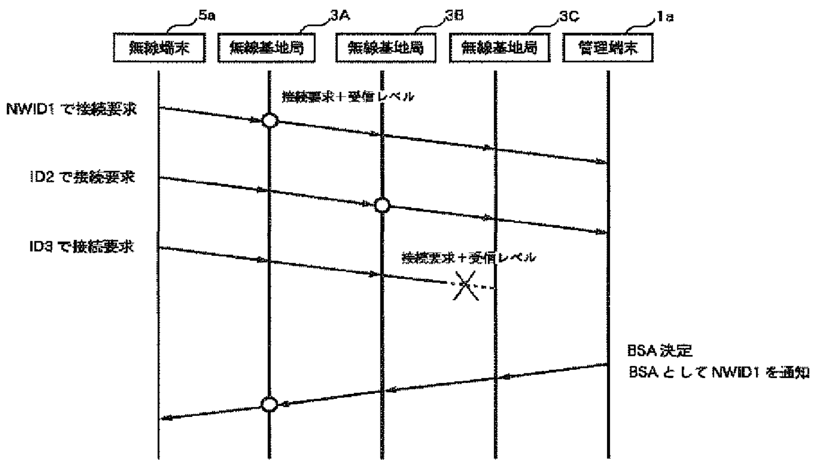
【図５】

エリアID		NWID1			
適正台数		3			
接続台数		3			
		他エリア情報		他エリア情報	
端末ID	信号レベル	エリアID	信号レベル	エリアID	信号レベル
5a	8	NWID2	0.3		
5c	5	NWID2	0.8		
5b	4	NWID2	5	NWID3	0.5

【図２】



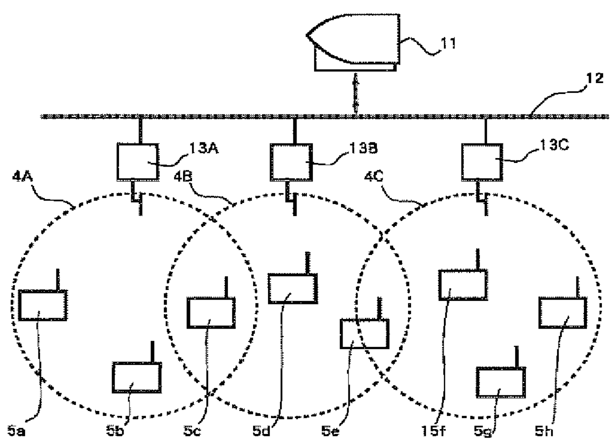
【図３】



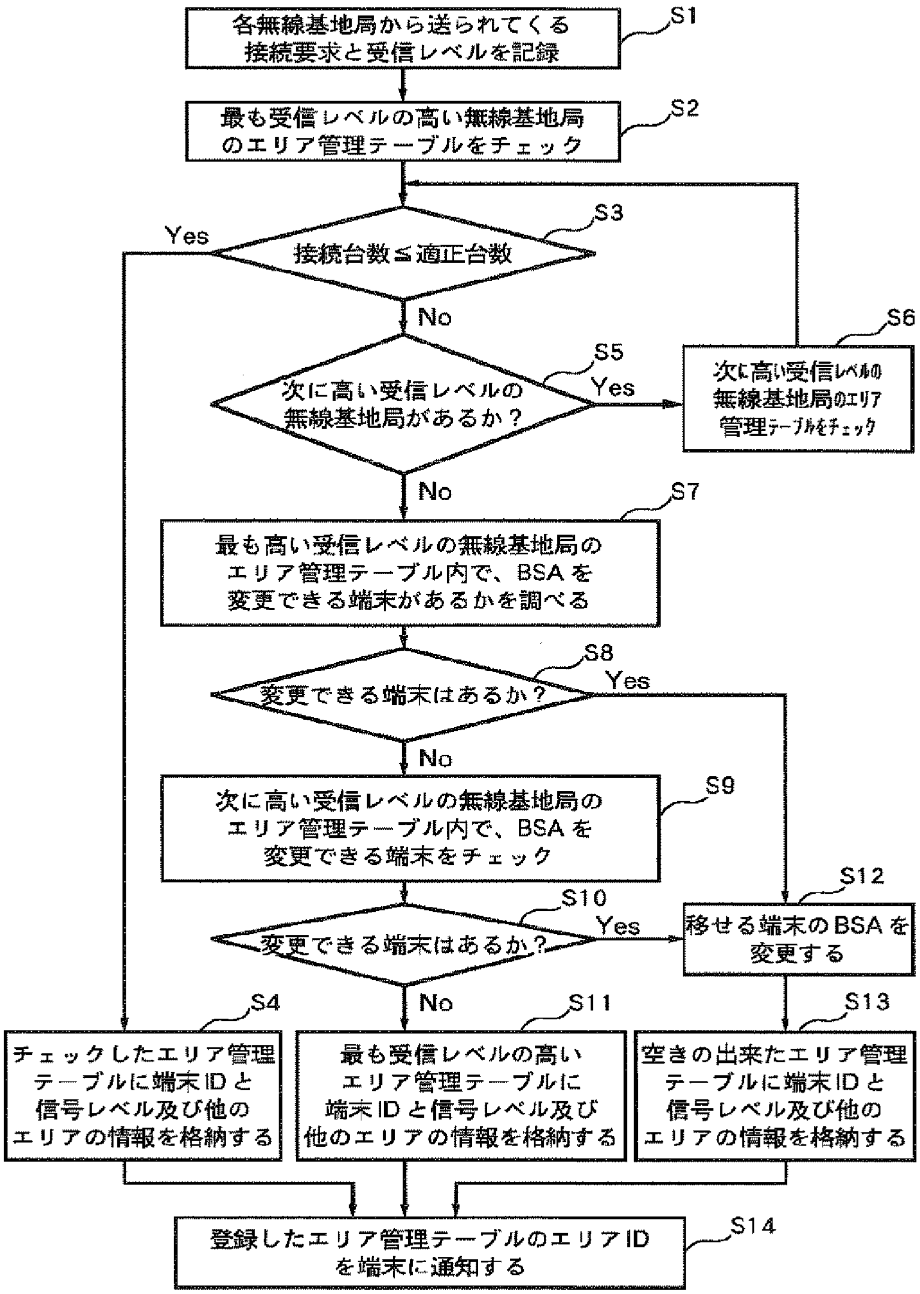
【図６】

エリアID		NWID2			
適正台数		3			
接続台数		2			
		他エリア情報		他エリア情報	
端末ID	信号レベル	エリアID	信号レベル	エリアID	信号レベル
5d	7	NWID3	0.6		
5e	5	NWID3	5	NWID1	0.5

【図７】



【図４】


S1
各無線基地局から送られてくる接続要求と受信レベルを記録
S2
最も受信レベルの高い無線基地局のエリア管理テーブルをチェック
S3
接続台数≦適正台数
Yes
No
S5
次に高い受信レベルの無線基地局があるか？
Yes
S6
次に高い受信レベルの無線基地局のエリア管理テーブルをチェック
No
S7
最も高い受信レベルの無線基地局のエリア管理テーブル内で、BSAを変更できる端末があるかを調べる
S8
変更できる端末はあるか？
Yes
No
S9
次に高い受信レベルの無線基地局のエリア管理テーブル内で、BSAを変更できる端末をチェック
S10
変更できる端末はあるか？
Yes
S12
移せる端末のBSAを変更する
No
S4
チェックしたエリア管理テーブルに端末IDと信号レベル及び他のエリアの情報を格納する
S11
最も受信レベルの高いエリア管理テーブルに端末IDと信号レベル及び他のエリアの情報を格納する
S13
空きの出来たエリア管理テーブルに端末IDと信号レベル及び他のエリアの情報を格納する
S14
登録したエリア管理テーブルのエリアIDを端末に通知する

Electronic Patent Application Fee Transmittal

Application Number:	10591184
Filing Date:	14-May-2007
Title of Invention:	System and Method for Negotiation of Wlan Entity
First Named Inventor/Applicant Name:	Hong Cheng
Filer:	James Edward Ledbetter/Erika Satterwhite
Attorney Docket Number:	L8638.06115

Filed as Large Entity

U.S. National Stage under 35 USC 371 Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Extension - 2 months with $0 paid	1252	1	490	490

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
	Total in USD ($)			**490**

Electronic Acknowledgement Receipt

EFS ID:	7900269
Application Number:	10591184
International Application Number:	
Confirmation Number:	7759
Title of Invention:	System and Method for Negotiation of Wlan Entity
First Named Inventor/Applicant Name:	Hong Cheng
Customer Number:	52989
Filer:	James Edward Ledbetter
Filer Authorized By:	
Attorney Docket Number:	L8638.06115
Receipt Date:	28-JUN-2010
Filing Date:	14-MAY-2007
Time Stamp:	16:53:26
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	$490
RAM confirmation Number	3775
Deposit Account	
Authorized User	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)

1	Extension of Time	aEOT.pdf	47215 1d663658fcaf511c4b8552e0e5270f860a884523	no	1
Warnings:					
Information:					
2	Transmittal Letter	aTRANS.pdf	53363 3d416f7f23ebbbe2ad1f18df3aafc69a2ba1c0d8	no	1
Warnings:					
Information:					
3	Amendment/Req. Reconsideration-After Non-Final Reject	aAMEND.pdf	612429 7f92227e2514d420f57a38b0c09754e7a2288024	no	21
Warnings:					
Information:					
4	Miscellaneous Incoming Letter	aREQKNIDS.pdf	68451 e5d9169f0507d2e925d294fb6768aaf3f27aeac6	no	2
Warnings:					
Information:					
5	Foreign Reference	aFR1.pdf	455739 9693d1a2139867bce409c23b6877929be29a8c34	no	9
Warnings:					
Information:					
6	Foreign Reference	aFR2.pdf	427444 724b12797834b70af008ddce2623e0a66c1b4896	no	8
Warnings:					
Information:					
7	Fee Worksheet (PTO-875)	fee-info.pdf	30248 87424476bc99cc3605fcd393b31175c37fe9b3df	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	1694889		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

<u>New Applications Under 35 U.S.C. 111</u>
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

<u>National Stage of an International Application under 35 U.S.C. 371</u>
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

<u>New International Application Filed with the USPTO as a Receiving Office</u>
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PETITION FOR EXTENSION OF TIME UNDER 37 CFR 1.136(a) (Large Entity)	Docket No. **008638-06115**

In Re Application Of: **Hong CHENG et al.**

Application No.	Filing Date	Examiner	Customer No.	Group Art Unit	Confirmation No.
10/591,184	**August 30, 2006**	**J. Byrd**	**52989**	**2617**	**7759**

Invention: **SYSTEM AND METHOD FOR NEGOTIATION OF WLAN ENTITY**

COMMISSIONER FOR PATENTS:

This is a request under the provisions of 37 CFR 1.136(a) to extend the period for filing a response to the Office Action of **January 26, 2010** (*Date*) in the above-identified application.

The requested extension is as follows (check time period desired):

☐ One month ☒ Two months ☐ Three months ☐ Four months ☐ Five months

from: **April 26, 2010** (*Date*) until: **June 26, 2010** (*Date*)

The fee for the extension of time is **$490** and is to be paid as follows:

☐ A check in the amount of the fee is enclosed.

☒ The Director is hereby authorized to charge any fees which may be required, or credit any overpayment, to Deposit Account No. **04-1061**

☒ If an additional extension of time is required, please consider this a petition therefor and charge any additional fees which may be required to Deposit Account No. **04-1061**

☐ Payment by credit card. Form PTO-2038 is attached.

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

/James Edward Ledbetter/
Signature

Dated: **June 28, 2010**

James E. Ledbetter, Reg. No. 28732
Dickinson Wright PLLC
1875 Eye Street, N.W., Suite 1200
Washington, D.C. 20006
Telephone: 202.457.0160
Facsimile: 202.659.1559

I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to "Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450" [37 CFR 1.8(a)] on

_______________.
(Date)

Signature of Person Mailing Correspondence

Typed or Printed Name of Person Mailing Correspondence

cc:

P12LARGE/REV11

AMENDMENT TRANSMITTAL LETTER (Large Entity) Applicant(s): **Hong CHENG et al.**					Docket No. **008638-06115**
Application No. **10/591,184**	Filing Date **August 30, 2006**	Examiner **J. Byrd**	Customer No. **52989**	Group Art Unit **2617**	Confirmation No. **7759**

Invention: **SYSTEM AND METHOD FOR NEGOTIATION OF WLAN ENTITY**

COMMISSIONER FOR PATENTS:

Transmitted herewith is an amendment in the above-identified application.

The fee has been calculated and is transmitted as shown below.

CLAIMS AS AMENDED

	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST # PREV. PAID FOR		NUMBER EXTRA CLAIMS PRESENT		RATE	ADDITIONAL FEE
TOTAL CLAIMS	28	-	32	=	0	x	$52.00	$0.00
INDEP. CLAIMS	10	-	14	=	0	x	$220.00	$0.00
Multiple Dependent Claims (check if applicable) ☐								$0.00
TOTAL ADDITIONAL FEE FOR THIS AMENDMENT								$0.00

☒ No additional fee is required for amendment.

☐ Please charge Deposit Account No. in the amount of

☐ A check in the amount of to cover the filing fee is enclosed.

☒ The Director is hereby authorized to charge payment of the following fees associated with this communication or credit any overpayment to Deposit Account **04-1061**

- ☒ Any additional filing fees required under 37 C.F.R. 1.16.
- ☒ Any patent application processing fees under 37 CFR 1.17.

☐ Payment by credit card. Form PTO-2038.

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

/James Edward Ledbetter/
Signature

Dated: **June 28, 2010**

James E. Ledbetter, Reg. No. 28732
Dickinson Wright PLLC
1875 Eye Street, N.W., Suite 1200
Washington, D.C. 20006
Telephone: 202.457.0160
Facsimile: 202.659.1559

I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to "Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450" [37 CFR 1.8(a)] on

_______________ .
(Date)

Signature of Person Mailing Correspondence

Typed or Printed Name of Person Mailing Correspondence

cc:

P11LARGE/REV10

PTO/SB/06 (07-06)
Approved for use through 1/31/2007. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 10/591,184	Filing Date 05/14/2007	☐ To be Mailed

APPLICATION AS FILED – PART I

FOR	NUMBER FILED (Column 1)	NUMBER EXTRA (Column 2)	SMALL ENTITY ☐ RATE ($)	FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =		OR	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =			X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $250 ($125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							
			TOTAL			TOTAL	

* If the difference in column 1 is less than zero, enter "0" in column 2.

APPLICATION AS AMENDED – PART II

AMENDMENT	06/28/2010	CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	SMALL ENTITY RATE ($)	ADDITIONAL FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 28	Minus	** 32	= 0	X $ =		OR	X $52=	0
	Independent (37 CFR 1.16(h))	* 10	Minus	***13	= 0	X $ =		OR	X $220=	0
	☐ Application Size Fee (37 CFR 1.16(s))									
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	**0**

AMENDMENT		CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	RATE ($)	ADDITIONAL FEE ($)		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =		OR	X $ =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =		OR	X $ =	
	☐ Application Size Fee (37 CFR 1.16(s))									
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

Legal Instrument Examiner:
/GAIL D. D. WOOTEN/

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/591,184	05/14/2007	Hong Cheng	L8638.06115	7759

52989 7590 09/27/2010

Dickinson Wright PLLC
James E. Ledbetter, Esq.
International Square
1875 Eye Street, N.W., Suite 1200
Washington, DC 20006

EXAMINER	
AJIBADE AKONAI, OLUMIDE	

ART UNIT	PAPER NUMBER
2617	

MAIL DATE	DELIVERY MODE
09/27/2010	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

PTOL-90A (Rev. 04/07)

	Application No.	Applicant(s)	
Office Action Summary	10/591,184	CHENG ET AL.	
	Examiner	**Art Unit**	
	OLUMIDE T. AJIBADE AKONAI	2617	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE _1_ MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on _28 June 2010_.

2a)☐ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) _1-23,25-27,31 and 32_ is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☐ Claim(s) _____ is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☒ Claim(s) _1-23,25-27,31 and 32_ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _06/28/2010_.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Response to Arguments

1. Applicant's arguments, see pages 12-20 of the remarks, filed June 28, 2010, with respect to Claims 1-31 have been fully considered and are persuasive. All 35 U.S.C. 102(a) and 102(b) rejections have been withdrawn.

Election/Restrictions

2. Restriction to one of the following inventions is required under 35 U.S.C. 121:

I. Claims 1-8, 12-14, 23, 25-27 and 32, drawn to a method and system for providing WLAN function in a wireless local area network WLAN, whereby the WLAN function is split between wireless access points and control nodes in the WLAN , classified in class 370, subclass 338.

II. Claims 9-11, drawn to transmitting and receiving of data between wireless communication devices and access points in a wireless local area network, classified in class 455, subclass 41.2.

III. Claims 15 and 16, drawn to communication between network devices in a wireless local area network, classified in class 370, subclass 328.

IV. Claims 17-22, drawn to a method for carrying out load balancing in a wireless local area network, classified in class 455, subclass 453.

V. Claim 31, drawn to a topology determination in a wireless network, classified in class 370, subclass 351.

The inventions are distinct, each from the other because of the following reasons:

Inventions I and II are related as combination and subcombination. Inventions in this relationship are distinct if it can be shown that (1) the combination as claimed does not require the particulars of the subcombination as claimed for patentability, and (2) that the subcombination has utility by itself or in other combinations (MPEP § 806.05(c)). In the instant case, the combination as claimed does not require the particulars of the subcombination as claimed because the method of negotiating between the control node and the wireless access point in order to determine the functionality to be provided by the control node does not require communication between the mobile terminals and the wireless access points. The subcombination has separate utility such as transmission of data between mobile terminals via a wireless access point in an infrastructure mode of an ad hoc network.

Inventions II and III are related as combination and subcombination. Inventions in this relationship are distinct if it can be shown that (1) the combination as claimed does not require the particulars of the subcombination as claimed for patentability, and (2) that the subcombination has utility by itself or in other combinations (MPEP § 806.05(c)). In the instant case, the combination as claimed does not require the particulars of the subcombination as claimed because the transmission of data between mobile terminals and the wireless access points and provision of WLAN functionality by the wireless access points to the mobile terminals does not require the control nodes negotiating with each other in other to provide WLAN functions to the wireless access point. The subcombination has separate utility such as providing multiple control nodes to be able to provide WLAN functions to the wireless access point, which provides redundancy should a control node currently communicating/negotiating with the wireless access point not have the WLAN function.

Inventions III and IV are related as combination and subcombination. Inventions in this relationship are distinct if it can be shown that (1) the combination as claimed does not require the particulars of the subcombination as claimed for patentability, and (2) that the subcombination has utility by itself or in other combinations (MPEP § 806.05(c)). In the instant case, the combination as claimed does not require the particulars of the subcombination as claimed because the negotiation between the control nodes regarding WLAN functions to be provided to the wireless access point does not require load balancing in the wireless network. The subcombination has separate utility such as reducing congestion in a wireless local area network.

Inventions IV and V are related as combination and subcombination. Inventions in this relationship are distinct if it can be shown that (1) the combination as claimed does not require the particulars of the subcombination as claimed for patentability, and (2) that the subcombination has utility by itself or in other combinations (MPEP § 806.05(c)). In the instant case, the combination as claimed does not require the particulars of the subcombination as claimed because the method of carrying out load balancing in the wireless network does not require determining network topology by exchanging neighbor information. The subcombination has separate utility such as determining optimal routing paths based on exchanging neighbor information in the wireless network.

The examiner has required restriction between combination and subcombination inventions. Where applicant elects a subcombination, and claims thereto are subsequently found allowable, any claim(s) depending from or otherwise requiring all the limitations of the allowable subcombination will be examined for patentability in accordance with 37 CFR 1.104. See MPEP § 821.04(a). Applicant is advised that if any claim presented in a continuation or divisional application is anticipated by, or includes all the limitations of, a claim that is allowable in the present application, such claim may be subject to provisional statutory and/or nonstatutory double patenting rejections over the claims of the instant application.

Restriction for examination purposes as indicated is proper because all these inventions listed in this action are independent or distinct for the reasons given above and there would be a serious search and/or examination burden if restriction were not required because at least the following reason(s) apply:

(a) the inventions have acquired a separate status in the art in view of their different classification;

(b) the inventions have acquired a separate status in the art due to their recognized divergent subject matter;

(c) the inventions require a different field of search (for example, searching different classes/subclasses or electronic resources, or employing different search queries);

(d) the prior art applicable to one invention would not likely be applicable to another invention;

(e) the inventions are likely to raise different non-prior art issues under 35 U.S.C. 101 and/or 35 U.S.C. 112, first paragraph.

Applicant is advised that the reply to this requirement to be complete must include (i) an election of a invention to be examined even though the requirement may be traversed (37 CFR 1.143) **and (ii) identification of the claims encompassing the elected invention**.

The election of an invention may be made with or without traverse. To reserve a right to petition, the election must be made with traverse. If the reply does not distinctly and specifically point out supposed errors in the restriction requirement, the election shall be treated as an election without traverse. Traversal must be presented at the time of election in order to be considered timely. Failure to timely traverse the requirement will result in the loss of right to petition under 37 CFR 1.144. If claims are added after the election, applicant must indicate which of these claims are readable upon the elected invention.

Should applicant traverse on the ground that the inventions are not patentably distinct, applicant should submit evidence or identify such evidence now of record showing the inventions to be obvious variants or clearly admit on the record that this is the case. In either instance, if the examiner finds one of the inventions unpatentable over the prior art, the evidence or admission may be used in a rejection under 35 U.S.C. 103(a) of the other invention.

A telephone call was made to the applicants' representative, James E. Ledbetter on September 21, 2010 to request an oral election to the above restriction requirement, but did not result in an election being made.

Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48(b) if one or more of the currently named inventors is no longer an inventor of at least one claim remaining in the application. Any amendment of inventorship must be accompanied by a request under 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(i).

Conclusion

3. Any inquiry concerning this communication or earlier communications from the examiner should be directed to OLUMIDE T. AJIBADE AKONAI whose telephone number is (571)272-6496. The examiner can normally be reached on M-F, 8.30p-5p.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Charles Appiah can be reached on 571-272-7904. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Olumide T Ajibade-Akonai/
Examiner, Art Unit 2617

Index of Claims	Application/Control No. 10591184	Applicant(s)/Patent Under Reexamination CHENG ET AL.
	Examiner JOHN B BYRD JR.	**Art Unit** 2617

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	01/16/2010	09/23/2010							
	1	✓	÷							
	2	✓	÷							
	3	✓	÷							
	4	✓	÷							
	5	✓	÷							
	6	✓	÷							
	7	✓	÷							
	8	✓	÷							
	9	✓	÷							
	10	✓	÷							
	11	✓	÷							
	12	✓	÷							
	13	✓	÷							
	14	✓	÷							
	15	✓	÷							
	16	✓	÷							
	17	✓	÷							
	18	✓	÷							
	19	✓	÷							
	20	✓	÷							
	21	✓	÷							
	22	✓	÷							
	23	✓	÷							
	24	✓	-							
	25	✓	÷							
	26	✓	÷							
	27	✓	÷							
	28	✓	-							
	29	✓	-							
	30	✓	-							
	31	✓	÷							
	32		÷							

SUBSTITUTE FOR FORM PTO-1449 U.S. Department of Commerce Patent and Trademark Office **INFORMATION DISCLOSURE STATEMENT BY APPLICANT** (Use several sheets if necessary)	ATTY. DOCKET NO. **008638-06115**	SERIAL NO. **10/591,184**
	APPLICANT **Hong CHENG, et al.**	
	FILING DATE **August 30, 2006**	GROUP **2617**

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CORRESPONDENT	DISCUSSED AND CITED IN SPEC? (insert page and line number where cited)

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CORRESPONDENT	TRANSLATION?	DISCUSSED AND CITED IN SPEC? (insert page and line number where cited)
/O.A./	**2000-069050**	**03/2000**	**JP**		**Abstract**	
/O.A./	**10-041969**	**02/1998**	**JP**		**Abstract**	

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc.)

		DISCUSSED AND CITED IN SPEC?

EXAMINER: Initial if citation is considered, draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

/Olumide Ajibade Akonai/ 09/20/2010 (Form PTO-1449 [6-4])

DC 8638-6115 156150

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of

Inventor:	Hong CHENG, et al.	Art Unit 2617
Appln. No.:	10/591,184	Exr. O. Ajibade Akonai
Filed:	August 30, 2006	Conf. No. 7759
For:	SYSTEM AND METHOD FOR NEGOTIATION OF WLAN ENTITY	

AMENDMENT UNDER 37 C.F.R. § 1.111 AND
RESPONSE TO RESTRICTION REQUIREMENT

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

In response to the Restriction Requirement mailed on September 27, 2010, the following remarks and amendments are respectfully submitted:

IN THE CLAIMS

Please amend the claims to read as follows:

Listing of Claims

1. (Previously Presented) A system for providing service in a wireless local area network comprising:

a single or plurality of wireless access points (WAP) for processing a subset of complete functionality defined for the wireless local area network;

a single or plurality of control nodes (CN) for providing a subset or complete functionalities defined for the wireless local area network; and

a negotiation unit for the single or plurality of WAPs to dynamically negotiate with the control node for a secure connection and function split arrangement;

whereby the control node negotiates with the single or plurality of WAPs using the negotiation unit and provides complementary functionality for the single or plurality of each of the WAPs to form a complete functionality defined for the wireless local area network according to a decision of the negotiation unit.

2. (Previously Presented) The system according to claim 1, wherein said WAPs and CNs further comprise logically independent functional components of the functionalities defined for the wireless local area network with predefined interfaces used between each functional components.

3. (Previously Presented) The system according to claim 2, wherein said predefined interfaces used between said functional components are used over remote connections between said WAPs and said CNs.

4. (Previously Presented) The system according to claim 1, wherein each of said CNs further comprises a control node controller module and each of said WAPs further comprises a wireless access point controller module.

5. (Previously Presented) The system according to claim 4, wherein the controller module of said CN further comprises a single or plurality of processing schedules comprising sequential lists of descriptors for subsets of said functional components used for each wireless access point.

6. (Previously Presented) The system according to claim 4, wherein the controller module of said WAP further comprises a single or plurality of processing schedules each comprising sequential lists of descriptors for subsets of said functional components used for each associated mobile terminal.

7. (Previously Presented) The system according to claim 1, wherein each of the WAPs further comprises:

a discovering unit for discovering an the available CN within a specified domain; and

a secure connection negotiating unit for negotiating a secure connection with a CN that may provide the complementary functionality desired by the WAP;

whereby the WAP locates the CN that provides the complementary functionality with regard to defined complete wireless local area network functions with the discovering unit and establishes a secure connection with the CN that provides the complementary functionality with the secure connection negotiating unit.

8. (Previously Presented) The system according to claim 1, wherein the controller module of said CN generates a data unit which resembles a data unit of a mobile terminal.

9. (Withdrawn) A system for providing service in a wireless local area network (WLAN) comprising:

a single or plurality of mobile terminals, each of said mobile terminals associated with and receiving services from a single or plurality of wireless access points (WAP);

a single or plurality of WAPs to process data units received from the single or plurality of mobile terminals or the single or plurality of WAPs using a subset of defined WLAN functions; and

an exchanging unit for the WAPs to exchange data units processed with a subset of WLAN functions;

wherein each of the WAPs further processes the processed data units received from other WAPs with complementary functionality among the subset of defined WLAN functions, and

whereby a data unit for a mobile terminal is processed with complete WLAN functions by a plurality of said WAPs.

10. (Withdrawn) The system according to claim 9, wherein each of the WAPs further comprises a control module for negotiating with other of said WAPs for a subset of the complete WLAN functions to be carried out at each of said WAPs.

11. (Withdrawn) The system according to claim 9, wherein each of the WAPs further comprises a local database that stores all associations of the mobile terminals attached to said WAP and a corresponding subset of the complete WLAN functions to be provided to the mobile terminals.

12. (Previously Presented) The system according to claim 1, wherein the functionalities of said WAP and CN are collocated in a single network element.

13. (Previously Presented) A method for providing service in a wireless local area network (WLAN) that allows a defined WLAN function split between a wireless access point (WAP) and a single or plurality of Control Nodes (CN) comprising the steps in which:

a the WAP discovers CNs that may provide complementary WLAN functions by sending a single or plurality of messages containing information about a subset of WLAN functions of the WAP to all of the CNs in the plurality of CNs;

after receiving said discover message, at least one of the CNs replies with a single or plurality of messages containing information about a subset of WLAN functions said CN has available for the WAP; and

said WAP chooses from all the replied CNs a proper CN based on local policy and establishes an association with said chosen CN.

14. (Previously Presented) The method according to claim 13, wherein the choosing of the proper CN by said WAP comprises choosing the proper CN using information, the information comprising:

i. the subset of the WLAN functions offered by the CN;

ii. a cost of using the CN;

iii. a vendor of the CN;

iv. characteristics of a connection to the CN; and

v. a weighted sum of the above factors.

15. (Withdrawn) A method for providing service in a wireless local area network (WLAN) that allows a defined WLAN function split between wireless access point (WAP) and a single or plurality of Control Nodes (CN) comprising the steps in which:

a CN dynamically discovers a capability of a WAP by sending a single or plurality of messages to the WAP, each of the messages containing a section that emulates a data unit sent by a mobile terminal;

the WAP receives at least one of said messages, processes said section using a same procedure for processing data units received from the mobile terminal and sends another data unit back to said CN in a reply message; and

said CN obtains capability information of said WAP by examining the processed data unit in said reply message.

16. (Withdrawn) A method for providing service in a wireless local area network (WLAN) that allows a defined WLAN function split between a wireless access point (WAP) and a single or plurality of Control Nodes (CN) comprising the steps in which:

a CN obtains a capability of the WAP; and

said CN negotiates with another CN or a plurality of other CNs for supplementary WLAN functions to be provided to the WAP.

17. (Withdrawn) A method for carrying out load balancing in a wireless local area network (WLAN) without requiring a mobile terminal to change an association relationship with a wireless access point (WAP) comprising the steps in which:

the WAP separates a processing function provided to the mobile terminal into an association specific part and a non-association specific part;

said WAP negotiates with another WAP regarding the non-association specific part and establishes a secure tunnel with said another WAP;

said WAP tunnels a data unit from a mobile terminal to the said another WAP through the tunnel after processing said data unit with functions of the association specific part; and

said another WAP receiving the processed data unit through said tunnel processes said data unit with functions of the non-association specific part.

18. (Withdrawn) The method according to claim 17 further comprising a step in which said WAP uses a wireless channel to establish a direct connection with said another WAP and sets up said secure tunnel over the direct connection.

19. (Withdrawn) The method according claim 17 further comprising a step in which the WAP decides on whether to tunnel said data unit from the mobile terminal to said another WAP for said non association specific processing by monitoring a load at said WAP and comparing it with a preset threshold value.

20. (Withdrawn) The method according to claim 17 further comprising a step in which said WAP decides on which other WAPs should be used for said non association specific processing by monitoring loads at said other WAPs said WAP has connections with and compares said loads with a preset threshold value.

21. (Withdrawn) The method according to claim 17 further comprising step in which a central control entity monitors a load status on all WAPs within a certain domain and mandates distribution of said non-association specific processing functions between different WAPs from among said all WAPs.

22. (Withdrawn) The method according to claim 17 for the WAP to determine a distribution of said non-association specific processing functions based on information, the information comprising:

a size of the data unit to be processed;

an expected average time for the processing of the data unit;

an overhead time for the processing of the data unit; and

a weighted sum of the above factors.

23. (Previously Presented) A method for providing service in a wireless local area network (WLAN) that allows a defined WLAN function split between a wireless access point (WAP) and a single or plurality of Control Nodes (CN) comprising the steps in which:

a subset of WAPs processes a total of its subset of functionality defined for the WLAN;

the WAP dynamically negotiates with a CN for a secure connection and function split arrangement; and

the CN provides complementary functionality for each of the WAPs to form a complete functionality defined for the wireless local area network according to a decision in the negotiation step.

24. (Cancelled)

25. (Previously Presented) A method for accommodating variances in a wireless network topology comprising a step of dynamically adapting an operations logic of at least one network entity of said wireless network topology to alter processing of one or more functional sub-components.

26. (Previously Presented) The method according to claim 25 further comprising a step of altering processing of selected functional sub-components at the at least one network entity by bypassing said processing of said selected functional sub-components.

27. (Previously Presented) The method according to claim 25 further comprising a step of altering processing of selected functional sub-components at the at least one network entity by selectively processing said selected functional sub-components.

28-30. (Cancelled)

31. (Withdrawn) A method for determining a topology of a wireless network, wherein a first network entity alters a connectivity association with a second network entity by including one or more third network entities in a communication path of an alternate connectivity association, comprising the steps of:

exchanging information on neighbouring network entities among said network entities of said wireless network;

analyzing communication frames received by said network entities based on pre-established representations of said topology of said wireless network; and

analyzing association request frames received by said network entities based on said pre-established representations of said topology of said network.

32. (Previously Presented) A wireless access point (WAP) in a wireless local area network (WLAN) that allows a defined WLAN function to be split between the wireless access point (WAP) and one or more Control Nodes (CNs), the WAP comprising:

a discovery function which initiates a discovery operation to discover a Control Node (CN) among said one or more CNs that may complement said WAP with respect to providing said defined WLAN function by sending a plurality of discover messages containing information about its own subset of the defined WLAN function, to the one or more CNs;

a receiving function which receives one or more reply messages from said one or more CNs in response to said discover messages, said one or more reply messages including information about a subset of the defined WLAN function, said one or more CNs have available for the WAP;

a choosing function which chooses from among said one or more CNs that sent said one or more reply messages a particular CN based on local policy.

33. (New) A Control Node that allows a defined wireless local area network (WLAN) function to be split between a wireless access point (WAP) in the WLAN and the Control Node, the Control Node comprising:

a receiving function which receives a discover message including information about a subset of the defined WLAN function from the WAP;

a sending function which sends a reply message to the WAP in response to the discover message;

a negotiating function which dynamically negotiates with the WAP for a secure connection and function split arrangement; and

a providing function which provides the WAP with complementary functionality for the WAP to form a complete functionality defined for the WLAN according to a decision in the negotiating function.

REMARKS

In response to the pending Restriction Requirement, Applicants hereby elect Group I, Claims 1-8, 12-14, 23, 25-27, 32, and 33(newly added).

Applicants respectfully request withdrawal of the Restriction Requirement. No unduly extensive or burdensome search would be required to examine the various claims of the noted Groups in the same application. MPEP §803 states:

> "If the search and examination of an entire application can be made without serious burden, the Examiner *must* examine it on the merits even though it includes claims to distinct or independent inventions." (Emphasis added)

In the present case, the search for all pending claims together would not be burdensome.

Moreover, from the standpoint of costs to the Applicants involved in filing, issuance and maintenance fees relating to separate applications if the present Restriction Requirement is maintained, it is clear that there is substantially more burden on Applicants by imposing the present Requirement than on the Patent Office if the Requirement were withdrawn.

In addition, it is noted that to require the claims of the various Groups to issue in separate patents would result in inconvenience to the public by necessitating reference to more than one patent during searching, to review closely related subject matter.

Therefore, withdrawal of the Restriction Requirement is warranted.

Reconsideration and withdrawal of the Restriction Requirement are respectfully requested.

Also, new claim 33 has been added which is directed towards a control node that allows a defined wireless local area network (WLAN) function to be split between a wireless access point (WAP) in a WLAN and the Control Node, and is therefore drawn to the elected Invention of Group I. Support for new claim 33 is found, for example, in claims 1, 23 and 32 and paragraphs [0057]-[0069] of the published U.S. application. (It should be noted that references to the specification and drawings are for illustrative purposes only and are not intended to limit the scope of the invention to the referenced embodiments). No new matter is entered.

Accordingly, it is respectfully submitted that entry and allowance of claim 33 is warranted for at least the same reasons that allowance of claims 1, 23 and 32 is warranted.

In view of the above, it is submitted that this application is in condition for allowance and a notice to that effect is respectfully solicited.

If any issues remain which may best be resolved through a telephone communication, the Examiner is requested to telephone the undersigned at the local Washington, D.C. telephone number listed below.

Respectfully submitted,

/James Edward Ledbetter/

James E. Ledbetter
Registration No. 28,732

Date: October 27, 2010
JEL/DEA/eks

Attorney Docket No. 008638-06115
Dickinson Wright PLLC
1875 Eye Street, NW, Suite 1200
Washington, DC 20006
Telephone: (202) 457-0160
Facsimile: (202) 659-1559

DC 8638-6115 162985

Electronic Acknowledgement Receipt

EFS ID:	8715150
Application Number:	10591184
International Application Number:	
Confirmation Number:	7759
Title of Invention:	System and Method for Negotiation of Wlan Entity
First Named Inventor/Applicant Name:	Hong Cheng
Customer Number:	52989
Filer:	James Edward Ledbetter
Filer Authorized By:	
Attorney Docket Number:	L8638.06115
Receipt Date:	27-OCT-2010
Filing Date:	14-MAY-2007
Time Stamp:	17:24:05
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Transmittal Letter	aTRANS.pdf	55015 886c4919680c3f25d68c2131322aed950cbfae21	no	1

Warnings:

Information:

2	Response to Election / Restriction Filed	aAMEND.pdf	320154 e6f2bda978076f14f37601c495a81e7a7d7fcc70	no	13
Warnings:					
Information:					
		Total Files Size (in bytes):	375169		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

<u>New Applications Under 35 U.S.C. 111</u>
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

<u>National Stage of an International Application under 35 U.S.C. 371</u>
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

<u>New International Application Filed with the USPTO as a Receiving Office</u>
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

AMENDMENT TRANSMITTAL LETTER (Large Entity) Applicant(s): **Hong CHENG, et al.**					Docket No. **008638-06115**
Application No. **10/591,184**	Filing Date **August 30, 2006**	Examiner **O. Ajibade Akonai**	Customer No. **52989**	Group Art Unit **2617**	Confirmation No. **7759**

Invention: **SYSTEM AND METHOD FOR NEGOTIATION OF WLAN ENTITY**

COMMISSIONER FOR PATENTS:

Transmitted herewith is an amendment in the above-identified application.

The fee has been calculated and is transmitted as shown below.

CLAIMS AS AMENDED

	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST # PREV. PAID FOR		NUMBER EXTRA CLAIMS PRESENT		RATE	ADDITIONAL FEE
TOTAL CLAIMS	29	-	32	=	0	x	$52.00	$0.00
INDEP. CLAIMS	11	-	14	=	0	x	$220.00	$0.00
Multiple Dependent Claims (check if applicable) ☐								$0.00
TOTAL ADDITIONAL FEE FOR THIS AMENDMENT								$0.00

- ☒ No additional fee is required for amendment.
- ☐ Please charge Deposit Account No. in the amount of
- ☐ A check in the amount of to cover the filing fee is enclosed.
- ☒ The Director is hereby authorized to charge payment of the following fees associated with this communication or credit any overpayment to Deposit Account **04-1061**
  - ☒ Any additional filing fees required under 37 C.F.R. 1.16.
  - ☒ Any patent application processing fees under 37 CFR 1.17.
- ☐ Payment by credit card. Form PTO-2038.

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

/James Edward Ledbetter/
Signature

Dated: **October 27, 2010**

James E. Ledbetter, Reg. No. 28732
Dickinson Wright PLLC
1875 Eye Street, N.W., Suite 1200
Washington, D.C. 20006
Telephone: 202.457.0160
Facsimile: 202.659.1559

I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to "Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450" [37 CFR 1.8(a)] on

________________.
(Date)

Signature of Person Mailing Correspondence

Typed or Printed Name of Person Mailing Correspondence

cc:

P11LARGE/REV10

PTO/SB/06 (07-06)
Approved for use through 1/31/2007. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 10/591,184	Filing Date 05/14/2007	☐ To be Mailed

APPLICATION AS FILED – PART I

FOR	NUMBER FILED (Column 1)	NUMBER EXTRA (Column 2)	SMALL ENTITY ☐ RATE ($)	FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =		OR	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =			X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $250 ($125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							
			TOTAL			TOTAL	

* If the difference in column 1 is less than zero, enter "0" in column 2.

APPLICATION AS AMENDED – PART II

AMENDMENT	10/27/2010	CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	SMALL ENTITY RATE ($)	ADDITIONAL FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 29	Minus	** 32	= 0	X $ =		OR	X $52=	0
	Independent (37 CFR 1.16(h))	* 11	Minus	***13	= 0	X $ =		OR	X $220=	0
	☐ Application Size Fee (37 CFR 1.16(s))									
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	0

AMENDMENT		CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	RATE ($)	ADDITIONAL FEE ($)		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =		OR	X $ =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =		OR	X $ =	
	☐ Application Size Fee (37 CFR 1.16(s))									
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

Legal Instrument Examiner:
/JULIET MCMILLAN/

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/591,184	05/14/2007	Hong Cheng	L8638.06115	7759

52989 7590 01/04/2011

Dickinson Wright PLLC
James E. Ledbetter, Esq.
International Square
1875 Eye Street, N.W., Suite 1200
Washington, DC 20006

EXAMINER	
AJIBADE AKONAI, OLUMIDE	

ART UNIT	PAPER NUMBER
2617	

MAIL DATE	DELIVERY MODE
01/04/2011	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

PTOL-90A (Rev. 04/07)

Office Action Summary	**Application No.** 10/591,184	**Applicant(s)** CHENG ET AL.	
	Examiner OLUMIDE T. AJIBADE-AKONAI	**Art Unit** 2617	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *27 October 2010*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-8,12-14,23,25-27,32 and 33* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *1-8,12,23 and 33* is/are allowed.

6)☒ Claim(s) *13,25-27 and 32* is/are rejected.

7)☒ Claim(s) *14* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

Response to Arguments

1. Applicant's arguments filed October 27, 2010 have been fully considered but they are not persuasive. In response to the restriction requirement mailed September 27, 2010, the applicants' representative asserts that the examination of the examination of all the claims would not be burdensome. The examiner respectfully disagrees. The groups of claims are directed to distinct inventions, which are in different Classes/subclasses and different search queries. For example, claims 1-8, 12-14, 23, 25-27 and 32 are directed to a negotiation between wireless access point and controller node, whereby the WLAN function is split between the wireless access point and the controller. Searching for this claims will require the examiner to search in class 370, subclass 338, and also to use search queries that are completely different from that of claim 31 (a method in which a network entity receives frames from neighboring entities and using the received frames to determine a network topology), or claim 17 (a method for performing load balancing in a wireless access point, as recited in the claim, which is not related to the system of claim 1). The different searches/queries would be burdensome on the examiner. Therefore the examiner maintains that the restriction requirement mailed September 27, 2010 is proper.

Claim Objections

2. Claim 13 is objected to because of the following informalities: on line 3, delete "**a**". Appropriate correction is required.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claims 13, 26, and 27 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claim 13 recites the limitation "said discover message" in line 7. There is insufficient antecedent basis for this limitation in the claim.

Claims 26 and 27 recite the limitation "**said selected** functional components" in line 3. There is insufficient antecedent basis for this limitation in the claim.

Allowable Subject Matter

5. Claims 1-8, 12, 23 and 33 are allowed.

Claim 14 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Claim Rejections - 35 USC § 102

6. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States

only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

7. Claims 13 are rejected under 35 U.S.C. 102(e) as being anticipated by **Chuah et al 20050059396** (**hereinafter Chuah**).

Regarding **claim 13**, Chuah discloses a method for providing service in a wireless local area network (WLAN) (see fig. 1, p.2, [0020]) that allows a defined WLAN function split between a wireless access point (WAP) (access point 138, see figs. 6A and 6B, p.4, [0044]) and a single or plurality of Control Nodes (CN) (gateway 136, see figs. 6A and 6B, p.4, [0044]) comprising the steps in which: a the WAP discovers CNs that may provide complementary WLAN functions by sending a single or plurality of messages containing information about a subset of WLAN functions of the WAP to all of the CNs in the plurality of CNs (gateway query message, see fig. 6, p.4, [0044]); after receiving said discover message, at least one of the CNs replies with a single or plurality of messages containing information about a subset of WLAN functions said CN has available for the WAP (service discovery message, see fig. 6, p.4. [0045] - [0046]); and said WAP chooses from all the replied CNs a proper CN based on Local policy and establishes an association with said chosen CN (access point selects a gateway, see fig. 6, p.4-5, [0046]).

Regarding **claim 32**, Chuah discloses a wireless access point (WAP) (access point 138, see figs. 6A and 6B, p.4, [0044]) in a wireless local area network (WLAN) (see fig. 1, p.2, [0020]) that allows a defined WLAN function to be split between the wireless access point (WAP) and one or more Control Nodes (CNs), the WAP comprising: a discovery function which initiates a discovery operation to discover a

Control Node (CN) (gateway 136, see figs. 6A and 6B, p.4, [0044]) among said one or more CNs that may complement said WAP with respect to providing said defined WLAN function by sending a plurality of discover messages (gateway query message, see fig. 6, p.4, [0044]) containing information about its own subset of the defined WLAN function, to the one or more CNs (access point transmitting gateway query message to one or more gateways, see fig. 6, p.4, [0044]); a receiving function which receives one or more reply messages from said one or more CNs in response to said discover messages, said one or more reply messages including information about a subset of the defined WLAN function, said one or more CNs have available for the WAP (service discovery message, transmitted from the gateways to the access point see fig. 6, p.4. [0045] - [0046]); a choosing function which chooses from among said one or more CNs that sent said one or more reply messages a particular CN based on local policy (access point selects a gateway, see fig. 6, p.4-5, [0046]).

8. Claims 25-27 are rejected under 35 U.S.C. 102(e) as being anticipated by **Cain et al 20050053005** (**hereinafter Cain**).

Regarding **claim 25**, Cain discloses a method for accommodating variances in a wireless network topology (MANET, see p.2, [0013], [0021]) comprising a step of dynamically adapting an operations logic of at least one network entity (controller, see p.2, [0013]) of said wireless network topology to alter processing of one or more functional sub-components (controller adjusting transmission parameters based on network topology changes, see p.2, [0013]-[0015], [0017]-[0018]).

Regarding **claim 26** as applied to claim 25, Cain further discloses a step of altering processing of selected functional sub-components at the at least one network entity by bypassing said processing of said selected functional sub-components (controller adjusting/maintaining transmission parameters based on network topology changes, steps 103-107, see fig. 10, p.2, [0013]-[0015], [0017]-[0018]).

Regarding **claim 27** as applied to claim 25, Cain further a step of altering processing of selected functional sub-components at the at least one network entity by selectively processing said selected functional sub-components (controller adjusting transmission parameters based on network topology changes, see p.2, [0013]-[0015], [0017]-[0018]).

Conclusion

9. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Benveniste 7,606,208 discloses distributed architecture for deploying multiple wireless local-area networks.

Tervo et al 7,478,146 discloses a system, apparatus, and method for communicating capabilities of a mobile device.

Simpson-Young et al 7,191,236 discloses transparent telecommunications system and apparatus.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to OLUMIDE T. AJIBADE-AKONAI whose telephone number is (571)272-6496. The examiner can normally be reached on M-F, 8.30p-5p.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Charles Appiah can be reached on 571-272-7904. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/OLUMIDE T AJIBADE-AKONAI/
Examiner, Art Unit 2617

Notice of References Cited	Application/Control No. 10/591,184	Applicant(s)/Patent Under Reexamination CHENG ET AL.	
	Examiner OLUMIDE T. AJIBADE-AKONAI	Art Unit 2617	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-7,191,236	03-2007	Simpson-Young et al.	709/228
*	B	US-7,478,146	01-2009	Tervo et al.	709/220
*	C	US-7,606,208	10-2009	Benveniste, Mathilde	370/338
*	D	US-2005/0053005	03-2005	Cain et al.	370/235
*	E	US-2005/0059396	03-2005	Chuah et al.	455/435.1
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Index of Claims *10591184*	Application/Control No. 10591184	Applicant(s)/Patent Under Reexamination CHENG ET AL.
	Examiner OLUMIDE T AJIBADE-AKONAI	**Art Unit** 2617

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE									
Final	Original	01/16/2010	09/23/2010	12/31/2010							
	1	✓	÷	=							
	2	✓	÷	=							
	3	✓	÷	=							
	4	✓	÷	=							
	5	✓	÷	=							
	6	✓	÷	=							
	7	✓	÷	=							
	8	✓	÷	=							
	9	✓	÷	N							
	10	✓	÷	N							
	11	✓	÷	N							
	12	✓	÷	=							
	13	✓	÷	✓							
	14	✓	÷	O							
	15	✓	÷	N							
	16	✓	÷	N							
	17	✓	÷	N							
	18	✓	÷	N							
	19	✓	÷	N							
	20	✓	÷	N							
	21	✓	÷	N							
	22	✓	÷	N							
	23	✓	÷	=							
	24	✓	-	-							
	25	✓	÷	✓							
	26	✓	÷	✓							
	27	✓	÷	✓							
	28	✓	-	-							
	29	✓	-	-							
	30	✓	-	-							
	31	✓	÷	N							
	32		÷	✓							
	33			=							

Search Notes *10591184*	Application/Control No. 10591184	Applicant(s)/Patent Under Reexamination CHENG ET AL.
	Examiner OLUMIDE T AJIBADE-AKONAI	**Art Unit** 2617

SEARCHED

Class	Subclass	Date	Examiner
370	338	01/16/2010	/J.B.B./
370	338,328,341,395.2,395.21	12/30/2010	OA
455	41.2,502	12/30/2010	OA
709	All	12/30/2010	OA

SEARCH NOTES

Search Notes	Date	Examiner
SEE EAST HISTORY	01/16/2010	/J.B.B./
EAST search	12/30/2010	OA

INTERFERENCE SEARCH

Class	Subclass	Date	Examiner
370	338	01/16/2010	/J.B.B./

/OLUMIDE T AJIBADE-AKONAI/ Examiner.Art Unit 2617	

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	3	(dynamic$4 adaptive$2 chang$3 variance$1) near3 topology with ((access near point$1) gateway controller$1) near2 (fucntion$1 functionalit$3 capabilit$3)	US-PGPUB; USPAT	OR	ON	2010/12/31 09:37
L2	6	(dynamic$4 adaptive$2 chang$3 variance$1) near3 topology with ((access near point$1) gateway controller$1) with (fucntion$1 functionalit$3 capabilit$3)	US-PGPUB; USPAT	OR	ON	2010/12/31 09:38
L3	67	(dynamic$4 adaptive$2 chang$3 variance$1) near3 topology with ((access near point$1) gateway controller$1) and 370/328,338,351.ccls.	US-PGPUB; USPAT	OR	ON	2010/12/31 09:38
L4	67	3 not 1	US-PGPUB; USPAT	OR	ON	2010/12/31 09:39
L5	2	complementary near3 (capabilit$3 functionalit$3) same (controller gateway server) same (WAP (access adj (point$1 node$1 unit$1)))	US-PGPUB; USPAT	OR	ON	2010/12/31 10:15
L6	2	complementary near3 (capabilit$3 functionalit$3) same (controller gateway server) same (WAP (access adj (point$1 node$1 unit$1)))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2010/12/31 10:15
L7	7	("20020060995" | "20030081547" | "20030174664" | "20030189915" | "20040105412" | "6870822" | "7209467").PN. OR ("7606208").URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2010/12/31 10:17
L8	9	complementary near5 (capabilit$3 service$1 functionalit$3) same (controller gateway server) same (WAP (access adj (point$1 node$1 unit$1)))	US-PGPUB; USPAT	OR	ON	2010/12/31 10:24
L9	28	("20010016909" | "20010040895" | "20020012320" | "20020062388" | "20030095504" | "20040032835" | "20040068647" | "20040090943" | "5371734" | "5796727" | "6201962" | "6314126" | "6349210" | "6493377" | "6512784" | "6590928" | "6625169" | "6633757" | "6640087" | "6707425" | "6721805" | "6744753" | "6754188" | "6763013" | "6771666" | "6842460" | "7305459").PN. OR ("7522731").URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2010/12/31 10:25
S1	38	(WLAN "wireless Lan" "wireless local area network" "802.11") same (access near (point$1 node$1 unit$1)) same (controller server) same negotiat$3 and ("455"/$. ccls. or "370"/$.ccls. or "709"/$.ccls.)	US-PGPUB; USPAT	OR	ON	2010/12/24 17:34
S2	117	(WLAN "wireless Lan" "wireless local area network" "802.11") same (access near (point$1 node$1 unit$1)) same (controller server) same discover$1 and ("455"/$. ccls. or "370"/$.ccls. or "709"/$.ccls.)	US-PGPUB; USPAT	OR	ON	2010/12/24 17:38

S3	115	S2 not S1	US-PGPUB; USPAT	OR	ON	2010/12/24 17:38
S4	1	(WLAN "wireless Lan" "wireless local area network" "802.11") same (access near (point$1 node$1 unit$1)) same (controller server) same (negotiat$3 exchang$3) near2 (capabilit$3 functionalit$3)	US-PGPUB; USPAT	OR	ON	2010/12/30 11:21
S5	64	(access near (point$1 node$1 unit$1)) same (controller server) same (negotiat$3 exchang$3) with (capabilit$3 functionalit$3) and ("455"/$.ccls. or "370"/$.ccls. or "709"/$.ccls.)	US-PGPUB; USPAT	OR	ON	2010/12/30 11:27
S6	1	(WLAN "wireless Lan" "wireless local area network" "802.11") same topology same (access near (point$1 node$1 unit$1)) same (negotiat$3 exchang$3) with (capabilit$3 functionalit$3)	US-PGPUB; USPAT	OR	ON	2010/12/30 11:32
S7	2	(WLAN "wireless Lan" "wireless local area network" "802.11") same topology same (negotiat$3 exchang$3) with (capabilit$3 functionalit$3)	US-PGPUB; USPAT	OR	ON	2010/12/30 11:32
S8	82	topology same (negotiat$3 exchang$3) with (capabilit$3 functionalit$3) and (455/41.2,502.ccls. or 370/338,328,341,395.2,395.21.ccls. or "709"/$.ccls.)	US-PGPUB; USPAT	OR	ON	2010/12/30 11:36
S9	0	(network near2 discover$3) same (controller server) same (WAP (access adj (point$1 node$1 unit$1))) same (negotiat$3 exchang$3) with (capabilit$3 functionalit$3)	US-PGPUB; USPAT	OR	ON	2010/12/30 11:45
S10	25	(network near2 discover$3) same (negotiat$3 exchang$3) with (capabilit$3 functionalit$3)	US-PGPUB; USPAT	OR	ON	2010/12/30 11:45
S11	17	("20010047383" | "6108308" | "6128314" | "6202096" | "6389464" | "6578075" | "6590677" | "6728267" | "6779004" | "6963784").PN. OR ("7191236").URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2010/12/30 11:48
S12	4	("20030202016" | "20040052233" | "20050060411" | "7191236").PN. OR ("7478146").URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2010/12/30 11:50
S13	2012	(access near (point$1 node$1 unit$1)) same (negotiat$3 exchang$3 receiv$3) with (capabilit$3 functionalit$3)	US-PGPUB; USPAT	OR	ON	2010/12/30 11:54
S14	1446	S13 and ("455"/$.ccls. or "370"/$.ccls. or "709"/$.ccls.)	US-PGPUB; USPAT	OR	ON	2010/12/30 11:54
S15	504	(WLAN mesh manet ad$1hoc "wireless Lan" "wireless local area network" "802.11") same (access near (point$1 node$1 unit$1)) same (negotiat$3 exchang$3 receiv$3) with (capabilit$3 functionalit$3)	US-PGPUB; USPAT	OR	ON	2010/12/30 11:55
S16	368	S15 and ("455"/$.ccls. or "370"/$.ccls. or "709"/$.ccls.)	US-PGPUB; USPAT	OR	ON	2010/12/30 11:55
S17	180	S16 and (@ad<"20040302" or @rlad<"20040302")	US-PGPUB; USPAT	OR	ON	2010/12/30 11:56
S18	8	("6374112").PN. OR ("7130625").URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2010/12/30 12:06

S19	75	(controller "controller node" gateway) with (access adj (point$1 node$1 unit$1)) with (capabalit$3 functionalit$3 parameter$1) near5 (security encryption QOS "quality-of-service" "quality of service")	US-PGPUB; USPAT; USOCR	OR	ON	2010/12/30 12:11
S20	22	(controller "controller node" gateway) with (access adj (point$1 node$1 unit$1)) with (capabalit$3 functionalit$3 parameter$1 security encryption QOS "quality-of-service" "quality of service") near5 (exchang$3 negotiat$3)	US-PGPUB; USPAT; USOCR	OR	ON	2010/12/30 12:41
S21	20	S20 not S19	US-PGPUB; USPAT; USOCR	OR	ON	2010/12/30 12:41
S22	869	(controller "controller node" gateway) with (access adj (point$1 node$1 unit$1)) with (capabalit$3 functionalit$3 parameter$1 (service near2 information) QOS "quality-of-service" "quality of service") and ("455"/$.ccls. or "370"/$.ccls. or "709"/$.ccls.)	US-PGPUB; USPAT; USOCR	OR	ON	2010/12/30 12:50
S23	6	(controller "controller node" gateway) with (access adj (point$1 node$1 unit$1)) with (exchang$3 negotiat$3) near3 (capabalit$3 functionalit$3 parameter$1 (service near2 information) QOS "quality-of-service" "quality of service") and ("455"/$.ccls. or "370"/$.ccls. or "709"/$.ccls.)	US-PGPUB; USPAT; USOCR	OR	ON	2010/12/30 12:51
S24	33	(controller "controller node" gateway) with (access adj (point$1 node$1 unit$1)) with (exchang$3 negotiat$3) with (capabalit$3 functionalit$3 parameter$1 (service near2 information) QOS "quality-of-service" "quality of service")	US-PGPUB; USPAT; USOCR	OR	ON	2010/12/30 12:54
S25	27	S24 not S23	US-PGPUB; USPAT; USOCR	OR	ON	2010/12/30 12:54
S26	266	(WLAN mesh manet ad$1hoc "wireless Lan" "wireless local area network" "802.11") same (controller "controller node" gateway) with (access adj (point$1 node$1 unit$1)) with (capabalit$3 functionalit$3 parameter$1 (service near2 information) QOS "quality-of-service" "quality of service")	US-PGPUB; USPAT	OR	ON	2010/12/30 14:30
S27	233	S26 and ("455"/$.ccls. or "370"/$.ccls. or "709"/$.ccls.)	US-PGPUB; USPAT	OR	ON	2010/12/30 14:31
S28	57	((controller "controller node" gateway) and (access adj (point$1 node$1 unit$1)) and (capabalit$3 functionalit$3 parameter$1 (service near2 information) QOS "quality-of-service" "quality of service") and (negotiat$3 exchang$3)).clm. and (455/41.2,502.ccls. or 370/338,328,341,395.2,395.21.ccls. or "709"/203,219,223,224,225,226,227,228,229,230,232,237.ccls.)	US-PGPUB; USPAT	OR	ON	2010/12/30 14:41
S29	30	S28 and (@ad<"20040302" or @rlad<"20040302")	US-PGPUB; USPAT	OR	ON	2010/12/30 14:42

12/31/2010 10:27:20 AM
C:\Documents and Settings\oajibadeakonai\My Documents\EAST\Workspaces\10591184.wsp

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of

Inventor:	Hong CHENG, et al.	Art Unit 2617
Appln. No.:	10/591,184	Exr. O. Ajibade Akonai
Filed:	May 14, 2007	Conf. No. 7759
For:	SYSTEM AND METHOD FOR NEGOTIATION OF WLAN ENTITY	

AMENDMENT UNDER 37 C.F.R. § 1.111

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

In response to the non-final rejection mailed on January 4, 2011, the following amendments and remarks are respectfully submitted:

IN THE CLAIMS

Please amend the claims to read as follows:

Listing of Claims

1. (Previously Presented) A system for providing service in a wireless local area network comprising:

a single or plurality of wireless access points (WAP) for processing a subset of complete functionality defined for the wireless local area network;

a single or plurality of control nodes (CN) for providing a subset or complete functionalities defined for the wireless local area network; and

a negotiation unit for the single or plurality of WAPs to dynamically negotiate with the control node for a secure connection and function split arrangement;

whereby the control node negotiates with the single or plurality of WAPs using the negotiation unit and provides complementary functionality for the single or plurality of each of the WAPs to form a complete functionality defined for the wireless local area network according to a decision of the negotiation unit.

2. (Currently Amended) The system according to claim 1, wherein said WAPs and CNs further comprise logically independent functional components of the functionalities defined for the wireless local area network with predefined interfaces used between each of the functional components.

3. (Previously Presented) The system according to claim 2, wherein said predefined interfaces used between said functional components are used over remote connections between said WAPs and said CNs.

4. (Previously Presented) The system according to claim 1, wherein each of said CNs further comprises a control node controller module and each of said WAPs further comprises a wireless access point controller module.

5. (Previously Presented) The system according to claim 4, wherein the controller module of said CN further comprises a single or plurality of processing schedules comprising sequential lists of descriptors for subsets of said functional components used for each wireless access point.

6. (Previously Presented) The system according to claim 4, wherein the controller module of said WAP further comprises a single or plurality of processing schedules each comprising sequential lists of descriptors for subsets of said functional components used for each associated mobile terminal.

7. (Previously Presented) The system according to claim 1, wherein each of the WAPs further comprises:

a discovering unit for discovering an available CN within a specified domain; and

a secure connection negotiating unit for negotiating a secure connection with a CN that may provide the complementary functionality desired by the WAP;

whereby the WAP locates the CN that provides the complementary functionality with regard to defined complete wireless local area network functions with the discovering unit and establishes a secure connection with the CN that provides the complementary functionality with the secure connection negotiating unit.

8. (Previously Presented) The system according to claim 1, wherein the controller module of said CN generates a data unit which resembles a data unit of a mobile terminal.

9. (Withdrawn) A system for providing service in a wireless local area network (WLAN) comprising:

a single or plurality of mobile terminals, each of said mobile terminals associated with and receiving services from a single or plurality of wireless access points (WAP);

a single or plurality of WAPs to process data units received from the single or plurality of mobile terminals or the single or plurality of WAPs using a subset of defined WLAN functions; and

an exchanging unit for the WAPs to exchange data units processed with a subset of WLAN functions;

wherein each of the WAPs further processes the processed data units received from other WAPs with complementary functionality among the subset of defined WLAN functions, and

whereby a data unit for a mobile terminal is processed with complete WLAN functions by a plurality of said WAPs.

10. (Withdrawn) The system according to claim 9, wherein each of the WAPs further comprises a control module for negotiating with other of said WAPs for a subset of the complete WLAN functions to be carried out at each of said WAPs.

11. (Withdrawn) The system according to claim 9, wherein each of the WAPs further comprises a local database that stores all associations of the mobile terminals attached to said WAP and a corresponding subset of the complete WLAN functions to be provided to the mobile terminals.

12. (Previously Presented) The system according to claim 1, wherein the functionalities of said WAP and CN are collocated in a single network element.

13. (Currently Amended) A method for providing service in a wireless local area network (WLAN) that allows a defined WLAN function split between a wireless access point (WAP) and a single or plurality of Control Nodes (CN) comprising the steps in which:

[[a]] the WAP discovers CNs that may provide complementary WLAN functions by sending a single or plurality of discover messages containing information about a subset of WLAN functions of the WAP to all of the CNs in the plurality of CNs;

after receiving said discover message, at least one of the CNs replies with a single or plurality of messages containing information about a subset of WLAN functions said at least one CN has available for the WAP; and

said WAP chooses from all of the ~~replied~~ CNs which replied a proper CN based on local policy and establishes an association with said chosen CN.

14. (Previously Presented) The method according to claim 13, wherein the choosing of the proper CN by said WAP comprises choosing the proper CN using information, the information comprising:

i. the subset of the WLAN functions offered by the CN;

ii. a cost of using the CN;

iii. a vendor of the CN;

iv. characteristics of a connection to the CN; and

v. a weighted sum of the above factors.

15. (Withdrawn) A method for providing service in a wireless local area network (WLAN) that allows a defined WLAN function split between wireless access point (WAP) and a single or plurality of Control Nodes (CN) comprising the steps in which:

a CN dynamically discovers a capability of a WAP by sending a single or plurality of messages to the WAP, each of the messages containing a section that emulates a data unit sent by a mobile terminal;

the WAP receives at least one of said messages, processes said section using a same procedure for processing data units received from the mobile terminal and sends another data unit back to said CN in a reply message; and

said CN obtains capability information of said WAP by examining the processed data unit in said reply message.

16. (Withdrawn) A method for providing service in a wireless local area network (WLAN) that allows a defined WLAN function split between a wireless access point (WAP) and a single or plurality of Control Nodes (CN) comprising the steps in which:

a CN obtains a capability of the WAP; and

said CN negotiates with another CN or a plurality of other CNs for supplementary WLAN functions to be provided to the WAP.

17. (Withdrawn) A method for carrying out load balancing in a wireless local area network (WLAN) without requiring a mobile terminal to change an association relationship with a wireless access point (WAP) comprising the steps in which:

the WAP separates a processing function provided to the mobile terminal into an association specific part and a non-association specific part;

said WAP negotiates with another WAP regarding the non-association specific part and establishes a secure tunnel with said another WAP;

said WAP tunnels a data unit from a mobile terminal to the said another WAP through the tunnel after processing said data unit with functions of the association specific part; and

said another WAP receiving the processed data unit through said tunnel processes said data unit with functions of the non-association specific part.

18. (Withdrawn) The method according to claim 17 further comprising a step in which said WAP uses a wireless channel to establish a direct connection with said another WAP and sets up said secure tunnel over the direct connection.

19. (Withdrawn) The method according claim 17 further comprising a step in which the WAP decides on whether to tunnel said data unit from the mobile terminal to said another WAP for said non association specific processing by monitoring a load at said WAP and comparing it with a preset threshold value.

20. (Withdrawn) The method according to claim 17 further comprising a step in which said WAP decides on which other WAPs should be used for said non association specific processing by monitoring loads at said other WAPs said WAP has connections with and compares said loads with a preset threshold value.

21. (Withdrawn) The method according to claim 17 further comprising step in which a central control entity monitors a load status on all WAPs within a certain domain and mandates distribution of said non-association specific processing functions between different WAPs from among said all WAPs.

22. (Withdrawn) The method according to claim 17 for the WAP to determine a distribution of said non-association specific processing functions based on information, the information comprising:

a size of the data unit to be processed;

an expected average time for the processing of the data unit;

an overhead time for the processing of the data unit; and

a weighted sum of the above factors.

23. (Currently Amended) A method for providing service in a wireless local area network (WLAN) that allows a defined WLAN function split between a wireless access point (WAP) and a single or plurality of Control Nodes (CN) comprising the steps in which:

a subset of WAPs processes a total of ~~its~~ a subset of functionality of the subset of WAPs defined for the WLAN;

the WAP dynamically negotiates with a CN for a secure connection and function split arrangement; and

the CN provides complementary functionality for each of the WAPs to form a complete functionality defined for the wireless local area network according to a decision in the negotiation step.

24-30. (Cancelled)

31. (Withdrawn) A method for determining a topology of a wireless network, wherein a first network entity alters a connectivity association with a second network entity by including one or more third network entities in a communication path of an alternate connectivity association, comprising the steps of:

exchanging information on neighbouring network entities among said network entities of said wireless network;

analyzing communication frames received by said network entities based on pre-established representations of said topology of said wireless network; and

analyzing association request frames received by said network entities based on said pre-established representations of said topology of said network.

32. (Currently Amended) A wireless access point (WAP) in a wireless local area network (WLAN) that allows a defined WLAN function to be split between the wireless access point (WAP) and one or more Control Nodes (CNs), the WAP comprising:

a discovery function which initiates a discovery operation to discover a Control Node (CN) among said one or more CNs that may complement said WAP with respect to providing said defined WLAN function by sending a plurality of discover messages containing information about ~~its own~~ a subset of the defined WLAN function of the WAP, to the one or more CNs;

a receiving function which receives one or more reply messages from said one or more CNs in response to said discover messages, said one or more reply messages including information about a subset of the defined WLAN function[[,]] which said one or more CNs have available for the WAP; and

a choosing function which chooses from among said one or more CNs that sent said one or more reply messages a particular CN based on local policy.

33. (Previously Presented) A Control Node that allows a defined wireless local area network (WLAN) function to be split between a wireless access point (WAP) in the WLAN and the Control Node, the Control Node comprising:

a receiving function which receives a discover message including information about a subset of the defined WLAN function from the WAP;

a sending function which sends a reply message to the WAP in response to the discover message;

a negotiating function which dynamically negotiates with the WAP for a secure connection and function split arrangement; and

a providing function which provides the WAP with complementary functionality for the WAP to form a complete functionality defined for the WLAN according to a decision in the negotiating function.

34. (New) The method according to claim 13, further comprising a step in which the proper control node chosen by the WAP negotiates with the WAP and provides complementary functionality for the WAP to form a complete functionality defined for the wireless local area network.

35. (New) The wireless access point (WAP) according to claim 32 further comprising a negotiation function which dynamically negotiates with the particular CN chosen by the choosing function for a secure connection and function split arrangement.

REMARKS

Reconsideration and allowance of this application is respectfully requested in light of the above amendments and the following remarks.

The Applicants acknowledge with appreciation the indication in the Office Action that claims 1-8, 12, 23 and 33 are allowed, and that claim 14 would be allowable if rewritten in independent form to include all of the limitations of the base claim and any intervening claims.

Claims 2, 13, 23 and 32 have been amended to overcome the 35 U.S.C. §112, second paragraph, rejections applied to claim 13, to ensure proper antecedent support for each recited feature, and to correct minor grammatical mistakes, claims 25-27 have been cancelled without prejudice or disclaimer, and claims 34-35 have been newly added. Support for the subject matter of claims 34-35 is found, for example, in paragraphs [0067]-[0068] of the published U.S. application. (It should be noted that references herein to the specification and drawings are for illustrative purposes only and are not intended to limit the scope of the invention to the referenced embodiments). No new matter is added.

More particularly, the subject matter of new claim 34 corresponds to the feature of "...the control node negotiates with the single or plurality of WAPs using the negotiation unit and provides complementary functionality for the single or plurality of each of the WAPs to form a complete functionality defined for the wireless local area network," as recited by claim 1, and the subject matter of claim 35 corresponds to the feature of "...a negotiating function which dynamically negotiates with the WAP for a secure connection and function split arrangement," as recited by claim 33. No new matter is added.

In the current Office Action, claims 13 and 32 were rejected under 35 U.S.C. §102(e) as being anticipated by Chuah et al. (US 2005/0059396) (hereinafter, "Chuah"). The Applicants respectfully disagree with these rejections and traverse based on the points set forth below.

Claim 13 is directed towards a method for providing service in a wireless local area network (WLAN) and recites the features of:

> "13. A method for providing service in a wireless local area network (WLAN) that allows a defined WLAN function split between a wireless access point (WAP) and a single or plurality of Control Nodes (CN) comprising the steps in which:
>
> the WAP discovers CNs that may provide complementary WLAN functions by sending a single or plurality of discover messages containing information about a subset of WLAN functions of the WAP to all of the CNs in the plurality of CNs;
>
> after receiving said discover message, at least one of the CNs replies with a single or plurality of messages containing information about a subset of WLAN functions said at least one CN has available for the WAP; and
>
> said WAP chooses from all of the CNs which replied a proper CN based on local policy and establishes an association with said chosen CN." (emphasis added)

As explained in the specification, the method of claim 13 provides a method for negotiations between controlling nodes (CNs) and wireless access points (WAPs) of a WLAN based on policies that allow for accommodating static and dynamic differences among the WLAN entities including dynamic changes in WLAN topologies within a single WLAN. (see, e.g., par. [0020] of the published U.S. application).

Chuah fails to disclose, either expressly or inherently, each of the features of claim 1.

By way of review, Chuah is directed towards a communications protocol (data structure) and associated methods for systematically configuring new gateways and/or access points installed in a wireless network environment, thereby reducing the time and cost associated with setting up or modifying a wireless network, such as a wireless fidelity local area network. (par.

[0019]). To achieve these objectives, Chuah discloses and illustrates a method of registering an access point with a gateway at paragraphs [0044]-[0048] and FIGs. 6A and 6B. Specifically, Chuah discloses that an access point is powered up (FIG. 6A, 602) and broadcasts a "gateway query message" over the network (FIG. 6A, 604). A gateway then receives the gateway query message (FIG. 6A, 606), and checks its database of registered access points to determine whether the broadcasting access point is registered therewith (FIG. 6A, 608). If the broadcasting access point is not registered with the gateway, the gateway sends a "unicast service discovery message" (SDM) to the broadcasting access point (FIG. 6A, 612). If the broadcasting access point receives plural SDMs, the broadcasting access point selects an appropriate gateway for registration (FIG. 6A, 616, 618). The broadcasting access point initiates an AP registration request message to the selected gateway (FIG. 6A, 620), and provides an "AP location, IP address, MAC address, number of radios, radio types, radio frequency range, and lifetime information" in the registration request message (shown in FIG. 7) to the selected gateway (FIG. 6A, 622).

As explained above, Chuah discloses that an access point discovers gateways at which the access point is not registered by broadcasting a gateway query message, and registers its basic information, such as its address and radio characteristics, at a selected gateway, among the discovered gateways.

In contrast, claim 13 recites the feature of: "...the WAP discovers CNs that may provide complementary WLAN functions by sending a single or plurality of discover messages containing information about a subset of WLAN functions of the WAP to all of the CNs in the plurality of CNs..." and "...after receiving said discover message, at least one of the CNs replies with a single or plurality of messages containing information about a subset of WLAN functions said at least one CN has available for the WAP." Chuah does not disclose, either expressly or inherently, either of these features of claim 13.

More specifically, Chuah does not mention anything about the access point 138 discovering a control node that "may provide complementary WLAN functions," as recited by claim 1. The Office Action (pg. 4) alleges that the "access point 138" disclosed by Chuah corresponds to the "WAP" recited by claim 1, and further alleges that the "gateway query message" disclosed by Chuah corresponds to the "discover message" recited by claim 13. However, although Chuah discloses that the access point transmits the "gateway query message" to a gateway, Chuah does not disclose that the gateway query message is used to discover "a control node that "may provide complementary WLAN functions," as recited by claim 13. Chuah does not mention anything about complementary WLAN functions at all.

Furthermore, Chuah does not does not disclose that the "gateway query message" contains "information about a subset of WLAN functions" of the access point, as recited by claim 13. Chuah does not mention a "subset" of functions of the access point 138 anywhere, and therefore clearly fails to disclose that the "gateway query message" contains "information about a subset of WLAN functions" of the access point, as recited by claim 13.

Moreover, Chuah fails to disclose the feature of: "...after receiving said discover message, at least one of the CNs replies with a single or plurality of messages containing information about a subset of WLAN functions said at least one CN has available for the WAP," as recited by claim 1. The Office Action (pg. 4) alleges that the "service discovery message" disclosed by Chuah corresponds to this feature of claim 1. However, as explained above, the "service discovery message" does not contain "information about a subset of WLAN functions said at least one CN has available for the WAP," as recited by claim 13. Instead, Chuah discloses that the "service discovery message" is used to register a broadcasting AP. (see Chuah, par. [0046] and FIG. 6A, steps 614-620).

Thus, Chuah clearly differs in substantial ways from the method of claim 13 in both (1) the purpose of exchanging messages, and (2) the information contained in the messages. More specifically, the method recited by claim 13 is related to a "defined WLAN function split between a wireless access point (WAP) and a single or plurality of Control Nodes (CN)," (see, e.g., par. [0021], noting that the method of claim 13 accomodates variations in system design, processing load or network topology), whereas the technique of Chuah is related to a protocol which systematically configures new gateways and/or access points to reduce the time and cost associated with setting up or modifying a wireless network. Chuah fails to disclose the features of: "...the WAP discovers CNs that may provide complementary WLAN functions by sending a single or plurality of discover messages containing information about a subset of WLAN functions of the WAP to all of the CNs in the plurality of CNs..." and "...after receiving said discover message, at least one of the CNs replies with a single or plurality of messages containing information about a subset of WLAN functions said at least one CN has available for the WAP," as recited by claim 13.

Accordingly, the Applicants respectfully submit that Chuah fails to disclose each of the features of claim 13, and that allowance of claim 13 and all dependent claims therefrom is warranted for at least these reasons. Claim 32 recites substantially the same features distinguishing method claim 13 from the applied references, though does so with respect to a wireless access point (WAP). Accordingly, it is respectfully submitted that allowance of claims 13 and 32 and all claims dependent therefrom is warranted for at least these reasons.

In view of the above, it is submitted that this application is in condition for allowance and a notice to that effect is respectfully solicited.

If any issues remain which may best be resolved through a telephone communication, the Examiner is requested to telephone the undersigned at the local Washington, D.C. telephone number listed below.

Respectfully submitted,

/James Edward Ledbetter/

James E. Ledbetter
Registration No. 28,732

Date: April 4, 2011
JEL/DEA/att

Attorney Docket No. L8638-06115
Dickinson Wright PLLC
1875 Eye Street, NW, Suite 1200
Washington, DC 20006
Telephone: (202) 457-0160
Facsimile: (202) 659-1559

DC 8638-6115 172670v1

Electronic Acknowledgement Receipt

EFS ID:	9805920
Application Number:	10591184
International Application Number:	
Confirmation Number:	7759
Title of Invention:	System and Method for Negotiation of Wlan Entity
First Named Inventor/Applicant Name:	Hong Cheng
Customer Number:	52989
Filer:	James Edward Ledbetter
Filer Authorized By:	
Attorney Docket Number:	L8638.06115
Receipt Date:	04-APR-2011
Filing Date:	14-MAY-2007
Time Stamp:	18:58:21
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Transmittal Letter	Trans.pdf	50722 ea91bd18453aa264564736e3560e9884c9df4781	no	1

Warnings:

Information:

2	Amendment/Req. Reconsideration-After Non-Final Reject	Amend.pdf	466542 76878dbbf13506424cc6428c436520cc534f5e5e	no	17
Warnings:					
Information:					
		Total Files Size (in bytes):	517264		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

<u>New Applications Under 35 U.S.C. 111</u>
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

<u>National Stage of an International Application under 35 U.S.C. 371</u>
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

<u>New International Application Filed with the USPTO as a Receiving Office</u>
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

AMENDMENT TRANSMITTAL LETTER (Large Entity) Applicant(s): **Hong CHENG, et al.**	Docket No. **008638-06115**

Application No.	Filing Date	Examiner	Customer No.	Group Art Unit	Confirmation No.
10/591,184	**May 14, 2007**	**O. Ajibade Akonai**	**52989**	**2617**	**7759**

Invention: **SYSTEM AND METHOD FOR NEGOTIATION OF WLAN ENTITY**

COMMISSIONER FOR PATENTS:

Transmitted herewith is an amendment in the above-identified application.

The fee has been calculated and is transmitted as shown below.

CLAIMS AS AMENDED

	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST # PREV. PAID FOR		NUMBER EXTRA CLAIMS PRESENT		RATE	ADDITIONAL FEE
TOTAL CLAIMS	28	-	32	=	0	x	$52.00	$0.00
INDEP. CLAIMS	10	-	14	=	0	x	$220.00	$0.00
Multiple Dependent Claims (check if applicable) ☐								$0.00
TOTAL ADDITIONAL FEE FOR THIS AMENDMENT								$0.00

☒ No additional fee is required for amendment.

☐ Please charge Deposit Account No. in the amount of

☐ A check in the amount of to cover the filing fee is enclosed.

☒ The Director is hereby authorized to charge payment of the following fees associated with this communication or credit any overpayment to Deposit Account **04-1061**

- ☒ Any additional filing fees required under 37 C.F.R. 1.16.
- ☒ Any patent application processing fees under 37 CFR 1.17.

☐ Payment by credit card. Form PTO-2038.

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

/James Edward Ledbetter/

Signature

Dated: **April 4, 2011**

James E. Ledbetter, Reg. No. 28732
Dickinson Wright PLLC
1875 Eye Street, N.W., Suite 1200
Washington, D.C. 20006
Telephone: 202.457.0160
Facsimile: 202.659.1559

I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to "Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450" [37 CFR 1.8(a)] on

_____________ .
(Date)

Signature of Person Mailing Correspondence

Typed or Printed Name of Person Mailing Correspondence

cc:

P11LARGE/REV10

PTO/SB/06 (07-06)
Approved for use through 1/31/2007. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

PATENT APPLICATION FEE DETERMINATION RECORD
Substitute for Form PTO-875

Application or Docket Number: 10/591,184
Filing Date: 05/14/2007
☐ To be Mailed

APPLICATION AS FILED – PART I

FOR	NUMBER FILED (Column 1)	NUMBER EXTRA (Column 2)	SMALL ENTITY ☐ RATE ($)	SMALL ENTITY FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	OTHER THAN SMALL ENTITY FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =		OR	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =			X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $250 ($125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							
			TOTAL			TOTAL	

* If the difference in column 1 is less than zero, enter “0” in column 2.

APPLICATION AS AMENDED – PART II

AMENDMENT

04/04/2011	CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	SMALL ENTITY RATE ($)	SMALL ENTITY ADDITIONAL FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	* 28	Minus	** 32	= 0	X $ =		OR	X $52=	0
Independent (37 CFR 1.16(h))	* 10	Minus	***13	= 0	X $ =		OR	X $220=	0
☐ Application Size Fee (37 CFR 1.16(s))									
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
					TOTAL ADD’L FEE		OR	TOTAL ADD’L FEE	**0**

AMENDMENT

	CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	RATE ($)	ADDITIONAL FEE ($)		RATE ($)	ADDITIONAL FEE ($)
Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =		OR	X $ =	
Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =		OR	X $ =	
☐ Application Size Fee (37 CFR 1.16(s))									
☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
					TOTAL ADD’L FEE		OR	TOTAL ADD’L FEE	

* If the entry in column 1 is less than the entry in column 2, write “0” in column 3.
** If the “Highest Number Previously Paid For” IN THIS SPACE is less than 20, enter “20”.
*** If the “Highest Number Previously Paid For” IN THIS SPACE is less than 3, enter “3”.
The “Highest Number Previously Paid For” (Total or Independent) is the highest number found in the appropriate box in column 1.

Legal Instrument Examiner:
/PAULA BRITTON/

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

NOTICE OF ALLOWANCE AND FEE(S) DUE

52989 7590 06/21/2011

James Edward Ledbetter
1875 Eye Street
Suite 1200
Washington, DC 20006

EXAMINER	
AJIBADE AKONAI, OLUMIDE	
ART UNIT	**PAPER NUMBER**
2617	

DATE MAILED: 06/21/2011

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/591,184	05/14/2007	Hong Cheng	L8638.06115	7759

TITLE OF INVENTION: SYSTEM AND METHOD FOR NEGOTIATION OF WLAN ENTITY

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	$1510	$300	$0	$1810	09/21/2011

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the SMALL ENTITY status shown above.

If the SMALL ENTITY is shown as YES, verify your current SMALL ENTITY status:

A. If the status is the same, pay the TOTAL FEE(S) DUE shown above.

B. If the status above is to be removed, check box 5b on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and twice the amount of the ISSUE FEE shown above, or

If the SMALL ENTITY is shown as NO:

A. Pay TOTAL FEE(S) DUE shown above, or

B. If applicant claimed SMALL ENTITY status before, or is now claiming SMALL ENTITY status, check box 5a on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and 1/2 the ISSUE FEE shown above.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: Mail **Mail Stop ISSUE FEE**
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

52989 7590 06/21/2011

James Edward Ledbetter
1875 Eye Street
Suite 1200
Washington, DC 20006

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/591,184	05/14/2007	Hong Cheng	L8638.06115	7759

TITLE OF INVENTION: SYSTEM AND METHOD FOR NEGOTIATION OF WLAN ENTITY

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	$1510	$300	$0	$1810	09/21/2011

EXAMINER	ART UNIT	CLASS-SUBCLASS
AJIBADE AKONAI, OLUMIDE	2617	370-338000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

- ❑ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
- ❑ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list

(1) the names of up to 3 registered patent attorneys or agents OR, alternatively,

(2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 ____________________
2 ____________________
3 ____________________

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

(B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ❑ Individual ❑ Corporation or other private group entity ❑ Government

4a. The following fee(s) are submitted:

- ❑ Issue Fee
- ❑ Publication Fee (No small entity discount permitted)
- ❑ Advance Order - # of Copies ____________

4b. Payment of Fee(s): **(Please first reapply any previously paid issue fee shown above)**

- ❑ A check is enclosed.
- ❑ Payment by credit card. Form PTO-2038 is attached.
- ❑ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number ____________ (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)

- ❑ a. Applicant claims SMALL ENTITY status. See 37 CFR 1.27.
- ❑ b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(2).

NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature ____________________ Date ____________________

Typed or printed name ____________________ Registration No. ____________________

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/591,184	05/14/2007	Hong Cheng	L8638.06115	7759

52989 7590 06/21/2011

James Edward Ledbetter
1875 Eye Street
Suite 1200
Washington, DC 20006

EXAMINER	
AJIBADE AKONAI, OLUMIDE	
ART UNIT	**PAPER NUMBER**
2617	

DATE MAILED: 06/21/2011

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(application filed on or after May 29, 2000)

The Patent Term Adjustment to date is 498 day(s). If the issue fee is paid on the date that is three months after the mailing date of this notice and the patent issues on the Tuesday before the date that is 28 weeks (six and a half months) after the mailing date of this notice, the Patent Term Adjustment will be 498 day(s).

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

PTOL-85 (Rev. 02/11)

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Notice of Allowability	**Application No.** 10/591,184	**Applicant(s)** CHENG ET AL.	
	Examiner OLUMIDE T. AJIBADE AKONAI	**Art Unit** 2617	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to *4/4/2011*.

2. ☒ The allowed claim(s) is/are *1-8,12-14,23 and 32-35*.

3. ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
   a) ☒ All b) ☐ Some* c) ☐ None of the:
   1. ☒ Certified copies of the priority documents have been received.
   2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
   3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
   1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
   (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☒ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
3. ☐ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application
6. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____ .
7. ☐ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____.

DETAILED ACTION

Allowable Subject Matter

1. Claims 1-8, 12-14, 23 and 32-35 are allowed.

The following is an examiner's statement of reasons for allowance:

Regarding **claim 1**, the instant invention discloses a negotiation unit for the single or plurality of wireless access points WAPs to dynamically negotiate with the control node for a secure connection and function split arrangement; whereby the control node negotiates with the single or plurality of WAPs using the negotiation unit and provides complementary functionality for the single or plurality of each of the WAPs to form a complete functionality defined for the wireless local area network according to a decision of the negotiation unit. The above novel features in combination with other recited limitations of claim 1 are neither taught, suggested, nor made obvious by any prior art of record. Claims 2-8 and 12 are allowable by virtue of their dependency on claim 1.

Regarding **claim 13**, the instant invention discloses a method for providing service in a wireless local area network (WLAN) that allows a defined WLAN function split between a wireless access point (WAP) and a single or plurality of Control Nodes (CN) comprising the steps in which: the WAP discovers CNs that may provide complementary WLAN functions by sending a single or plurality of discover messages containing information about a subset of WLAN functions of the WAP to al1 of the CNs in the plurality of CNs; after receiving said discover message, at least one of the CNs replies with a single or plurality of messages containing information about a subset of

WLAN functions said at least one CN has available for the WAP; and said WAP chooses from all of the CNs which replied a proper CN based on local policy and establishes an association with said chosen CN. The above novel features in combination with other recited limitations of claim 13 are neither taught, suggested, nor made obvious by any prior art of record. Claims 14 and 34 are allowable by virtue of their dependency on claim 13.

Regarding **claim 23**, the instant invention discloses the steps in which: the WAP dynamically negotiates with a CN for a secure connection and function split arrangement; and the CN provides complementary functionality for each of the WAPs to form a complete functionality defined for the wireless local area network according to a decision in the negotiation step. The above novel features in combination with other recited limitations of claim 23 are neither taught, suggested, nor made obvious by any prior art of record.

Regarding **claim 32**, the instant invention discloses a discovery function which initiates a discovery operation to discover a Control| Node (CN) among said one or more CNs that may complement said WAP with respect to providing said defined WLAN function by sending a plurality of discover messages containing information about a subset of the defined WLAN function of the WAP, to the one or more CNs; a receiving function which receives one or more reply messages from said one or more CNs in response to said discover messages, said one or more reply messages including information about a subset of the defined WLAN function which said one or more CNs have available for the WAP; and a choosing function which chooses from among said one or more CNs that sent said one or more reply messages a particular CN based on local policy. The above novel features in combination with other recited limitations of claim 32 are neither taught, suggested, nor made obvious by any prior art of record. Claim 35 is allowable by virtue of its dependency on claim 32.

Regarding **claim 33**, the instant invention discloses a receiving function which receives a discover message including information about a subset of the defined WLAN function from the WAP; a sending function which sends a reply message to the WAP in response to the discover message; a negotiating function which dynamically negotiates with the WAP for a secure connection and function split arrangement; and a providing function which provides the WAP with complementary functionality for the WAP to form a complete functionality defined for the WLAN according to a decision in the negotiating function.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled “Comments on Statement of Reasons for Allowance.”

Conclusion

2. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Amos et al 6,965,605 discloses a split access point.

Eran 7,697,549 discloses wireless LAN control over a wired network.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to OLUMIDE T. AJIBADE AKONAI whose telephone number is (571)272-6496. The examiner can normally be reached on M-F, 8.30p-5p.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Charles Appiah can be reached on 571-272-7904. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/OLUMIDE T AJIBADE AKONAI/
Primary Examiner, Art Unit 2617

Notice of References Cited	Application/Control No. 10/591,184	Applicant(s)/Patent Under Reexamination CHENG ET AL.	
	Examiner OLUMIDE T. AJIBADE AKONAI	Art Unit 2617	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-6,965,605	11-2005	Amos et al.	370/401
*	B	US-7,697,549	04-2010	Eran, Shpak	370/401
	C	US-			
	D	US-			
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	0	("wireless Local area network" WLAN "wireless LAN") same (access near (point$1 terminal$1 unit$1)) same ((core near (network node $1)) "network controller") same (negotiat$3 agree$4) same complementary near3 (function$5 capabilit$3)	US-PGPUB; USPAT	OR	ON	2011/06/10 07:06
L2	5	("wireless Local area network" WLAN "wireless LAN") same (access near (point$1 terminal$1 unit$1)) same ((core near (network node $1)) "network controller") same (negotiat$3 agree$4) same (function$5 capabilit$3)	US-PGPUB; USPAT	OR	ON	2011/06/10 07:06
L3	184	("wireless Local area network" WLAN "wireless LAN") same (access near (point$1 terminal$1 unit$1)) same ((core near (network node $1)) "network controller") same (function$5 capabilit$3)	US-PGPUB; USPAT	OR	ON	2011/06/10 07:07
L4	53	3 and (455/41.2,435.1,515.ccls. or 370/328,338.ccls.)	US-PGPUB; USPAT	OR	ON	2011/06/10 07:12
L5	10	("wireless Local area network" WLAN "wireless LAN") same (access near (point$1 terminal$1 unit$1)) same ((core near (network node $1)) "network controller") same negotiat$3	US-PGPUB; USPAT	OR	ON	2011/06/10 07:23
L6	12	(adaptive$2 dynamic$4 switch$3 chang$3) near3 (function$5 functionalities capabilit$3) same ("wireless Local area network" WLAN "wireless LAN") same (access near (point$1 terminal$1 unit $1)) same ((core near (network node$1)) "network controller")	US-PGPUB; USPAT	OR	ON	2011/06/10 07:27
L7	185	(function$5 functionalities capabilit$3) same ("wireless Local area network" WLAN "wireless LAN") same (access near (point$1 terminal $1 unit$1)) same ((core near (network node$1)) "network controller")	US-PGPUB; USPAT	OR	ON	2011/06/10 07:32

L8	0	(shar$3 split$4 divid$3) near4 (responsibilit$3 function$5 functionalities capabilit$3) same ("wireless Local area network" WLAN "wireless LAN") same ((access near (point$1 terminal$1 unit $1)) base$1station$1) same ((core near (network node$1)) "network controller")	US-PGPUB; USPAT	OR	ON	2011/06/10 09:16
L9	66	(shar$3 split$4 divid$3) near4 (responsibilit$3 function$5 functionalities capabilit$3) same ("wireless Local area network" WLAN "wireless LAN") same ((access near (point$1 terminal$1 unit $1)) base$1station$1)	US-PGPUB; USPAT	OR	ON	2011/06/10 09:16
L10	14	(shar$3 split$4 divid$3) near4 (responsibilit$3 function$5 functionalities capabilit$3) same ((access near (point$1 terminal$1 unit$1)) base$1station$1) same ((core near (network node$1)) "network controller")	US-PGPUB; USPAT	OR	ON	2011/06/10 09:22
L11	65	(shar$3 split$4 divid$3) near3 (responsibilit$3 function$5 functionalities capabilit$3) same ("wireless Local area network" WLAN "wireless LAN") and (455/41.1,414.1,509,550.1.ccls. or 370/252,254,328,329,330,338,341,395.2,395.21.ccls.)	US-PGPUB; USPAT	OR	ON	2011/06/10 09:29
L12	5	("20020089994" | "20020159407").PN. OR ("6965605").URPN.	US-PGPUB; USPAT; USOCR	OR	ON	2011/06/10 09:30
L13	9	(shar$3 split$4 divid$3) near5 (responsibilit$3 function$5 functionalities capabilit$3) same ("wireless Local area network" WLAN "wireless LAN" sub$1net) same ((core near (network node $1)) "network controller")	US-PGPUB; USPAT	OR	ON	2011/06/10 09:36
L14	7778	(dynamic$4 adaptive$2 flexibl$1 chang$3) near3 topolog$3 with (access near point$1) (gateway controller "core network") same (shar$3 split$4 divid$3) near4 (responsibilit$3 function$5 functionalities capabilit$3)	US-PGPUB; USPAT	OR	ON	2011/06/10 09:39
L15	0	(dynamic$4 adaptive$2 flexibl$1 chang$3) near3 topolog$3 with (access near point$1) same (gateway controller "core network") same (shar$3 split$4 divid$3) near4 (responsibilit$3 function$5 functionalities capabilit$3)	US-PGPUB; USPAT	OR	ON	2011/06/10 09:39
L16	1	(dynamic$4 adaptive$2 flexibl$1 chang$3) near3 topolog$3 with (access near point$1) same (gateway controller "core network") same (shar$3 split$4 divid$3)	US-PGPUB; USPAT	OR	ON	2011/06/10 09:39

L17	55	(dynamic$4 adaptive$2 flexibl$1 chang$3) with (access near point $1) same (gateway controller "core network") same (shar$3 split$4 divid$3)	US-PGPUB; USPAT	OR	ON	2011/06/10 09:40
L18	0	("wireless Local area network" WLAN "wireless LAN") same (access near (point$1 terminal$1 unit$1)) same ((core near (network node $1)) "network controller") same (co$1operat$3 negotiat$3) near5 (complement$3 function$1 functionalities capabilit$3)	US-PGPUB; USPAT	OR	ON	2011/06/10 09:43
L19	19	("wireless Local area network" WLAN "wireless LAN") same (access near (point$1 terminal$1 unit$1)) same ((core near (network node $1)) "network controller") same (co$1operat$3 negotiat$3)	US-PGPUB; USPAT	OR	ON	2011/06/10 09:43
L20	1	((access near point$1) and ((core control) near node$1) and (functionalit$3 function$1) and "local area network" and (negotiat $3 co$1operat$3)).clm. and (455/41.1,414.1,509,550.1.ccls. or 370/252,254,328,329,330,338,341,395.2,395.21.ccls. or "709"/$. ccls.)	US-PGPUB; USPAT	OR	ON	2011/06/10 09:47
L21	94	(WLAN "wireless Lan" "wireless local area network" "802.11") same (access near (point$1 node$1 unit$1)) same (controller server) same (co$1operat$3 negotiat$3) and ("455"/$.ccls. or "370"/$.ccls. or "709"/$.ccls.)	US-PGPUB; USPAT	OR	ON	2011/06/10 09:48
L23	1	((access near point$1) and ((core control) near node$1) and (functionalit$3 function$1) and "local area network" and (negotiat $3 co$1operat$3)).clm. and (455/41.2,414.1,509,550.1.ccls. or 370/252,254,328,329,330,338,341,395.2,395.21.ccls. or "709"/$. ccls.)	US-PGPUB; USPAT	OR	ON	2011/06/10 11:58
L24	1	((access near point$1) and ((core control) near node$1) and (functionalit$3 function$1) and "local area network" and (negotiat $3 co$1operat$3)).clm. and (455/41.2,414.1,435.1,509,515,550.1. ccls. or 370/252,254,328,329,330,338,341,395.2,395.21.ccls. or "709"/$.ccls.)	US-PGPUB; USPAT	OR	ON	2011/06/10 11:59
L25	25	(WLAN "wireless local area network" "wireless lan") with (split$4 divid$3 division shar$3) near3 functions and (455/41.2,414.1,435.1,509,515,550.1.ccls. or 370/252,254,328,329,330,338,341,395.2,395.21.ccls. or "709"/$. ccls.)	US-PGPUB; USPAT	OR	ON	2011/06/10 12:37

6/ 10/ 2011 12:38:16 PM

C:\ Documents and Settings\ oajibadeakonai\ My Documents\ EAST\ Workspaces\ 10591184.wsp

Index of Claims	Application/Control No. 10591184	Applicant(s)/Patent Under Reexamination CHENG ET AL.
	Examiner OLUMIDE T AJIBADE-AKONAI	Art Unit 2617

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE									
Final	Original	01/16/2010	09/23/2010	12/31/2010	06/10/2011						
1	1	✓	÷	=	=						
2	2	✓	÷	=	=						
3	3	✓	÷	=	=						
4	4	✓	÷	=	=						
5	5	✓	÷	=	=						
6	6	✓	÷	=	=						
7	7	✓	÷	=	=						
8	8	✓	÷	=	=						
-	9	✓	÷	N	-						
-	10	✓	÷	N	-						
-	11	✓	÷	N	-						
9	12	✓	÷	=	=						
10	13	✓	÷	✓	=						
11	14	✓	÷	O	=						
-	15	✓	÷	N	-						
-	16	✓	÷	N	-						
-	17	✓	÷	N	-						
-	18	✓	÷	N	-						
-	19	✓	÷	N	-						
-	20	✓	÷	N	-						
-	21	✓	÷	N	-						
-	22	✓	÷	N	-						
13	23	✓	÷	=	=						
-	24	✓	-	-	-						
-	25	✓	÷	✓	-						
-	26	✓	÷	✓	-						
-	27	✓	÷	✓	-						
-	28	✓	-	-	-						
-	29	✓	-	-	-						
-	30	✓	-	-	-						
-	31	✓	÷	N	-						
14	32		÷	✓	=						
16	33			=	=						
12	34				=						
15	35				=						

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	10591184	CHENG ET AL.
	Examiner	**Art Unit**
	OLUMIDE T AJIBADE AKONAI	2617

ORIGINAL		INTERNATIONAL CLASSIFICATION					
CLASS	SUBCLASS	CLAIMED					NON-CLAIMED
370	338	H	0	4	W	4 / 00 (2009.01.01)	

CROSS REFERENCE(S)

CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)				
370	252	254	328	329	341
455	41.2	435.1	515	550.1	

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
1	1	-	17	16	33										
2	2	-	18	12	34										
3	3	-	19	15	35										
4	4	-	20												
5	5	-	21												
6	6	-	22												
7	7	13	23												
8	8	-	24												
-	9	-	25												
-	10	-	26												
-	11	-	27												
9	12	-	28												
10	13	-	29												
11	14	-	30												
-	15	-	31												
-	16	14	32												

NONE (Assistant Examiner)	(Date)	**Total Claims Allowed:** 16	
/OLUMIDE T AJIBADE AKONAI/ Primary Examiner.Art Unit 2617 (Primary Examiner)	06/10/2011 (Date)	O.G. Print Claim(s) 1	O.G. Print Figure 2

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	10591184	CHENG ET AL.
	Examiner	**Art Unit**
	OLUMIDE T AJIBADE-AKONAI	2617

SEARCHED

Class	Subclass	Date	Examiner
370	338	01/16/2010	/J.B.B./
370	338,328,341,395.2,395.21	12/30/2010	OA
455	41.2,502	12/30/2010	OA
709	All	12/30/2010	OA
370	252,254,328,329,330,338,341,395.2,395.21	06/10/2011	OA
455	41.2,414.1,435.1,509,515,550.1	06/10/2011	OA
709	All	06/10/2011	OA

SEARCH NOTES

Search Notes	Date	Examiner
SEE EAST HISTORY	01/16/2010	/J.B.B./
EAST search	12/30/2010	OA
EAST search	06/10/2011	OA

INTERFERENCE SEARCH

Class	Subclass	Date	Examiner
370	338	01/16/2010	/J.B.B./
370	252,254,328,329,330,338,341,395.2,395.21	06/10/2011	OA
455	41.2,414.1,435.1,509,515,550.1	06/10/2011	OA
709	All	06/10/2011	OA

	/OLUMIDE T AJIBADE AKONAI/ Primary Examiner.Art Unit 2617

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of

Inventor:	H. CHENG, et al.	Art Unit: 2617
Appln. No.:	10/591,184	Exr.: A. Olumide
Filed:	May 14, 2007	Conf. No. 7759
For:	SYSTEM AND METHOD FOR NEGOTIATION OF WLAN ENTITY	

INFORMATION DISCLOSURE STATEMENT

Assistant Commissioner of Patents
Alexandria, VA 22131

Dear Sir:

Pursuant to Rules 56 and 99, Applicants hereby call the attention of the Patent Office to the art listed on the attached Form PTO 1449. Attached is a Supplementary European Search Report dated May 20, 2011, which issued in a corresponding European Patent Application.

The cited art is listed in the attached PTO-1449 for an indication of consideration by the examiner. Copies of any references listed on the PTO-1449, besides U.S. patent documents, are submitted herewith.

Applicants present this art so that the Patent Office may, in the first instance, determine any relevancy thereof to the presently claimed invention; see Beckman Instruments, Inc. v. Chemtronics, Inc., 439 F.2d 1369, 1380, 165 USPQ 355, 364 (5th Cir. 1970).

Applicants respectfully request that this art be expressly considered during the prosecution of this application and made of record herein and appear among the "References Cited" on any patent to issue herefrom.

If any additional fee is due please charge it to Deposit Account 04-1061.

Respectfully submitted,

/James Edward Ledbetter/

Date: June 29, 2011

James E. Ledbetter
Registration No. 28,732

JEL/mlc

ATTORNEY DOCKET NO. 008638-06115
Dickinson Wright PLLC
1875 Eye Street, N.W., Suite 1200
Washington, D.C. 20006
Telephone: 202.457.0160
Fax: 202.659.1559

DC 8638-6115 177207v1

SUBSTITUTE FOR FORM PTO-1449 U.S. Department of Commerce Patent and Trademark Office **INFORMATION DISCLOSURE STATEMENT BY APPLICANT** (Use several sheets if necessary)	ATTY. DOCKET NO. **008638-06115**	SERIAL NO. **10/591,184**
	APPLICANT **Hong CHENG, et al.**	
	FILING DATE **August 30, 2006**	GROUP **2617**

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CORRESPONDENT	DISCUSSED AND CITED IN SPEC? (insert page and line number where cited)

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CORRESPONDENT	TRANSLATION?	DISCUSSED AND CITED IN SPEC? (insert page and line number where cited)

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc.)

		DISCUSSED AND CITED IN SPEC?
	European Search Report dated May 24, 2011.	
	B. O'hara, et al., "Architecture for Control and Provisioning of Wireless Access Points (CAPWAP)," CAPWAP Working Group Internet-Draft, February 2004, pp. 1-35.	
	H. Tang, et al., "Issues of the Radio Access Network with Distributed Radio Network Control Functions for Universal Mobile Telecommunication System," The 14th IEEE 2003 International Symposium on Personal, Indoor and Mobile Radio Communication Proceedings, September 2003, pp. 931-935	
	P. Calhoun, et al., "CAPWAP Problem Statement," CAPWAP Working Group Internet-Draft, February 2004, pp. 1-9.	
	H. Cheng, et al., "Functionality Classifications for Control and Provisioning of Wireless Access Points," CAPWAP Internet-Draft, February 2004 pp 1-9.	

EXAMINER: Initial if citation is considered, draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

(Form PTO-1449 [6-4])

DC 8638-6115 177208v1

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application

Inventor:	H. CHENG, et al.	Art Unit: 2617
Appln. No.:	10/591,184	Exr.: A. Olumide
Filed:	May 14, 2007	Conf. No. 7759
For:	SYSTEM AND METHOD FOR NEGOTIATION OF WLAN ENTITY	

CERTIFICATION UNDER 37 CFR §1.97(e)(1)

Assistant Commissioner of Patents
Alexandria VA, 22313

Dear Sir:

In fulfillment of 37 CFR 1.97(c)(1) and 1.97(e)(1), it is hereby certified that each item of information contained in the Information Disclosure Statement filed June 29, 2011 was first cited in any communication (see the attached copy of the Supplementary European Search Report dated May 20, 2011, which issued in a corresponding European Patent Application ion) from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of this Information Disclosure Statement.

Respectfully submitted,

/James Edward Ledbetter/

James E. Ledbetter
Registration No. 28,732

Date: June 29, 2011

JEL/mlc

ATTORNEY DOCKET NO. 008638-6115
DICKINSON WRIGHT, PLLC
1875 EYE STREET, NW, Suite 1200
WASHINGTON, DC 20006
TELEPHONE: (202) 457-0160
FACSIMILE: (202) 659-1559

DC 8638-6115 177212v1

Electronic Patent Application Fee Transmittal

Application Number:	10591184
Filing Date:	14-May-2007
Title of Invention:	SYSTEM AND METHOD FOR NEGOTIATION OF WLAN ENTITY
First Named Inventor/Applicant Name:	Hong Cheng
Filer:	James Edward Ledbetter
Attorney Docket Number:	L8638.06115

Filed as Large Entity

U.S. National Stage under 35 USC 371 Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
Submission- Information Disclosure Stmt	1806	1	180	180
	Total in USD ($)			**180**

Electronic Acknowledgement Receipt

EFS ID:	10417157
Application Number:	10591184
International Application Number:	
Confirmation Number:	7759
Title of Invention:	SYSTEM AND METHOD FOR NEGOTIATION OF WLAN ENTITY
First Named Inventor/Applicant Name:	Hong Cheng
Customer Number:	52989
Filer:	James Edward Ledbetter
Filer Authorized By:	
Attorney Docket Number:	L8638.06115
Receipt Date:	29-JUN-2011
Filing Date:	14-MAY-2007
Time Stamp:	18:50:30
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	$180
RAM confirmation Number	6289
Deposit Account	
Authorized User	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)

1	Non Patent Literature	esr.pdf	108381 632cd3e50be03b7900c874d25863676a9d1cec93	no	3
Warnings:					
Information:					
2	Non Patent Literature	npl1.pdf	1029115 7aa2d02600f9fe9cfebb14d252968e947929eed2	no	35
Warnings:					
Information:					
3	Non Patent Literature	npl2.pdf	233796 b603f2ec26ccc31c585ed6d7c01ce9f1adfc2826	no	5
Warnings:					
Information:					
4	Non Patent Literature	npl3.pdf	224898 9d208e8df86d6915b89f7a382128f34f12ed7d32	no	9
Warnings:					
Information:					
5	Non Patent Literature	npl4.pdf	245779 4c89f26b2b732c3710d423e82ce81bad2531e4e3	no	9
Warnings:					
Information:					
6	Information Disclosure Statement (IDS) Form (SB08)	ids.pdf	81227 6269f5f89b1b2a21261ac51063d636bcc9009c3a	no	3
Warnings:					
Information:					
This is not an USPTO supplied IDS fillable form					
7	Miscellaneous Incoming Letter	cert.pdf	24690 2e591a38d9a55ff56e19b7d9ef925065283f349e	no	1
Warnings:					
Information:					
8	Fee Worksheet (SB06)	fee-info.pdf	30492 7c5bda799ff840ce17e82a7fd6ac37ccd8de3d8a	no	2
Warnings:					
Information:					
			Total Files Size (in bytes):	1978378	

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/591,184	05/14/2007	Hong Cheng	L8638.06115	7759

52989 7590 07/13/2011
James Edward Ledbetter
1875 Eye Street
Suite 1200
Washington, DC 20006

EXAMINER	
AJIBADE AKONAI, OLUMIDE	
ART UNIT	**PAPER NUMBER**
2617	

MAIL DATE	DELIVERY MODE
07/13/2011	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

PTOL-90A (Rev. 04/07)

UNITED STATES DEPARTMENT OF COMMERCE
U.S. Patent and Trademark Office
Address : COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450

APPLICATION NO./ CONTROL NO.	FILING DATE	FIRST NAMED INVENTOR / PATENT IN REEXAMINATION	ATTORNEY DOCKET NO.
10/591,184	14 May, 2007	CHENG ET AL.	L8638.06115

		EXAMINER	
James Edward Ledbetter 1875 Eye Street Suite 1200 Washington, DC 20006		OLUMIDE T. AJIBADE AKONAI	
		ART UNIT	PAPER
		2617	07052011

DATE MAILED:

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner for Patents

The IDS filed June 29, 2011 has been considered and made of record.

/Charles N. Appiah/ Supervisory Patent Examiner, Art Unit 2617	/OLUMIDE T AJIBADE AKONAI/ Examiner, Art Unit 2617

PTO-90C (Rev.04-03)

SUBSTITUTE FOR FORM PTO-1449 U.S. Department of Commerce Patent and Trademark Office **INFORMATION DISCLOSURE STATEMENT BY APPLICANT** (Use several sheets if necessary)	ATTY. DOCKET NO. **008638-06115**	SERIAL NO. **10/591,184**
	APPLICANT **Hong CHENG, et al.**	
	FILING DATE **August 30, 2006**	GROUP **2617**

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CORRESPONDENT	DISCUSSED AND CITED IN SPEC? (insert page and line number where cited)

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CORRESPONDENT	TRANSLATION?	DISCUSSED AND CITED IN SPEC? (insert page and line number where cited)

OTHER DOCUMENTS (Including Author, Title, Date, Pertinent Pages, Etc.)

		DISCUSSED AND CITED IN SPEC?
	European Search Report dated May 24, 2011.	
/O.A./	**B. O'hara, et al., "Architecture for Control and Provisioning of Wireless Access Points (CAPWAP)," CAPWAP Working Group Internet-Draft, February 2004, pp. 1-35.**	
/O.A./	**H. Tang, et al., "Issues of the Radio Access Network with Distributed Radio Network Control Functions for Universal Mobile Telecommunication System," The 14th IEEE 2003 International Symposium on Personal, Indoor and Mobile Radio Communication Proceedings, September 2003, pp. 931-935**	
/O.A./	**P. Calhoun, et al., "CAPWAP Problem Statement," CAPWAP Working Group Internet-Draft, February 2004, pp. 1-9.**	
/O.A./	**H. Cheng, et al., "Functionality Classifications for Control and Provisioning of Wireless Access Points," CAPWAP Internet-Draft, February 2004 pp 1-9.**	

EXAMINER: Initial if citation is considered, draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

/Olumide Ajibade Akonai/ 07/05/2011 (Form PTO-1449 [6-4])

DC 8638-6115 177208v1

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: Mail **Mail Stop ISSUE FEE**
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

52989 7590 06/21/2011

James Edward Ledbetter
1875 Eye Street
Suite 1200
Washington, DC 20006

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)

(Signature)

(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/591,184	05/14/2007	Hong Cheng	L8638.06115	7759

TITLE OF INVENTION: SYSTEM AND METHOD FOR NEGOTIATION OF WLAN ENTITY

APPLN. TYPE	SMALL ENTITY	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	$1510	$300	$0	$1810	09/21/2011

EXAMINER	ART UNIT	CLASS-SUBCLASS
AJIBADE AKONAI, OLUMIDE	2617	370-338000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.

☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list

(1) the names of up to 3 registered patent attorneys or agents OR, alternatively,

(2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 DICKINSON WRIGHT PLLC
2 ______
3 ______

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE
PANASONIC CORPORATION

(B) RESIDENCE: (CITY and STATE OR COUNTRY)
OSAKA, JAPAN

Please check the appropriate assignee category or categories (will not be printed on the patent) : ☐ Individual ☒ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:

☒ Issue Fee
☒ Publication Fee (No small entity discount permitted)
☐ Advance Order - # of Copies ______

4b. Payment of Fee(s): **(Please first reapply any previously paid issue fee shown above)**

☐ A check is enclosed.
☐ Payment by credit card. Form PTO-2038 is attached.
☒ The Director is hereby authorized to charge the required fee(s), any deficiency, or credit any overpayment, to Deposit Account Number 04-1061 (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)

☐ a. Applicant claims SMALL ENTITY status. See 37 CFR 1.27.
☐ b. Applicant is no longer claiming SMALL ENTITY status. See 37 CFR 1.27(g)(2).

NOTE: The Issue Fee and Publication Fee (if required) will not be accepted from anyone other than the applicant; a registered attorney or agent; or the assignee or other party in interest as shown by the records of the United States Patent and Trademark Office.

Authorized Signature /James Edward Ledbetter/

Date September 19, 2011

Typed or printed name James E. Ledbetter

Registration No. 28,732

This collection of information is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450.

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

Electronic Patent Application Fee Transmittal

Application Number:	10591184
Filing Date:	14-May-2007
Title of Invention:	SYSTEM AND METHOD FOR NEGOTIATION OF WLAN ENTITY
First Named Inventor/Applicant Name:	Hong Cheng
Filer:	James Edward Ledbetter/Jacqueline Black
Attorney Docket Number:	L8638.06115

Filed as Large Entity

U.S. National Stage under 35 USC 371 Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Utility Appl issue fee	1501	1	1510	1510
Publ. Fee- early, voluntary, or normal	1504	1	300	300

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
		Total in USD ($)		**1810**

Electronic Acknowledgement Receipt

EFS ID:	10974880
Application Number:	10591184
International Application Number:	
Confirmation Number:	7759
Title of Invention:	SYSTEM AND METHOD FOR NEGOTIATION OF WLAN ENTITY
First Named Inventor/Applicant Name:	Hong Cheng
Customer Number:	52989
Filer:	James Edward Ledbetter
Filer Authorized By:	
Attorney Docket Number:	L8638.06115
Receipt Date:	19-SEP-2011
Filing Date:	14-MAY-2007
Time Stamp:	15:50:24
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	$1810
RAM confirmation Number	2041
Deposit Account	
Authorized User	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)

1	Issue Fee Payment (PTO-85B)	Fee.pdf	89794 8531119616855509c7af3ff79675ee535c1ffe22	no	1
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	32620 031bb623b141d109a57d17285a404990af9fd2e7	no	2
Warnings:					
Information:					
Total Files Size (in bytes):			122414		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/591,184	10/25/2011	8045531	L8638.06115	7759

52989 7590 10/05/2011

James Edward Ledbetter
1875 Eye Street
Suite 1200
Washington, DC 20006

ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(application filed on or after May 29, 2000)

The Patent Term Adjustment is 1120 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Data Management (ODM) at (571)-272-4200.

APPLICANT(s) (Please see PAIR WEB site http://pair.uspto.gov for additional applicants):

Hong Cheng, Singapore, SINGAPORE;
Pek Yew Tan, Singapore, SINGAPORE;
Saravanan Govindan, Singapore, SINGAPORE;

IR103 (Rev. 10/09)

PTO/SB/44 (09-07)
Approved for use through 08/31/2010. OMB 0651-0033
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.
(Also Form PTO-1050)

UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : **8,045,531** Page 1 of 1

APPLICATION NO. : **10/591,184**

ISSUE DATE : **October 25, 2011**

INVENTOR(S) : **Hong CHENG, et al.**

It is certified that an error appears or errors appear in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Claim 8, column 24, line 55, incorrectly reads:

"data unit of a mobile tenninal"

and should read:

"data unit of a mobile terminal"

Claim 11, column 25, line 11, incorrectly reads:

"the subset of the WLAN functions offered by the CN;"

and should read:

"i. the subset of the WLAN functions offered by the CN;"

Claim 13, column 25, line 23, incorrectly reads:

"network (WLAN) that allows a defined. WLAN function split"

and should read:

"network (WLAN) that allows a defined WLAN function split"

MAILING ADDRESS OF SENDER (Please do not use customer number below):
James E. Ledbetter, Registration No. 28,732
Dickinson Wright PLLC
1875 Eye Street, NW Suite 1200 **Telephone: (202) 457-0160**
Washington, DC 20006 **Facsimile: (202) 659-1559**

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Patent

Patent No.: 8,045,531

Inventor: Hong CHENG, et al. Art Unit 2617

Appln. No.: 10/591,184 Exr. O. Ajibade Akonai

Filed: May 14, 2007 Conf. No. 7759

For: SYSTEM AND METHOD FOR NEGOTIATION OF WLAN ENTITY

REQUEST FOR CERTIFICATE OF CORRECTION
PURSUANT TO 35 USC 254 (OFFICE MISTAKE)

Honorable Commissioner of
Patents and Trademarks
Washington, DC 20231

Sir:

A Certificate Of Correction of the above-captioned patent is respectfully requested.

Grant of this Request is respectfully requested in accordance with the provisions of 35 USC 254 which states:

> 35 U.S.C. 254 Certificate of correction of Patent and Trademark Office mistake. Whenever a mistake in a patent, incurred through the fault of the Patent and Trademark Office, is clearly disclosed by the records of the Office, the Director may issue a certificate of correction stating the fact and nature of such mistake, under seal, without charge, to be recorded in the records of patents. A printed copy thereof shall be attached to each printed copy of the patent, and such certificate shall be considered as part of the original patent. Every such patent, together with such certificate, shall have the same effect and operation in law on the trial of actions for causes thereafter arising as if the same had been originally issued in such corrected form. The Director may issue a

corrected patent without charge in lieu of and with like effect as a certificate of correction.

In the Letters Patent issued on October 25, 2011, claim 8, column 24, line 55, incorrectly reads as "data unit of a mobile tenninal".

However, in the present patent, claim 8, column 24, line 55, should read "data unit of a mobile terminal", as shown in claim 8, page 4, line 7 of the Amendment filed April 4, 2011.

In the Letters Patent issued on October 25, 2011, claim 11, column 25, line 11, incorrectly reads as "the subset of the WLAN functions offered by the CN;".

However, in the present patent, claim 11, column 25, line 11, should read "i. the subset of the WLAN functions offered by the CN;" as shown in claim 14, page 6, line 4 of the Amendment filed April 4, 2011.

In the Letters Patent issued on October 25, 2011, claim 13, column 25, line 23, incorrectly reads as "network (WLAN) that allows a defined. WLAN function split".

However, in the present patent, claim 13, column 25, line 23, should read "network (WLAN) that allows a defined WLAN function split" as shown in claim 23, page 9, line 2 of the Amendment filed on April 4, 2011.

It is submitted that issuance of a Certificate of Correction is warranted under 37 CFR 1.322 and MPEP 1480 in that the above-noted error is consequential, is not of a minor typographical nature, and is not readily apparent to one skilled in the art.

Grant of the attached Request for Certificate of Correction is respectfully solicited.

Respectfully submitted,

/James Edward Ledbetter/

James E. Ledbetter
Registration No. 28,732

Date: February 25, 2012
JEL/maw

Attorney Docket No. 008638-06115
Dickinson Wright PLLC
International Square
1875 Eye Street, N.W., Suite 1200
Washington, D.C. 20006
Telephone: 202.457.0160
Facsimile: 202.659.1559

DC 8638-6115 199971

Electronic Acknowledgement Receipt

EFS ID:	12159711
Application Number:	10591184
International Application Number:	
Confirmation Number:	7759
Title of Invention:	SYSTEM AND METHOD FOR NEGOTIATION OF WLAN ENTITY
First Named Inventor/Applicant Name:	Hong Cheng
Customer Number:	52989
Filer:	James Edward Ledbetter
Filer Authorized By:	
Attorney Docket Number:	L8638.06115
Receipt Date:	25-FEB-2012
Filing Date:	14-MAY-2007
Time Stamp:	14:33:12
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Request for Certificate of Correction	COC.pdf	40162 4f8c426d8a7eb24a8b050de93adcabbf2d8b05c0	no	1

Warnings:

Information:

2	Request for Certificate of Correction	REQ-COC.pdf	63387 86f0d9f274b1fc787f29e8f04873e73564c0c86a	no	3
Warnings:					
Information:					
		Total Files Size (in bytes):	103549		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

UNITED STATES PATENT AND TRADEMARK OFFICE

CERTIFICATE OF CORRECTION

PATENT NO. : 8,045,531 B2
APPLICATION NO. : 10/591184
DATED : October 25, 2011
INVENTOR(S) : Hong Cheng et al.

It is certified that error appears in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

Claim 8, column 24, line 55, incorrectly reads:
"data unit of a mobile tenninal"
and should read:
"data unit of a mobile terminal"

Claim 11, column 25, line 11, incorrectly reads:
"the subset of the WLAN functions offered by the CN;"
and should read:
"i. the subset of the WLAN functions offered by the CN;"

Claim 13, column 25, line 23, incorrectly reads:
"network (WLAN) that allows a defined. WLAN function split"
and should read:
"network (WLAN) that allows a defined WLAN function split"

Signed and Sealed this
Twenty-seventh Day of March, 2012

David J. Kappos

David J. Kappos
Director of the United States Patent and Trademark Office