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Jones et al.

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(54) **ASYMMETRIC WIRELESS PROTOCOL COMMUNICATIONS WHEREIN UPSTREAM TRAFFIC USES ONE PROTOCOL AND DOWNSTREAM TRAFFIC USES A DIFFERENT PROTOCOL**

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(51) **Int. Cl.**
H04B 7/10 (2006.01)
H04Q 7/24 (2006.01)

(52) **U.S. Cl.** **375/347**; 370/338

(58) **Field of Classification Search** 375/264, 375/347, 225, 299; 370/208, 338, 204, 465, 370/455; 455/450
See application file for complete search history.

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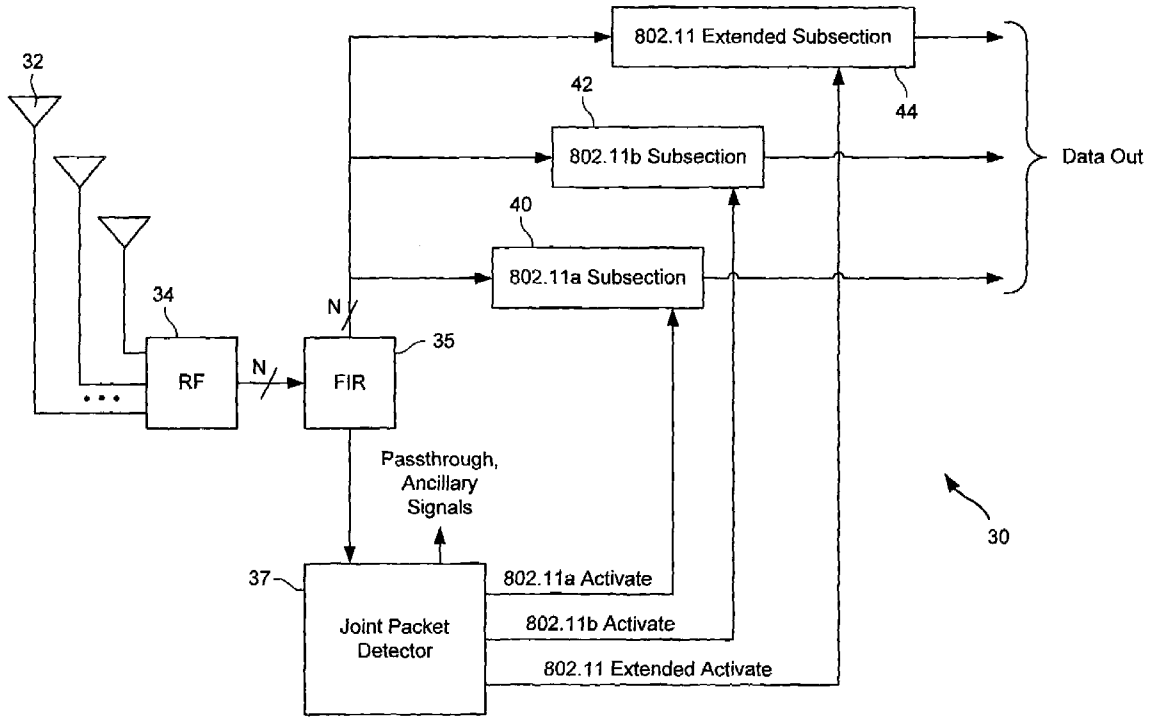
(57) **ABSTRACT**

In a wireless network, data transmitted from a client station to an access point is transmitted using the 802.11b protocol while data transmitted from the access point to the client station is transmitted using the 802.11g protocol. In an alternative embodiment of a wireless network, data transmitted from a client station to an access point is transmitted using the 802.11g protocol while data transmitted from the access point to the client station is transmitted using the 802.11b protocol.

23 Claims, 3 Drawing Sheets



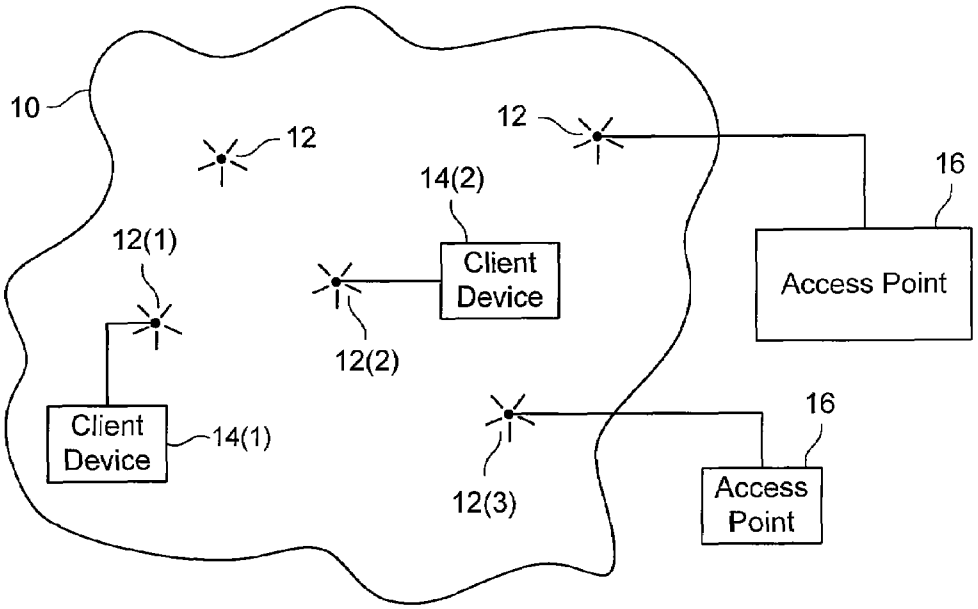


FIG. 1

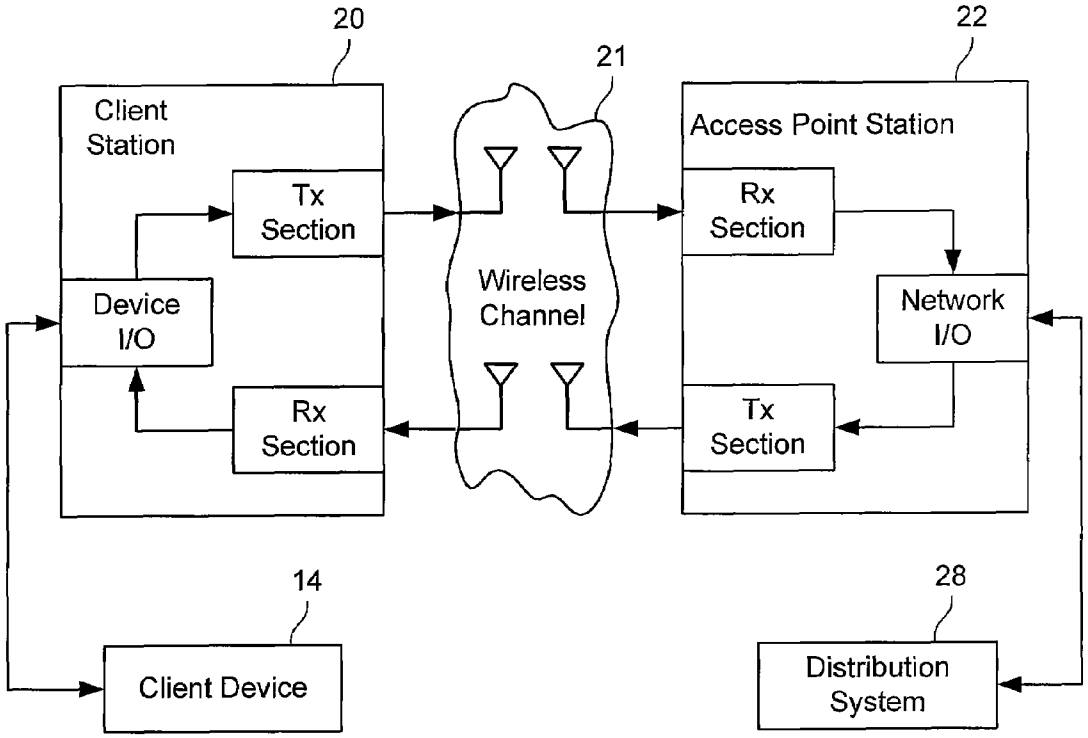


FIG. 2

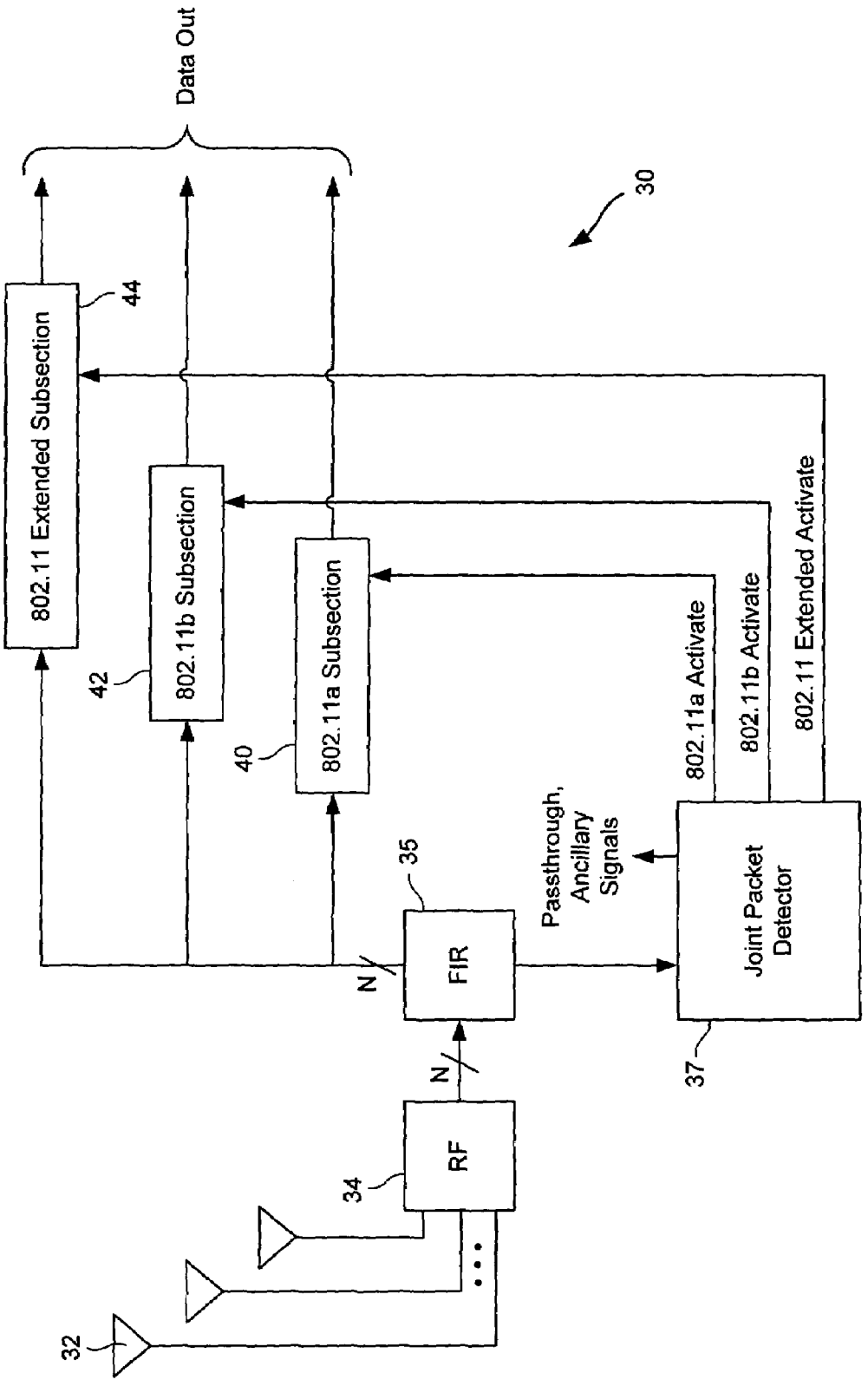


FIG. 3

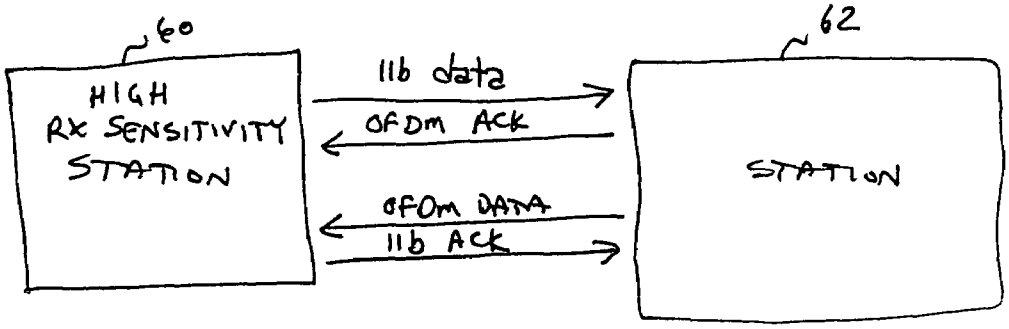


FIG. 4

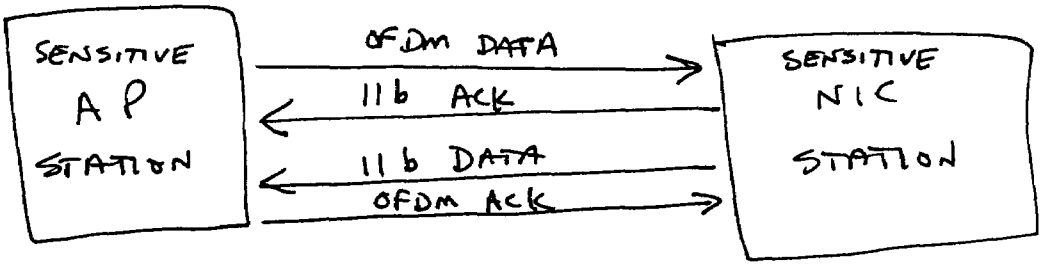


FIG. 5

ASYMMETRIC WIRELESS PROTOCOL COMMUNICATIONS WHEREIN UPSTREAM TRAFFIC USES ONE PROTOCOL AND DOWNSTREAM TRAFFIC USES A DIFFERENT PROTOCOL

BACKGROUND OF THE INVENTION

Wireless networks have become increasingly popular, as computers and other devices can be coupled for data communications without requiring wired connections between the network nodes. One set of standards for wireless networks is the IEEE 802.11 standards, but other wireless standards or protocols might be used instead. In the IEEE 802.11 standards, there are at least two widely-used standards, 802.11a and 802.11b, and communication systems and devices might be required to support both standards and/or be required to operate in areas where both are being used. Enhancements to the 802.11 standards have been in place, such as the 802.11g standard that allows for OFDM transmissions (802.11a is an OFDM transmission protocol) in the 2.4 GHz band.

The 802.11a protocol supports OFDM transmissions in the 5 GHz band for data rates of 6 to 54 million bits per second ("Mbps"). The 802.11b protocol supports DSSS transmissions in the 2.4 GHz band for data rates of 1, 2, 5.5 and 11 Mbps. The 802.11g protocol mixes OFDM and DSSS protocols in the 2.4 GHz band for data rates of 1, 2, 5.5, 6, 9, 11, 12, 18, 24, 36, 48 and 54 Mbps. Data transmissions are well known for these protocols, so they need not be set forth herein. They are described, for example, in ANSI/IEEE Std 802.11, 1999 Edition; IEEE Std 802.11b, 1999; IEEE Std 802.11a, 1999/Amd 1:2000(E). Those references are incorporated by reference herein for all purposes.

The 802.11b protocol can be supported by a station with a lower power than the full range of the 802.11g protocol. One reason for this is that the 1 to 11 Mbps transmissions can be at a lower signal-to-noise ratio (SNR) than the 12 to 54 Mbps transmissions. Another reason is that demodulation is simpler for DSSS than OFDM. Thus, where power limitations exist at a station, 802.11b might be used instead of 802.11g. Where a station is not power-limited and higher data rates are needed, the 802.11g protocol might be preferred, as data rates can be as high as 54 Mbps.

It would be desirable to overcome the shortcomings of the prior art described above.

BRIEF SUMMARY OF THE INVENTION

In one embodiment of a wireless network, data transmitted from one of an access point station and a client station to the other of the client station and the access point station is transmitted using the 802.11b protocol while data transmitted in the other direction is transmitted using the 802.11g protocol.

In some embodiments, data is sent with one protocol and acknowledgements are returned in the other protocol. Thus, the client station might send data in one protocol of 802.11b or 802.11g and the access point station acknowledges the data in the other protocol. Likewise, the access point station can send data in one protocol and receive acknowledgements in the other protocol.

A further understanding of the nature and the advantages of the inventions disclosed herein may be realized by

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a block diagram of a simple wireless network that might use the present invention.

FIG. **2** is a block diagram illustrating the coupling between one device and one network connection of the wireless network shown in FIG. **1**.

FIG. **3** is a block diagram of a receive section of station hardware as might be used in hardware illustrated in FIG. **2**.

FIG. **4** is a block diagram illustrating data communication among two client devices.

FIG. **5** is a block diagram illustrating data communication between an access point and a network interface card of a client device.

DETAILED DESCRIPTION OF THE INVENTION

FIG. **1** illustrates a simple wireless network that might use the present invention. As shown in FIG. **1**, a wireless network **10** comprises a plurality of stations **12** wherein each station **12** is capable of communicating with at least one other station **12** of wireless network **10**. In specific implementations, wireless network **10** is a local area wireless network, as might be used within a building, campus, vehicle or similar environments.

In a specific embodiment, wireless network **10** is designed to be compliant with one or more of the IEEE 802.11 standards. However, it should be understood that other standards and nonstandard networks might be substituted therefore to solve problems similar to those solved in the 802.11 environment.

As shown, some of the stations are coupled to client devices **14**, while other stations are coupled to wired network interfaces **16**. For example, station **12**(**1**) is coupled to client device **14**(**1**), while station **12**(**3**) is coupled to a wired network interface **16**. FIG. **1** is intended to be a simplified and generalized diagram of a wireless network. Interfering signal generators are not shown, but are assumed to be present. More generally, wired network interfaces **16** might be instead replaced with other types of distribution systems as the invention is not limited to a particular interface.

Examples of client devices **14** include laptops, personal digital assistants (PDAs), or any other portable or semi-portable electronic device needing to communicate with other devices, or a stationary electronic device needing to communicate with other devices where a wired connection to a network or the other devices is not available or easily provided. Wired network interfaces **16** couple their respective stations to a network. Examples of such networks include the Internet, a local area network (LAN) or a public or private connection to a TCP/IP packet network or other packet network or networks.

In a typical operation, a plurality of client devices **14** are outfitted with circuitry and/or software that implements a station **12** functionality and one or more network access points are provided in wireless network **10** to provide access between such a client device and the network to which a wired network interface (or other distribution system) is coupled. A station coupled to a wired network interface or other distribution system is referred to as an "access point". Just one example of the uses of such a system is to connect computers within a building to a network without requiring network wires to be run to each computer. In that example,

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