OFFICIAL PATENT

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8-5-98

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application	:	Christopher P. Lawler et al.
Application No.	:	08/927,336
Filed	:	September 11, 1997
For	:	HIGH SPEED CACHE MANAGEMENT UNIT FOR USE IN A BRIDGE/ROUTER
Examiner	:	
Attorney's Docket	:	SYNER-118XX

Group Art Unit: ~~2751~~ 2786

* *

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to: Box Non-Fee Amendment, Assistant Commissioner for Patents, Washington, D.C. 20231 on March 10, 1998.

By _____
Gordon R. Moriarty
Registration No. 38,973
Attorney for Applicant(s)

* *

PRELIMINARY AMENDMENT

Box Non-Fee Amendment
Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

Please preliminarily amend the above-identified patent application as follows:

08/10/1998 SKEMPER 00000006 230804 08927336

01 FC:202 41.00 CH
02 FC:203 66.00 CH

WEINGARTEN, SCHURGIN,
GAGNEBIN & HAYES LLP
TEL (617) 542-2290
FAX (617) 451-0313

Application No.: 08/927,336
Filed: September 11, 1997
Group Art Unit: ~~2751~~ 2786

IN THE DETAILED DESCRIPTION

Please amend the Detailed Description as follows:

On page 1, line 26, replace "harware" with --hardware--.

On page 3, line 30, replace "permits" with --enables--.

On page 7, line 31, replace the second occurrence of "DAs" with --SAs--.

On page 12, line 23, after the period, insert the following new sentence:

A1 --To avoid confusion in the drawing, not all communication paths are illustrated in Fig. 3; the accompanying text defines those paths.--

On page 17, line 19, replace "26" with --28--.

On page ~~19~~, line 17, replace "of" with --or--.

On page ~~26~~, line 5, replace "transit" with --transmit--.

On page ~~26~~, lines 11 and 13, replace "learn" with --learned--.

WEINGARTEN, SCHURGIN,
GAGNEBIN & HAYES LLP
TEL (617) 542-2290
FAX (617) 451-0313

Application No.: 08/927,336
Filed: September 11, 1997
Group Art Unit: ~~2751~~ 27-86

IN THE CLAIMS

Please add the following new claims 2-26:

2. A method of forwarding a data unit through a network element having a cache comprised of plural rows, each having plural respective entries, the method comprising the steps of:

receiving said data unit at said network element;

parsing said data unit for address information;

encoding said received address information;

using said received, encoded address information to identify one of said cache rows;

retrieving first address information from a first entry of said identified row;

comparing said retrieved first address information with said received address information;

retrieving second address information from said first entry of said identified row if said retrieved first address information and said received address information are equal; and

using said retrieved second address information for forwarding said data unit.

3. The method of claim 2, further comprising the steps of retrieving first address information from a subsequent entry of

WEINGARTEN, SCHURGIN, GAGNEBIN & HAYES LLP
TEL (617) 542-2290
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said identified row if said retrieved first address information of said first entry and said received address information are not equal, then repeating said comparing, retrieving second address information, and using steps.

4. The method of claim 3, wherein said step of encoding said received address information further comprises cyclic redundancy encoding said received address information.

5. The method of claim 3, further comprising the step of packetizing said received, encoded address information with an indication of which of said plural entries is to be used first in said step of retrieving first address information.

6. The method of claim 5, wherein said step of packetizing further comprises referencing a usage tracking table to determine which of said plural entries is to be used first.

7. The method of claim 5, wherein said step of packetizing further comprises referencing a validity table to determine which of said plural entries is to be used first, said validity table providing an indication, for each of said cache entries, whether said entry is enabled for providing said first and second address information.

WEINGARTEN, SCHURGIN,
GAGNEBIN & HAYES LLP
TEL (617) 542-2290
FAX (617) 451-0313

Application No.: 08/927,136
Filed: September 11, 1997
Group Art Unit: ~~2751~~ 2786

8. A cache management unit of a data unit forwarding network device, comprising:

an input register for receiving data unit header information including received source and destination address;

a cyclic redundancy code (CRC) generator in communication with said input register for executing a CRC algorithm on each of said received source and destination addresses from said input register to form respective CRC encoded addresses;

an input packetizer in communication with said CRC generator and said input register for formatting said CRC encoded addresses and for receiving said received source and destination addresses from said input register;

a cache lookup unit and an associated cache in communication with said input packetizer for searching said cache with said formatted CRC encoded addresses;

an output packetizer in communication with said cache lookup unit for receiving and formatting retrieved source and destination address information from said cache; and

an output register in communication with said output packetizer for receiving said formatted retrieved source and destination address information.

9. The cache management unit of claim 8, wherein said input register is further for receiving an identifier of a received data

WEINGARTEN, SCHURGIN,
GAGNEBIN & HAYES LLP
TEL (617) 542-2290
FAX (617) 451-0313

Application No.: 08/927,336
Filed: September 11, 1997
Group Art Unit: ~~2754~~ 2736

unit protocol, and wherein said input packetizer formats said CRC encoded addresses with said protocol identifier.

10. The cache management unit of claim 8, wherein said cache lookup unit comprises a cache lookup queue for storing said formatted CRC encoded addresses

11. The cache management unit of claim 8, wherein said cache lookup unit comprises a cache lookup controller for searching said cache with said formatted CRC encoded addresses.

12. The cache management unit of claim 8, wherein said cache is provided as plural rows each having plural entries, each entry comprising an address value and an associated data value.

13. The cache management unit of claim 12, wherein said cache lookup controller is adapted for identifying a row of said cache using said CRC encoded addresses.

14. The cache management unit of claim 12, wherein said cache lookup controller is adapted for comparing one of said received source and destination addresses to said address value of at least one of said plural entries of said identified cache row, and if said comparison generates a first value, returning said associated

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FAX (617) 451-0313

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data value as one of said retrieved source and destination address information.

15. The cache management unit of claim 12, further comprising a usage tracking table associated with said input packetizer for maintaining an ordered list, for each of said plural rows, of which of said plural entries is to be searched first upon receipt by said cache lookup unit of a CRC encoded address, said input packetizer for addressing said usage tracking table using one of said CRC encoded addresses.

A2 16. The cache management unit of claim 15, further comprising a validity table associated with said input packetizer for maintaining an indication, for each of said entries of said cache whether said data value of the respective entry is to be compared to said CRC encoded addresses, said input packetizer for addressing said validity table using one of said CRC encoded addresses.

17. The cache management unit of claim 16, further comprising an I/O register for interfacing said cache management unit to an external processor, said I/O register for enabling processor configuration of said CRC generator, said usage tracking table, and said validity table.

WEINGARTEN, SCHURGIN, GAGNEBIN & HAYES LLP
TEL (617) 542-2290
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18. The cache management unit of claim 17, wherein said I/O register is further for interfacing said cache management unit to an external age table having entries reflecting whether each of said entries in said cache has been accessed by said cache lookup unit during a specified interval, said I/O register for enabling said age table to be read and updated.

19. The cache management unit of claim 16, wherein said cache lookup unit is for receiving said CRC encoded addresses from said input packetizer, for identifying a cache row using said CRC encoded address, for referencing a respective usage tracking table value to identify which of said cache entries for said identified cache row is to be referenced first by said cache lookup unit, for referencing a respective validity table entry for said identified entry to determine if said identified entry is valid, for comparing said received address with said address value of said identified, valid cache entry, and for retrieving said data value associated with said identified, valid cache entry if said comparison is made.

20. The cache management unit of claim 19, wherein said cache lookup unit is further for referencing said respective usage tracking table value to identify which of said remaining cache entries for said identified cache row is to be referenced next if said comparison is not made.

WEINGARTEN, SCHURGIN,
GAGNEBIN & HAYES LLP
TEL (617) 542-2290
FAX (617) 451-0313

Application No.: 08/927,336
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21. A network device for selectively forwarding a received data unit, comprising

a data unit header processor for receiving said data unit and for processing header data associated with said received data unit;

a cache having plural rows, each of said rows having plural entries, wherein each of said entries has an address and is comprised of a first value and a second value;

a cache management unit associated with said cache and in communication with said data unit header processor; and

a data unit forwarding engine, in communication with said cache management unit and said data unit header processor, for dispatching said data unit in response to data unit characterizing information from said data unit header processor and said cache management unit, wherein

said cache management unit is adapted for receiving said header data from said data unit header processor, for using said header data as said cache address to identify a cache entry, to retrieve cache data associated with said cache entry, and for providing said cache data to said data unit forwarding engine as part of said data unit characterizing information.

22. The network device of claim 21, wherein said cache management unit further comprises a cyclic redundancy code (CRC) generator for

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FAX (617) 451-0313

CRC encoding said header data and for using said CRC encoded header data as said cache entry address.

23. The network device of claim 22, wherein said cache management unit is further for comparing said received header data with said first cache entry value referenced by said CRC encoded header data, and for retrieving said second cache entry value as said cache data to be provided to said data unit forwarding engine if said received header data equals said first cache entry value.

24. The network device of claim 23, wherein said cache management unit further comprises a usage tracking table having a respective entry for each of said cache rows, said cache management unit using said usage tracking table entry to determine which of said respective cache entries is to be compared first.

25. The network device of claim 23, wherein said cache management unit further comprises a validity table having a respective entry for each of said cache entries, said validity table entries indicating whether said respective cache entry is a valid entry for said comparison.

26. The network device of claim 23, further comprising an age table, capable of being updated by said cache management unit, for

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TEL (617) 542-2290
FAX (617) 451-0313

indicating whether each of said cache entries has been accessed by said cache management unit within a specified time period.

REMARKS

Claim 1 is pending in the present application prior to entry of the present preliminary amendment. By this amendment, claims 2-26 are added for the purpose of further refining that which Applicants claim as their invention.

Amendments to the Detailed Description of the application as filed are also presented. These amendments correct typographical errors. As for the correction of page 7, line 31, reference is made to page 13, lines 18-22 for support. Due to space limitations, not all data flow paths are illustrated in Fig. 3. While a reading of the Detailed Description should make this obvious, Applicants now add language to make this explicit. The remainder of the corrections remedy obvious errors.

As for all of the amendments proposed herein, Applicants submit that no new matter is introduced. Allowance of the claims is respectfully requested.

WEINGARTEN, SCHURGIN, GAGNEBIN & HAYES LLP
TEL (617) 542-2290
FAX (617) 451-0313

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Group Art Unit: ~~2751~~ 2786

Any questions with regard to this submission should be directed to Applicants' representative at the below-listed telephone number.

Respectfully submitted,

CHRISTOPHER P. LAWLER

By _____
Gordon R. Moriarty
Registration No. 38,973
Attorney for Applicant(s)

WEINGARTEN, SCHURGIN,
GAGNEBIN & HAYES LLP
Ten Post Office Square
Boston, Massachusetts 02109

Telephone: (617) 542-2290
Telecopier: (617) 451-0313

Date: March 10, 1998

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WEINGARTEN, SCHURGIN,
GAGNEBIN & HAYES LLP
TEL (617) 542-2290
FAX (617) 451-0313

WEINGARTEN, SCHURGIN, GAGNEBIN & HAYES LLP
TEN POST OFFICE SQUARE
BOSTON, MASSACHUSETTS 02109

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TELEPHONE
(617) 542-2290
FACSIMILE
(617) 451-0313

JOSEPH WEINGARTEN (1919-1984)
STANLEY M. SCHURGIN
CHARLES L. GAGNEBIN III
PAUL J. HAYES
VICTOR B. LEBOVICI
DEAN GRAHAM BOSTOCK
EUGENE A. FEHER
BEVERLY E. HJORTH
HOLLIDAY C. HEINE, PH.D.

GORDON R. MORIARTY
HOLMES W. ANDERSON
DAVID W. ROUILLE
NICHOLAS P. TRIANO III
RUSSELL W. BINNS, JR.
CHRISTOPHER J. LUTZ
GWENDOLYN H. YIP
JAMES F. THOMPSON

FACSIMILE COVER SHEET

DATE: August 3, 1998

TO: Examiner Moise — Fax No. Dialed: (703) 305-9724

FROM: Victor B. Lebovici — No. of pages transmitted (including this page): 14

Our File: SYNER-118XX — Time: 9:35 a.m.
Appl No.: 08/927,336
Your Ref: — Sent by: Lisa Fralick

A confirmation copy of this transmission will not be mailed unless the following is checked: [ ]

MESSAGE

Attached per your request, please find a copy of the Preliminary Amendment filed on March 10, 1998 with respect to the above-identified application and additionally a copy of the postcard stamped by the U.S. Patent and Trademark Office evidencing receipt of such Amendment. In view of the fact that such Amendment was filed long prior to the issuance of the Official Action on July 22, 1998, and the Official Action did not consider the additional claims presented via the Preliminary Amendment, it is respectfully requested that the Official Action be reissued after consideration of all presented claims and that the Applicants' time for response be reset.

CERTIFICATE OF FAXING

I hereby certify that this correspondence is being facsimile transmitted to the U.S. Patent and Trademark Office, Attention: Examiner Emmanuel L. Moise, Group Art Unit 2786, at fax no.: (703) 305-9724 on 8/3/98.

By Victor B. Lebovici
Victor B. Lebovici

125469

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AUG 03 1998
Group 2700

OFFICIAL

Applicant: Christopher P. Lawler et al
Title: High Speed Cache... Filed: 9.11.97
Application No. 08/927,336 Patent No. ________ Docket No. Synes-118CX

Enclosed is the Following:

- [x] Transmittal Letter in triplicate, ~~Check(s) for~~ ________;
- [ ] Application including Pgs. ___-___ of Spec., ___-___ of claims and pg ___ of Abstract
- [ ] Declaration and Power of Attorney, Check(s) for ________;
- [ ] Informal / Formal Drawings, ________ Sheets of Figs. ___-___;
- [ ] Letter to Chief Draftsman;
- [x] Amend./Resp. dated 3.10.98 Check(s) for $214.00;
- [ ] Information Disclosure Statement, Form 1449, ___ refs., Check for ________;
- [ ] Assignment; Check for ________;
- [ ] Issue Fee; PTO Form 85B&C; Check for ________;
- [ ] Certificate/Letter of Correction, Cover letter & check for ________;
- [ ] Notice of Appeal (In Triplicate), Check for ________;
- [ ] Petition for Extension of Time for ___ Months, Check for ________;
- [ ] Verified Statement Claiming Small Entity Status
- [ ] Certificate of Mailing by Express Mail
- [ ] Other ________

Date Mailed: 3/10/98
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Initials: GRM/cw
Express Mail Receipt No. ________

Receipt Date & Application No.
OIPE JC3
MAR 13 1998
PATENT & TRADEMARK OFFICE

2786

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TEN POST OFFICE SQUARE
BOSTON, MASSACHUSETTS 02109

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(617) 542-2290
FACSIMILE
(617) 451-0313

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JUL 28 1998
Group 2700

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FACSIMILE COVER SHEET

DATE: July 28, 1998

TO: Examiner Moise — Fax No. Dialed: (703) 305-9724

FROM: Victor B. Lebovici — No. of pages transmitted (including this page): 14

Our File: SYNER-118XX
Appl No.: 08/927,336
Your Ref: ____ — Time: ____ Sent by: Lisa Fralick

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MESSAGE

Attached per your request, please find a copy of the Preliminary Amendment filed on March 10, 1998 with respect to the above-identified application and additionally a copy of the postcard stamped by the U.S. Patent and Trademark Office evidencing receipt of such Amendment. In view of the fact that such Amendment was filed long prior to the issuance of the Official Action on July 22, 1998, and the Official Action did not consider the additional claims presented via the Preliminary Amendment, it is respectfully requested that the Official Action be reissued after consideration of all presented claims and that the Applicants' time for response be reset.

CERTIFICATE OF FAXING

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By Victor B Lebovici
Victor B. Lebovici

125469

Applicant: Christopher P. Lawler et al.
Title: High Speed Cache . . . Filed: 9.11.97
Application No. 08/927,336 Patent No. ________ Docket No. Synu-115XX

Enclosed is the Following:

- ☒ Transmittal Letter in triplicate, ~~Check(s) for~~ ________;
- ☐ Application including Pgs. ___-___ of Spec., ___-___ of claims and pg ___ of Abstract
- ☐ Declaration and Power of Attorney, Check(s) for ________;
- ☐ Informal / Formal Drawings, ________ Sheets of Figs. ___-___;
- ☐ Letter to Chief Draftsman;
- ☒ Amend./Resp. dated 3.10.98, Check(s) for $214.00;
- ☐ Information Disclosure Statement, Form 1449, ___ refs., Check for ________;
- ☐ Assignment; Check for ________;
- ☐ Issue Fee; PTO Form 85B&C; Check for ________;
- ☐ Certificate/Letter of Correction, Cover letter & check for ________;
- ☐ Notice of Appeal (In Triplicate), Check for ________;
- ☐ Petition for Extension of Time for ___ Months, Check for ________;
- ☐ Verified Statement Claiming Small Entity Status
- ☐ Certificate of Mailing by Express Mail
- ☐ Other ________

Date Mailed: 3/10/98
Date Due: 3/29/98
Initials: GRM/ces
Express Mail Receipt No. ________

Receipt Date & Application No.

OIPE JC3 MAR 13 1998 PATENT & TRADEMARK OFFICE

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application	:	Christopher P. Lawler et al.
Application No.	:	08/927,336
Filed	:	September 11, 1997
For	:	HIGH SPEED CACHE MANAGEMENT UNIT FOR USE IN A BRIDGE/ROUTER
Examiner	:	
Attorney's Docket	:	SYNER-118XX

Group Art Unit: 2751

* *

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to: Box Non-Fee Amendment, Assistant Commissioner for Patents, Washington, D.C. 20231 on March 6, 1998.

By _____
Gordon R. Moriarty
Registration No. 38,973
Attorney for Applicant(s)

* *

PRELIMINARY AMENDMENT

Box Non-Fee Amendment
Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

Please preliminarily amend the above-identified patent application as follows:

WEINGARTEN, SCHURGIN,
GAGNEBIN & HAYES LLP
TEL (617) 542-2290
FAX (617) 451-0313

OFFICIAL

Application No.: 08/927,136
Filed: September 11, 1997
Group Art Unit: 2751

IN THE DETAILED DESCRIPTION

Please amend the Detailed Description as follows:

On page 1, line 26, replace "harware" with --hardware--.

On page 3, line 30, replace "permits" with --enables--.

On page 7, line 31, replace the second occurrence of "IAs" with --SAs--.

On page 12, line 23, after the period, insert the following new sentence:

--To avoid confusion in the drawing, not all communication paths are illustrated in Fig. 3; the accompanying text defines those paths.--

On page 17, line 19, replace "26" with --28--.

On page 19, line 17, replace "of" with --or--.

On page 26, line 5, replace "transit" with --transmit--.

On page 26, lines 11 and 13, replace "learn" with --learned--.

WEINGARTEN, SCHURGIN,
GAGNEBIN & HAYES LLP
TEL (617) 542-2290
FAX (617) 451-0313

Application No.: 08/927,336
Filed: September 11, 1997
Group Art Unit: 2751

IN THE CLAIMS

Please add the following new claims 2-26:

2. A method of forwarding a data unit through a network element having a cache comprised of plural rows, each having plural respective entries, the method comprising the steps of:

receiving said data unit at said network element;

parsing said data unit for address information;

encoding said received address information;

using said received, encoded address information to identify one of said cache rows;

retrieving first address information from a first entry of said identified row;

comparing said retrieved first address information with said received address information;

retrieving second address information from said first entry of said identified row if said retrieved first address information and said received address information are equal; and

using said retrieved second address information for forwarding said data unit.

3. The method of claim 2, further comprising the steps of retrieving first address information from a subsequent entry of

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TEL (617) 542-2290
FAX (617) 451-0313

said identified row if said retrieved first address information of said first entry and said received address information are not equal, then repeating said comparing, retrieving second address information, and using steps.

4. The method of claim 3, wherein said step of encoding said received address information further comprises cyclic redundancy encoding said received address information.

5. The method of claim 3, further comprising the step of packetizing said received, encoded address information with an indication of which of said plural entries is to be used first in said step of retrieving first address information.

6. The method of claim 5, wherein said step of packetizing further comprises referencing a usage tracking table to determine which of said plural entries is to be used first.

7. The method of claim 5, wherein said step of packetizing further comprises referencing a validity table to determine which of said plural entries is to be used first, said validity table providing an indication, for each of said cache entries, whether said entry is enabled for providing said first and second address information.

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GAGNEBIN & HAYES LLP
TEL (617) 542-2290
FAX (617) 451-0313

Application No.: 08/927,336
Filed: September 11, 1997
Group Art Unit: 2751

8. A cache management unit of a data unit forwarding network device, comprising:

an input register for receiving data unit header information including received source and destination address;

a cyclic redundancy code (CRC) generator in communication with said input register for executing a CRC algorithm on each of said received source and destination addresses from said input register to form respective CRC encoded addresses;

an input packetizer in communication with said CRC generator and said input register for formatting said CRC encoded addresses and for receiving said received source and destination addresses from said input register;

a cache lookup unit and an associated cache in communication with said input packetizer for searching said cache with said formatted CRC encoded addresses;

an output packetizer in communication with said cache lookup unit for receiving and formatting retrieved source and destination address information from said cache; and

an output register in communication with said output packetizer for receiving said formatted retrieved source and destination address information.

9. The cache management unit of claim 8, wherein said input register is further for receiving an identifier of a received data

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GAGNEBIN & HAYES LLP
TEL (617) 542-2290
FAX (617) 451-0313

Application No.: 08/927,036
Filed: September 11, 1997
Group Art Unit: 2751

unit protocol, and wherein said input packetizer formats said CRC encoded addresses with said protocol identifier.

10. The cache management unit of claim 8, wherein said cache lookup unit comprises a cache lookup queue for storing said formatted CRC encoded addresses

11. The cache management unit of claim 8, wherein said cache lookup unit comprises a cache lookup controller for searching said cache with said formatted CRC encoded addresses.

12. The cache management unit of claim 8, wherein said cache is provided as plural rows each having plural entries, each entry comprising an address value and an associated data value.

13. The cache management unit of claim 12, wherein said cache lookup controller is adapted for identifying a row of said cache using said CRC encoded addresses.

14. The cache management unit of claim 12, wherein said cache lookup controller is adapted for comparing one of said received source and destination addresses to said address value of at least one of said plural entries of said identified cache row, and if said comparison generates a first value, returning said associated

WEINGARTEN, SCHURGIN, GAGNEBIN & HAYES LLP
TEL (617) 542-2290
FAX (617) 451-0313

Application No.: 08/927,536
Filed: September 11, 1997
Group Art Unit: 2751

data value as one of said retrieved source and destination address information.

15. The cache management unit of claim 12, further comprising a usage tracking table associated with said input packetizer for maintaining an ordered list, for each of said plural rows, of which of said plural entries is to be searched first upon receipt by said cache lookup unit of a CRC encoded address, said input packetizer for addressing said usage tracking table using one of said CRC encoded addresses.

16. The cache management unit of claim 15, further comprising a validity table associated with said input packetizer for maintaining an indication, for each of said entries of said cache whether said data value of the respective entry is to be compared to said CRC encoded addresses, said input packetizer for addressing said validity table using one of said CRC encoded addresses.

17. The cache management unit of claim 16, further comprising an I/O register for interfacing said cache management unit to an external processor, said I/O register for enabling processor configuration of said CRC generator, said usage tracking table, and said validity table.

WEINGARTEN, SCHURGIN,
GAGNEBIN & HAYES LLP
TEL (617) 542-2290
FAX (617) 451-0313

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Group Art Unit: 2751

18. The cache management unit of claim 17, wherein said I/O register is further for interfacing said cache management unit to an external age table having entries reflecting whether each of said entries in said cache has been accessed by said cache lookup unit during a specified interval, said I/O register for enabling said age table to be read and updated.

19. The cache management unit of claim 16, wherein said cache lookup unit is for receiving said CRC encoded addresses from said input packetizer, for identifying a cache row using said CRC encoded address, for referencing a respective usage tracking table value to identify which of said cache entries for said identified cache row is to be referenced first by said cache lookup unit, for referencing a respective validity table entry for said identified entry to determine if said identified entry is valid, for comparing said received address with said address value of said identified, valid cache entry, and for retrieving said data value associated with said identified, valid cache entry if said comparison is made.

20. The cache management unit of claim 19, wherein said cache lookup unit is further for referencing said respective usage tracking table value to identify which of said remaining cache entries for said identified cache row is to be referenced next if said comparison is not made.

WEINGARTEN, SCHURGIN,
GAGNEBIN & HAYES LLP
TEL (617) 542-2290
FAX (617) 451-0313

Application No.: 08/927,336
Filed: September 11, 1997
Group Art Unit: 2751

21. A network device for selectively forwarding a received data unit, comprising

a data unit header processor for receiving said data unit and for processing header data associated with said received data unit;

a cache having plural rows, each of said rows having plural entries, wherein each of said entries has an address and is comprised of a first value and a second value;

a cache management unit associated with said cache and in communication with said data unit header processor; and

a data unit forwarding engine, in communication with said cache management unit and said data unit header processor, for dispatching said data unit in response to data unit characterizing information from said data unit header processor and said cache management unit, wherein

said cache management unit is adapted for receiving said header data from said data unit header processor, for using said header data as said cache address to identify a cache entry, to retrieve cache data associated with said cache entry, and for providing said cache data to said data unit forwarding engine as part of said data unit characterizing information.

22. The network device of claim 21, wherein said cache management unit further comprises a cyclic redundancy code (CRC) generator for

WEINGARTEN, SCHURGIN, GAGNEBIN & HAYES LLP
TEL (617) 542-2290
FAX (617) 451-0313

Application No.: 08/927,336
Filed: September 11, 1997
Group Art Unit: 2751

CRC encoding said header data and for using said CRC encoded header data as said cache entry address.

23. The network device of claim 22, wherein said cache management unit is further for comparing said received header data with said first cache entry value referenced by said CRC encoded header data, and for retrieving said second cache entry value as said cache data to be provided to said data unit forwarding engine if said received header data equals said first cache entry value.

24. The network device of claim 23, wherein said cache management unit further comprises a usage tracking table having a respective entry for each of said cache rows, said cache management unit using said usage tracking table entry to determine which of said respective cache entries is to be compared first.

25. The network device of claim 23, wherein said cache management unit further comprises a validity table having a respective entry for each of said cache entries, said validity table entries indicating whether said respective cache entry is a valid entry for said comparison.

26. The network device of claim 23, further comprising an age table, capable of being updated by said cache management unit, for

WEINGARTEN, SCHURGIN,
GAGNEBIN & HAYES LLP
TEL (617) 542-2290
FAX (617) 451-0313

indicating whether each of said cache entries has been accessed by said cache management unit within a specified time period.

REMARKS

Claim 1 is pending in the present application prior to entry of the present preliminary amendment. By this amendment, claims 2-26 are added for the purpose of further refining that which Applicants claim as their invention.

Amendments to the Detailed Description of the application as filed are also presented. These amendments correct typographical errors. As for the correction of page 7, line 31, reference is made to page 13, lines 18-22 for support. Due to space limitations, not all data flow paths are illustrated in Fig. 3. While a reading of the Detailed Description should make this obvious, Applicants now add language to make this explicit. The remainder of the corrections remedy obvious errors.

As for all of the amendments proposed herein, Applicants submit that no new matter is introduced. Allowance of the claims is respectfully requested.

WEINGARTEN, SCHURGIN, GAGNEBIN & HAYES LLP
TEL (617) 542-2290
FAX (617) 451-0313

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Any questions with regard to this submission should be directed to Applicants' representative at the below-listed telephone number.

Respectfully submitted,

CHRISTOPHER P. LAWLER

By _____
Gordon R. Moriarty
Registration No. 38,973
Attorney for Applicant(s)

WEINGARTEN, SCHURGIN,
GAGNEBIN & HAYES LLP
Ten Post Office Square
Boston, Massachusetts 02109

Telephone: (617) 542-2290
Telecopier: (617) 451-0313

Date: March 10, 1998

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116247

WEINGARTEN, SCHURGIN,
GAGNEBIN & HAYES LLP
TEL (617) 542-2290
FAX (617) 451-0313