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(71) Applicant: **CISCO TECHNOLOGY, INC.** [US/US];
Patent Prosecution, c/o Robert Barr, 170 W. Tasman Dr.,
San Jose, CA 95134 (US).

(72) Inventors: **EATHERTON, William, N.**; 1266 Hickerson
Court, San Jose, CA 95127 (US). **LEE, Jaushin**; 19869
Lanark Lande, Saratoga, CA 95070 (US). **PRIYADAR-**
SHAN, Bangalore, L.; 4177 Polonius Circle, Fremont,
CA 94555 (US). **WARKHEDE, Priyank, Ramesh**;
4355 Renaissance Dr. 201, San Jose, CA 95134 (US).

ERTEMALP, Fusun; 491 Claremont Way, Menlo Park,
CA 94025 (US). **HOLBROOK, Hugh, Weber**; 85
Buena Vista Terrace, San Francisco, CA 94117 (US).
DEVIREDDY, Dileep, Kumar; 4260 Albany Drive #
I-110, San Jose, CA 95129 (US). **KANEKAR, Bhushan,**
Mangesh; 4022 Chamberer Drive, San Jose, CA 95135
(US). **PULLELA, Venkateshwar, Rao**; 3032 Vin Grande
Ct., San Jose, CA 95135 (US).

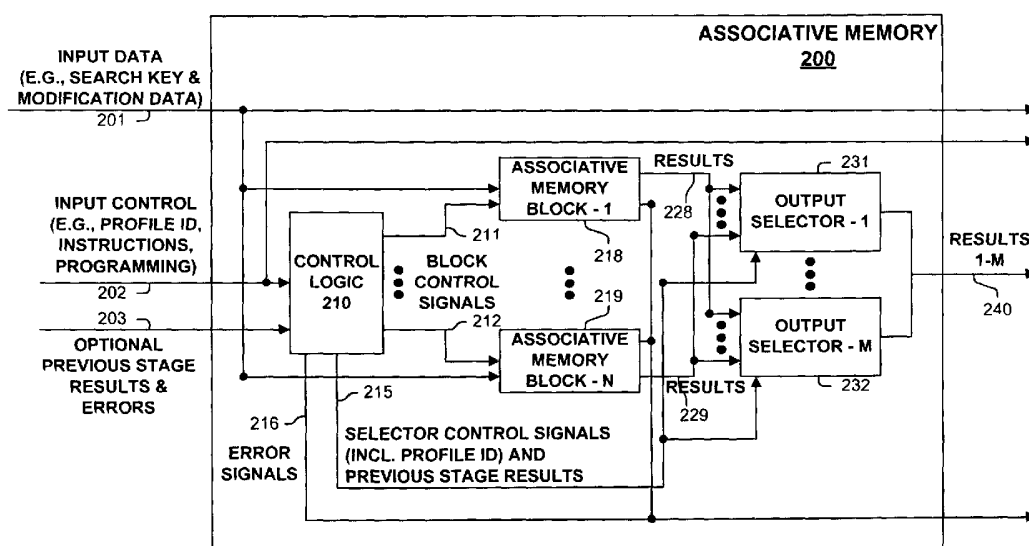
(74) Agent: **WILLIAMS, Kirk**; The Law Office of Kirk D.
Williams, (USPTO Customer No. 26327), 1234 S. Ogden
St., Denver, CO 80210 (US).

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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,
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[Continued on next page]

(54) Title: ASSOCIATIVE MEMORY WITH ENHANCED CAPABILITIES



(57) Abstract: Methods and apparatus are disclosed for performing lookup operations using associative memories, including, but not limited to modifying search keys within an associative memory based on modification mappings, forcing a no hit condition in response to a highest priority matching entry including a force no hit indication, selecting among various sets or banks of associative memory entries in determining a lookup result, and detecting and propagating error conditions. In one implementation, each block retrieves a modification mapping from a local memory and modifies a received search key based on the mapping and received modification data. In one implementation, each of the associative memory entries includes a field for indicating that a successful match on the entry should or should not force a no hit result. In one implementation, an indication of which associative memory blocks or sets of entries to use in a particular lookup operation is retrieved from memory.



European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

- as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii)) for the following designations AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, 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, NI, NO, NZ, OM, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VC, VN, YU, ZA, ZM, ZW, ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG)
- as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii)) for the following designations AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, 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, NI, NO, NZ, OM, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VC, VN, YU, ZA, ZM, ZW, ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG)

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INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 03/22574

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 G06F17/30

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)

IPC 7 G06F

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

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

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 6 374 326 B1 (SAMBANDAN SACHIDANANDAN ET AL) 16 April 2002 (2002-04-16) column 1, line 66 - column 2, line 31 column 3, line 38 - column 3, line 57 column 5, line 65 - column 6, line 49 -----	1
A	US 6 295 576 B1 (MURASE TUTOMU ET AL) 25 September 2001 (2001-09-25) column 8, line 65 - column 9, line 38 ----- -/--	1

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in 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 document 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

2 June 2004

Date of mailing of the international search report

01.10.2004

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

DE CASTRO PALOMARES

INTERNATIONAL SEARCH REPORT

International Application No

PCT/US 03/22574

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	PEI T-B ET AL: "VLSI implementation of routing tables: tries and CAMs" NETWORKING IN THE NINETIES. BAL HARBOUR, APR. 7 - 11, 1991, PROCEEDINGS OF THE ANNUAL JOINT CONFERENCE OF THE COMPUTER AND COMMUNICATIONS SOCIETIES. (INFOCOM), NEW YORK, IEEE, US, vol. VOL. 2 CONF. 10, 7 April 1991 (1991-04-07), pages 515-524, XP010042438 ISBN: 0-87942-694-2 page 515 - page 516	1
A	----- MCAULEY A J ET AL: "Fast routing table lookup using CAMs" NETWORKING : FOUNDATION FOR THE FUTURE. SAN FRANCISCO, MAR. 28 - APR. 1, 1993, PROCEEDINGS OF THE ANNUAL JOINT CONFERENCE OF THE COMPUTER AND COMMUNICATIONS SOCIETIES (INFOCOM), LOS ALAMITOS, IEEE COMP. SOC. PRESS, US, vol. VOL. 2 CONF. 12, 28 March 1993 (1993-03-28), pages 1382-1391, XP010032383 ISBN: 0-8186-3580-0 the whole document -----	1

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US 03/22574

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☒ No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1-28

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
- ☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-28

Associative memory with search configurations

2. claims: 29-40

Associative memory with configurable result

3. claims: 41-60, 66-83

Associative memory with improved match selection

4. claims: 61-65

Associative memory with error condition identification and management.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US 03/22574

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 6374326	B1	16-04-2002	US 6526474 B1	25-02-2003
US 6295576	B1	25-09-2001	JP 3191737 B2	23-07-2001
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