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UNITED STATES DEPARTMENT OF COMMERCE
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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
09/703,427	10/31/2000	Blaine D. Gaither	10008316-1

CONFIRMATION NO. 2980

192641
Botos Churchill IP Law LLP - Malik
430 Mountain Avenue
Suite 401
New Providence, NJ 07974

POA ACCEPTANCE LETTER

OC0000007309907

Date Mailed: 05/29/2024

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 05/23/2024.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

/vostuart/

SAP - Exhibit 1102
SAP v. Valtrus et al. - IPR2025-00420
Page 1 of 704

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
09/703,427	10/31/2000	Blaine D. Gaither	10008316-1

CONFIRMATION NO. 2980

56436
Hewlett Packard Enterprise
3404 E. Harmony Road
Mail Stop 79
Fort Collins, CO 80528

POWER OF ATTORNEY NOTICE

OC0000007309379

Date Mailed: 05/29/2024

NOTICE REGARDING CHANGE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 05/23/2024.

- The Power of Attorney to you in this application has been revoked by the assignee who has intervened as provided by 37 CFR 3.71. Future correspondence will be mailed to the new address of record(37 CFR 1.33).

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

/vostuart/

Doc Code: PA..
Document Description: Power of Attorney

PTO/AIA/82A (07-13)
Approved for use through 11/30/2014. OMB 0651-0051
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.

TRANSMITTAL FOR POWER OF ATTORNEY TO ONE OR MORE REGISTERED PRACTITIONERS

NOTE: This form is to be submitted with the Power of Attorney by Applicant form (PTO/AIA/82B) to identify the application to which the Power of Attorney is directed, in accordance with 37 CFR 1.5, unless the application number and filing date are identified in the Power of Attorney by Applicant form. If neither form PTO/AIA/82A nor form PTO/AIA82B identifies the application to which the Power of Attorney is directed, the Power of Attorney will not be recognized in the application.

Application Number	09/703,427
Filing Date	October 31, 2000
First Named Inventor	Blaine D. Gaither
Title	METHOD AND APPARATUS FOR PASSING MESSAGES USING A FAULT TOLERANT STORAGE SYSTEM
Art Unit	2144
Examiner Name	
Attorney Docket Number	10008316-1

SIGNATURE of Applicant or Patent Practitioner

Signature	/Richard J. Botos/	Date (Optional)	5/23/2024
Name	Richard J. Botos	Registration Number	32,016
Title (if Applicant is a juristic entity)			
Applicant Name (if Applicant is a juristic entity)			

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications. If more than one applicant, use multiple forms.

☑ *Total of 1 forms are submitted.

This collection of information is required by 37 CFR 1.131, 1.32, and 1.33. 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 1.11 and 1.14. This collection is estimated to take 3 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.

PTO/AIA/80 (07-17)
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POWER OF ATTORNEY TO PROSECUTE APPLICATIONS BEFORE THE USPTO

I hereby revoke all previous powers of attorney given in the application identified in the attached statement under 37 CFR 3.73(c).

I hereby appoint:

[x] Practitioners associated with Customer Number: 192641

OR

[ ] Practitioner(s) named below (if more than ten patent practitioners are to be named, then a customer number must be used):

Name	Registration Number	Name	Registration Number

As attorney(s) or agent(s) to represent the undersigned before the United States Patent and Trademark Office (USPTO) in connection with any and all patent applications assigned only to the undersigned according to the USPTO assignment records or assignment documents attached to this form in accordance with 37 CFR 3.73(c).

Please change the correspondence address for the application identified in the attached statement under 37 CFR 3.73(c) to:

[x] The address associated with Customer Number: 192641

OR

[ ]

Firm or individual name	Botos Churchill IP Law, LLP	
Address	430 Mountain Ave., Suite 401	
City New Providence	State NJ	Zip 07974
Country USA		
Telephone (908) 738-1770	Email pto@bciplaw.com	

Assignee name and address: Maikie Innovations Limited
The Glass Houses GH2 92 Georges Street Lower
Dun Laoghaire, Dublin, A96 VR66

A copy of this form, together with a statement under 37 CFR 3.73(c) (Form PTO/AIA/96 or equivalent) is required to be filed in each application in which this form is used. The statement under 37 CFR 3.73(c) may be completed by one of the practitioners appointed in this form, and must identify the application in which this Power of Attorney is to be filed.

SIGNATURE of Assignee of Record

The individual whose signature and title is supplied below is authorized to act on behalf of the assignee.

Signature Angela Quinlan	Date 13th June 2023
Name ANGELA QUINLAN	Telephone +353 89 9191202
Title MANAGING DIRECTOR	

This collection of information is required by 37 CFR 1.31, 1.32, and 1.33. The information is required to obtain or retain a benefit by the public, which is to update (and by the USPTO to process) the file of a patent or reexamination proceeding. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 18 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.

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.

PTO/AIA/96 (08-12)
Approved for use through 11/30/2020. OMB 0651-0031
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STATEMENT UNDER 37 CFR 3.73(c)

Applicant/Patent Owner: VALTRUS INNOVATIONS LIMITED

Application No./Patent No.: 09/703,427/6,889,244 Filed/Issue Date: October 31, 2000/May 3, 2005

Titled: METHOD AND APPARATUS FOR PASSING MESSAGES USING A FAULT TOLERANT STORAGE SYSTEM

VALTRUS INNOVATIONS LIMITED, a a Corporation

(Name of Assignee) (Type of Assignee, e.g., corporation, partnership, university, government agency, etc.)

states that, for the patent application/patent identified above, it is (choose **one** of options 1, 2, 3 or 4 below):

1. ☑ The assignee of the entire right, title, and interest.

2. ☐ An assignee of less than the entire right, title, and interest (check applicable box):

   ☐ The extent (by percentage) of its ownership interest is _____%. Additional Statement(s) by the owners holding the balance of the interest must be submitted to account for 100% of the ownership interest.

   ☐ There are unspecified percentages of ownership. The other parties, including inventors, who together own the entire right, title and interest are:

   Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

3. ☐ The assignee of an undivided interest in the entirety (a complete assignment from one of the joint inventors was made). The other parties, including inventors, who together own the entire right, title, and interest are:

   Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

4. ☐ The recipient, via a court proceeding or the like (*e.g.*, bankruptcy, probate), of an undivided interest in the entirety (a complete transfer of ownership interest was made). The certified document(s) showing the transfer is attached.

The interest identified in option 1, 2 or 3 above (not option 4) is evidenced by either (choose **one** of options A or B below):

A. ☐ An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel _____, Frame _____, or for which a copy thereof is attached.

B. ☑ A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as follows:

1. From: BLAINE D. GAITHER and BRET A. MCKEE To: HEWLETT-PACKARD COMPANY

   The document was recorded in the United States Patent and Trademark Office at
   Reel 011520, Frame 0829, or for which a copy thereof is attached.

2. From: HEWLETT-PACKARD COMPANY To: HEWLETT-PACKARD DEVELOPMENT COMPANY, L.P.

   The document was recorded in the United States Patent and Trademark Office at
   Reel 014061, Frame 0492, or for which a copy thereof is attached.

This collectionof information is required by 37CFR 3.73(b). The informationis required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application.Confidentiality isgoverned by 35U.S.C. 122 and37 CFR 1.11and 1.14.This collection is estimated to take 12 minutes to complete, including gathering,preparing, and submitting the completed applicationform 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 besent 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 COMPLETEDFORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA22313-1450** .

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

PTO/AIA/96 (08-12)
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STATEMENT UNDER 37 CFR 3.73(c)

3. From: HEWLETT-PACKARD DEVELOPMENT COMPANY, L.P. To: HEWLETT PACKARD ENTERPRISE DEVELOPMENT LP

The document was recorded in the United States Patent and Trademark Office at
Reel 037079, Frame 0001, or for which a copy thereof is attached.

4. From: HEWLETT PACKARD ENTERPRISE DEVELOPMENT LP and HEWLETT PACKARD ENTERPRISE COMPANY To: OT PATENT ESCROW, LLC

The document was recorded in the United States Patent and Trademark Office at
Reel 055269, Frame 0001, or for which a copy thereof is attached.

5. From: OT PATENT ESCROW, LLC To: VALTRUS INNOVATIONS LIMITED

The document was recorded in the United States Patent and Trademark Office at
Reel 055403, Frame 0001, or for which a copy thereof is attached.

6. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at
Reel _____, Frame _____, or for which a copy thereof is attached.

☐ Additional documents in the chain of title are listed on a supplemental sheet(s).

☐ As required by 37 CFR 3.73(c)(1)(i), the documentary evidence of the chain of title from the original owner to the assignee was, or concurrently is being, submitted for recordation pursuant to 37 CFR 3.11.

[NOTE: A separate copy (i.e., a true copy of the original assignment document(s)) must be submitted to Assignment Division in accordance with 37 CFR Part 3, to record the assignment in the records of the USPTO. See MPEP 302.08]

The undersigned (whose title is supplied below) is authorized to act on behalf of the assignee.

/Richard J. Botos/	5/23/2024
Signature	Date
Richard J. Botos	32,016
Printed or Typed Name	Title or Registration Number

Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requiresthat you begiven certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirementsof the Act, please be advised that: (1)the general authority for the collectionof this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary;and (3) the principalpurpose for whichthe informationis used by the U.S. Patent and Trademark Office is to process and/or examine your submission related toa patent application or patent. If you do not furnishthe requested information, the U.S. Patent and Trademark Officemay not be able to process and/or examine yoursubmission, which may result in termination of proceedings orabandonment of the application or expiration of the patent.

Theinformation 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 forthe 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 recordrelated 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 recordfrom 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.

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ELECTRONIC ACKNOWLEDGEMENT RECEIPT

APPLICATION #	RECEIPT DATE / TIME	ATTORNEY DOCKET #
09/703,427	**05/23/2024 02:58:38 PM Z ET**	**10008316-1**

Title of Invention

METHOD AND APPARATUS FOR PASSING MESSAGES USING A FAULT TOLERANT STORAGE SYSTEM

Application Information

APPLICATION TYPE	Utility - Nonprovisional Application under 35 USC 111(a)	PATENT #	6889244
CONFIRMATION #	2980	FILED BY	Gaby Hecht
PATENT CENTER #	65648559	FILING DATE	10/31/2000
CUSTOMER #	56436	FIRST NAMED INVENTOR	Blaine D. Gaither
CORRESPONDENCE ADDRESS	-	AUTHORIZED BY	Richard Botos

Documents

TOTAL DOCUMENTS: 4

DOCUMENT	PAGES	DESCRIPTION	SIZE (KB)
Valtrus Power of Attorney - Post AIA General.pdf	2	Power of Attorney	444 KB
Warning: The attached file contains comments or annotations. Comments are not recommended and may cause processing problems with the document.			
6889244_statement_373c.pdf	3	Assignee showing of ownership per 37 CFR 3.73	112 KB
6889244 POA Transmittal.pdf	3	Power of Attorney	1316 KB
6889244 Change of Correspondence Address Patent.pdf	2	Change of Address	265 KB

Digest

DOCUMENT	MESSAGE DIGEST(SHA-512)
Valtrus Power of Attorney - Post AIA General.pdf	F6D7ECA9928D8E1B029DFFF2C523B07F37029E0EDA6B092A8EF8F191B20E6A0EB07D90AFC41309F3FDC1AA18AAE1672DA889D9CC6E9B5DE83A308CBD58DB55D5
6889244_statement_373c.pdf	DB2E0B2D1D2CEB44CAC068E5764B6526561753 71E79086445B7E0E1025EC1940621EE5076E4D3E8FB658DCA74E423C8C5B99BEFDC07E07C874E3FCCCBBE550A3
6889244 POA Transmittal.pdf	856A4AB8A47A69AF8157323EF8E31E5C719E669CCAC9BD387F1D1656B8EA87CDFCAFA40AAF266058C3BD9E48A0825FA7A908906717426C3D8FA7A81C41F1DD0F
6889244 Change of Correspondence Address Patent.pdf	33C4035A2390C01DA388262B6BD710A35F2EDD8B3566364D83B42D782298DAA64C28830A6ED10D0E99A8C6BDB8CC8818E5A178C10ACFD970C23FDAF6C3FB343F

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 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.

PTO/AIA/123 (08-12)
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CHANGE OF CORRESPONDENCE ADDRESS
Patent

Address to:
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Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Patent Number	6,889,244
Issue Date	05/03/2005
Application Number	09/703,427
Filing Date	10/31/2000
First Named Inventor	Blaine D. Gaither
Attorney Docket Number	10008316-1

Please change the Correspondence Address for the above-identified patent to:

☑ The address associated with Customer Number: 192641

OR

☐ **Firm *or* Individual Name**

Address

City	**State**	**ZIP**

Country

Telephone	**Email**

This form cannot be used to change the data associated with a Customer Number. To change the data associated with an existing Customer Number use "Request for Customer Number Data Change" (PTO/SB/124).

This form will not affect any "fee address" provided for the above-identified patent. To change a "fee address" use the "Fee Address Indication Form" (PTO/SB/47).

I am the:

☐ Patentee.

☐ If the Patentee was not the applicant for patent (37 CFR 1.42), then a Statement under 37 CFR 3.73(c) (Form PTO/AIA/96 or equivalent) is enclosed or was filed on _____. See 37 CFR 3.71.

☑ Attorney or agent of record. Registration Number 32,016.

☐ Patent practitioner acting in a representative capacity whose correspondence address is the correspondence address of record. Notice has been given to the patentee or owner. Registration Number 32,016.

Signature	/Richard J. Botos/
Typed or Printed Name	Richard J. Botos
Date	May 23, 2024
Telephone	(908) 738-1770

NOTE: This form must be signed in accordance with 37 CFR 1.33. See 37 CFR 1.4(d) for signature requirements and certifications. Submit multiple forms if more than one signature is required, see below*.

☑ *Total of 1 forms are submitted.

A Federal agency may not conduct or sponsor, and a person is not required to respond to, nor shall a person be subject to a penalty for failure to comply with an information collection subject to the requirements of the Paperwork Reduction Act of 1995, unless the information collection has a currently valid OMB Control Number. The OMB Control Number for this information collection is 0651-00**. Public burden for this form is estimated to average ** hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the information collection. Send comments regarding this burden estimate or any other aspect of this information collection, including suggestions for reducing this burden to the Chief Administrative Officer, United States Patent and Trademark Office, P.O. Box 1450, Alexandria, VA 22313-1450 or email InformationCollection@uspto.gov. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **If filing this completed form by mail, 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.

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PTO/AIA/80 (07-17)
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POWER OF ATTORNEY TO PROSECUTE APPLICATIONS BEFORE THE USPTO

I hereby revoke all previous powers of attorney given in the application identified in the attached statement under 37 CFR 3.73(c).

I hereby appoint:

[X] Practitioners associated with Customer Number: 192641

OR

[ ] Practitioner(s) named below (if more than ten patent practitioners are to be named, then a customer number must be used):

Name	Registration Number	Name	Registration Number

As attorney(s) or agent(s) to represent the undersigned before the United States Patent and Trademark Office (USPTO) in connection with any and all patent applications assigned only to the undersigned according to the USPTO assignment records or assignment documents attached to this form in accordance with 37 CFR 3.73(c).

Please change the correspondence address for the application identified in the attached statement under 37 CFR 3.73(c) to:

[X] The address associated with Customer Number: 192641

OR

[ ]

Firm or individual name		
Address		
City	State	Zip
Country		
Telephone	Email	

Assignee name and address: VALTRUS INNOVATIONS LIMITED THE GLASS HOUSES 92 GEORGES STREET LOWER, DUN LAOGHAIRE DUBLIN, IRELAND A96 VR66

A copy of this form, together with a statement under 37 CFR 3.73(c) (Form PTO/AIA/96 or equivalent) is required to be filed in each application in which this form is used. The statement under 37 CFR 3.73(c) may be completed by one of the practitioners appointed in this form, and must identify the application in which this Power of Attorney is to be filed.

SIGNATURE of Assignee of Record

The individual whose signature and title is supplied below is authorized to act on behalf of the assignee.

Signature /Angela Quinlan/	Date 5/22/2024
Name Angela Quinlan	Telephone +353 87 9171202
Title Managing Director	

This collection of information is required by 37 CFR 1.31, 1.32, and 1.33. The information is required to obtain or retain a benefit by the public, which is to update (and by the USPTO to process) the file of a patent or reexamination proceeding. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 18 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.**

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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.

PATENT ASSIGNMENT COVER SHEET

Electronic Version v1.1
Stylesheet Version v1.2

EPAS ID: PAT6516770

SUBMISSION TYPE:	NEW ASSIGNMENT
NATURE OF CONVEYANCE:	PATENT ASSIGNMENT, SECURITY INTEREST, AND LIEN AGREEMENT

CONVEYING PARTY DATA

Name	Execution Date
HEWLETT PACKARD ENTERPRISE DEVELOPMENT LP	01/15/2021
HEWLETT PACKARD ENTERPRISE COMPANY	01/15/2021

RECEIVING PARTY DATA

Name:	OT PATENT ESCROW, LLC
Street Address:	200 WEST MADISON - 37TH FLOOR
City:	CHICAGO
State/Country:	ILLINOIS
Postal Code:	60606

PROPERTY NUMBERS Total: 1328

Property Type	Number
Patent Number:	6880153
Patent Number:	7103639
Patent Number:	6832181
Patent Number:	6668294
Patent Number:	7043586
Patent Number:	6684381
Patent Number:	6757849
Patent Number:	7003559
Patent Number:	6684218
Patent Number:	6661748
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Patent Number:	7440360
Patent Number:	6539527
Patent Number:	6907603
Patent Number:	6738783
Patent Number:	7251780
Patent Number:	6853835
Patent Number:	6842754
Patent Number:	6889244

Property Type	Number
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Patent Number:	7131199
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Patent Number:	6935419
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Patent Number:	6665166
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Patent Number:	6952689
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Patent Number:	6657868
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Patent Number:	9031876
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Patent Number:	9098276

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Property Type	Number
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Patent Number:	9411657
Patent Number:	8810780
Patent Number:	9408050
Patent Number:	9195727

CORRESPONDENCE DATA

Fax Number: (203)542-7220

Correspondence will be sent to the e-mail address first; if that is unsuccessful, it will be sent using a fax number, if provided; if that is unsuccessful, it will be sent via US Mail.

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Email: jlutzker@oceantomo.com
Correspondent Name: JOEL E LUTZKER
Address Line 1: 500 WEST PUTNAM AVE. #500
Address Line 4: GREENWICH, CONNECTICUT 06830

NAME OF SUBMITTER:	JOEL E. LUTZKER
SIGNATURE:	/Joel E. Lutzker/
DATE SIGNED:	01/26/2021
	This document serves as an Oath/Declaration (37 CFR 1.63).

Total Attachments: 211
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Patent Assignment, Security Interest, and Lien Agreement

This Patent Assignment, Security Interest, and Lien Agreement ("Agreement"), dated as of January 15, 2021 ("***Effective Date***"), is made by and among Hewlett Packard Enterprise Development LP, a Texas limited partnership having its principal place of business at 11445 Compaq Drive West, Houston, Texas 77070-1443 ("***HPED***"), and Hewlett Packard Enterprise Company, a Delaware corporation having its principal place of business at 6280 America Center Drive, San Jose, California 95002, U.S.A. ("***HPECO***") (HPED and HPECO are collectively referred to herein as "***Assignor***"); and OT Patent Escrow, LLC, aDelaware limited liability company having its principal place of business at 200 West Madison, 37th Floor, Chicago, IL 60606 ("***Assignee***").

WHEREAS, Assignor and Assignee, as well as Valtrus Innovations Limited, a company incorporated in Ireland under company number 669289 and having its principal place of business at The Glasshouses GH2, 92 Georges Street Lower, Dun Laoghaire, Dublin, Ireland A96 VR66 ("***Purchaser***") are parties to a Patent Escrow Agreement dated as of January 15, 2021, pursuant to which the Patents identified in the attached Exhibit A-2 (collectively, "***Assigned Patents***") are to be assigned to Assignee to hold in escrow for later assignment to Purchaser subject to the terms and conditions of the Patent Escrow Agreement;

NOW THEREFORE, for good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, the parties agree as follows:

1. Assignment to Assignee. Assignor hereby grants and assigns to Assignee all of Assignor's right, title and interest in and to the Assigned Patents, to have and to hold the same, for Assignee's own use and enjoyment and for the use and enjoyment of its successors and assigns, and the right to sue for damages for infringement of such Assigned Patents accruing at any time prior to, on, and/or after the date hereof, for the full term or terms of all such Assigned Patents, subject to all rights granted under the Assigned Patents to any and all parties (including Assignor) prior to or concurrent with January 15, 2021.

2. Security Interest and Lien. Assignee hereby grants Assignor a security interest and lien in and to all of Assignee's right, title and interest in and to the Assigned Patents (the "Security Interest"). The Security Interest is granted by Assignee's to secure Assignee's performance of, and compliance with, its obligations under the Patent Escrow Agreement.

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IN WITNESS WHEREOF, the parties hereto have caused this Agreement to be executed by their duly authorized representatives as of the Effective Date as set forth below:

Hewlett Packard Enterprise Company

By: _____
Brett Alten (Jan 20, 2021 19:11 PST)

Name: Brett Alten

Title: SVP, DGC, Chief IP Counsel

Date: Jan 20, 2021

Hewlett Packard Enterprise Development LP

By: Enterprise DC Holdings LLC, its General Partner

By: _____
Brett Alten (Jan 20, 2021 19:11 PST)

Name: Brett Alten

Title: Chief Intellectual Property Counsel

Date: Jan 20, 2021

OT Patent Escrow, LLC

By: _____
Joel Lutzker (Jan 21, 2021 11:08 EST)

Name: Joel Lutzker

Title: General Counsel

Date: 01/21/2021

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Exhibit A-2 – Escrow Patents

List of Escrow Patents:

Tranche 2:

Patent ID Tranche 2	Patent Family Id	CC	Patent Number	Patent Status	Application Number if not Granted	Filed Date	Annuity Due Date	Annuity Cost (Est. USD)	Application Title
81966449	F10001152	US	US6880153	Granted		21-Nov-2000	N/A	N/A	METHOD AND APPARATUS FOR VARYING THE LEVEL OF CORRECTNESS CHECKS EXECUTED WHEN PEFORMING CORRECTNESS CHECKS OPPORTUNISTICALLY USING SPARE INSTRUCTION SLOTS
81968165	F10001626	US	US7103639	Granted		5-Dec-2000	N/A	N/A	METHOD AND APPARATUS FOR PROCESSING UNIT SYNCHRONIZATION FOR SCALABLE PARALLEL PROCESSING

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Patent ID Tranche 2	Patent Family Id	CC	Patent Number	Patent Status	Application Number if not Granted	Filed Date	Annuity Due Date	Annuity Cost (Est. USD)	Application Title
81968168	F10001626	JP	JP3947381	Granted		19-Oct-2001	20-Apr-2021	934.20	METHOD FOR PROCESSING UNIT SYNCHRONIZATION FOR SCALABLE PARALLEL PROCESSING
81972728	F10003154	US	US6832181	Granted		3-Nov-2000	N/A	N/A	METHOD TO DISTINGUISH BETWEEN PHYSICAL HARDWARE AND SIMULATED HARDWARE
81973646	F10003436	US	US6668294	Granted		17-Mar-2001	N/A	N/A	DATA CORRUPTION AVOIDANCE ON A BACKPLANE BUS ADAPTED TO RECEIVE BUS CONTROLLER CARDS OF DIFFERENT TYPES

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Patent ID Tranche 2	Patent Family Id	CC	Patent Number	Patent Status	Application Number if not Granted	Filed Date	Annuity Due Date	Annuity Cost (Est. USD)	Application Title
81973649	F10003436	US	US7043586	Granted		19-Nov-2003	N/A	N/A	DATA CORRUPTION AVOIDANCE ON A BACKPLANE BUS ADAPTED TO RECEIVE BUS CONTROLLER CARDS OF DIFFERENT TYPES
81976343	F10004126	US	US6684381	Granted		29-Sep-2000	N/A	N/A	HARDWARE DESCRIPTION LANGUAGE-EMBEDDED REGULAR EXPRESSION SUPPORT FOR MODULE ITERATION AND INTERCONNECTIO N
81976415	F10004177	US	US6757849	Granted		3-Aug-2001	N/A	N/A	SYSTEM AND METHOD FOR DEVELOPING CUSTOMIZED INTEGRATION TESTS AND NETWORK PERIPHERAL DEVICE EVALUATIONS
81977366	F10004526	US	US7003559	Granted		23-Oct-2000	N/A	N/A	SYSTEM AND METHOD FOR DETERMINING PROBABLE NETWORK PATHS BETWEEN NODES IN A NETWORK TOPOLOGY
81977369	F10004526	GB	GB2370720	Granted		17-Oct-2001	17-Oct-2020	882.85	SYSTEM AND METHOD FOR DETERMINING PROBABLE NETWORK PATHS BETWEEN NODES IN A NETWORK TOPOLOGY
81977879	F10004727	US	US6684218	Granted		21-Nov-2000	N/A	N/A	STANDARD SPECIFIC URL

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Patent ID Tranche 2	Patent Family Id	CC	Patent Number	Patent Status	Application Number if not Granted	Filed Date	Annuity Due Date	Annuity Cost (Est. USD)	Application Title
81978845	F10004960	US	US6661748	Granted		5-Mar-2001	N/A	N/A	POSITION CONTROL FOR PLUNGE MECHANISM
81978959	F10004966	US	US6663003	Granted		22-Feb-2001	N/A	N/A	APPARATUS AND METHOD FOR RETRIEVING DATA RELATED TO A DATA CARTRIDGE IN A MEDIA STORAGE SYSTEM
81978968	F10004966	US	US7440360	Granted		13-Aug-2003	N/A	N/A	APPARATUS AND METHOD FOR RETRIEVING DATA RELATED TO A DATA CARTRIDGE IN A MEDIA STORAGE SYSTEM
81980636	F10005848	US	US6539527	Granted		19-Mar-2001	N/A	N/A	SYSTEM AND METHOD OF DETERMINING THE NOISE SENSITIVITY OF AN INTEGRATED CIRCUIT
81983471	F10006882	US	US6907603	Granted		29-Sep-2003	N/A	N/A	SOFTWARE UPDATE MANAGEMENT SYSTEM WITH UPDATE CHRONOLOGY GENERATOR
81984224	F10007224	US	US6738783	Granted		9-Feb-2001	N/A	N/A	DYNAMICALLY CONFIGURABLE GENERIC CONTAINER
81984374	F10007278	US	US7251780	Granted		1-Jun-2005	N/A	N/A	DYNAMIC WEB CONTENT UNFOLDING IN WIRELESS INFORMATION GATEWAYS

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Patent ID Tranche 2	Patent Family Id	CC	Patent Number	Patent Status	Application Number if not Granted	Filed Date	Annuity Due Date	Annuity Cost (Est. USD)	Application Title
81986504	F10007956	US	US6853835	Granted		13-Aug-2001	N/A	N/A	ASYMMETRIC WIRELESS COMMUNICATION SYSTEM USING TWO DIFFERENT RADIO TECHNOLOGIES
81986516	F10007956	DE	DE60202618.0	Granted		13-Aug-2002	13-Aug-2020	2,108.66	ASYMMETRIC WIRELESS CELLULAR COMMUNICATION SYSTEM USING A CARRIER WAVE DOWNLINK AND AN ULTRAWIDEBAND UPLINK
81986522	F10007956	GB	GB1417783	Granted		13-Aug-2002	13-Aug-2020	826.86	ASYMMETRIC WIRELESS CELLULAR COMMUNICATION SYSTEM USING A CARRIER WAVE DOWNLINK AND AN ULTRAWIDEBAND UPLINK
81987053	F10008127	US	US6842754	Granted		17-Apr-2001	N/A	N/A	LEASE ENFORCEMENT IN A DISTRIBUTED FILE SYSTEM
81987509	F10008316	US	US6889244	Granted		31-Oct-2000	N/A	N/A	METHOD AND APPARATUS FOR PASSING MESSAGES USING A FAULT TOLERANT STORAGE SYSTEM
82079381	F100110249	US	US6910271	Granted		29-Oct-2002	N/A	N/A	MECHANICAL HIGHLY COMPLIANT THERMAL INTERFACE PAD
82079387	F100110249	US	US7131199	Granted		1-Feb-2005	N/A	N/A	MECHANICAL HIGHLY COMPLIANT THERMAL INTERFACE PAD

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Patent ID Tranche 2	Patent Family Id	CC	Patent Number	Patent Status	Application Number if not Granted	Filed Date	Annuity Due Date	Annuity Cost (Est. USD)	Application Title
82081496	F100111334	US	US7246101	Granted		16-May-2002	N/A	N/A	KNOWLEDGE-BASED SYSTEM AND METHOD FOR RECONSTRUCTIN G CLIENT WEB PAGE ACCESSES FROM CAPTURED NETWORK PACKETS
82081724	F100111445	US	US6935419	Granted		20-Feb-2002	N/A	N/A	HEAT SINK APPARATUS WITH AIR DUCT
81991499	F10011625	US	US6832303	Granted		3-Jan-2002	N/A	N/A	METHOD AND SYSTEM FOR MANAGING AN ALLOCATION OF A PORTION OF A MEMORY
81992498	F10012052	US	US6665166	Granted		15-Mar-2001	N/A	N/A	SYSTEMS WITH ENHANCED ELECTROSTATIC DISCHARGE PROTECTION
81993035	F10012236	US	US6832927	Granted		3-Oct-2001	N/A	N/A	LOW PROFILE PCI HOT PLUG ACTUATOR ASSEMBLY
81993038	F10012236	GB	GB2385205	Granted		24-Sep-2002	24-Sep-2021	896.07	LOW PROFILE PCI HOT PLUG ACTUATOR ASSEMBLY
81995060	F10013088	US	US6848114	Granted		23-Aug-2001	N/A	N/A	BULK ACCESS SYSTEM FOR A DATA STORAGE SYSTEM
81995123	F10013110	US	US6961716	Granted		31-Jul-2001	N/A	N/A	NETWORK USAGE ANALYSIS SYSTEM AND METHOD FOR DETERMINING EXCESS USAGE
81998876	F10014427	US	US6952689	Granted		21-Feb-2003	N/A	N/A	AUTOMATING EXPERT KNOWLEDGE WITH ANALYZER HARNESS

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Patent ID Tranche 2	Patent Family Id	CC	Patent Number	Patent Status	Application Number if not Granted	Filed Date	Annuity Due Date	Annuity Cost (Est. USD)	Application Title
81998279	F10014777	US	US7002801	Granted		16-Oct-2003	N/A	N/A	METHOD OF COOLING SEMICONDUCTOR DIE USING MICROCHANNEL THERMOSYPHON
82186076	F10014777	US	US7120022	Granted		24-Mar-2004	N/A	N/A	LOOP THERMOSYPHON WITH WICKING STRUCTURE AND SEMICONDUCTOR DIE AS EVAPORATOR
81998489	F10015052	US	US6826675	Granted		9-Oct-2001	N/A	N/A	STACK UTILIZATION MANAGEMENT SYSTEM AND METHOD FOR A SINGLE-STACK ARRANGEMENT
81998492	F10015052	US	US6904513	Granted		2-Jul-2004	N/A	N/A	STACK UTILIZATION MANAGEMENT SYSTEM AND METHOD FOR A SINGLE-STACK ARRANGEMENT
82000850	F10016665	US	US6941489	Granted		27-Feb-2002	N/A	N/A	CHECKPOINTING OF REGISTER FILE
82000862	F10016668	US	US6832300	Granted		20-Mar-2002	N/A	N/A	METHODS AND APPARATUS FOR CONTROL OF ASYNCHRONOUS CACHE
82183202	F10018060	US	US6867976	Granted		21-Oct-2003	N/A	N/A	PIN RETENTION FOR THERMAL TRANSFER INTERFACES, AND ASSOCIATED METHODS
82006229	F10019555	US	US6882536	Granted		25-Apr-2002	N/A	N/A	WRAP- AROUND COOLING ARRANGEMENT FOR PRINTED CIRCUIT BOARD

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82006235	F10019555	GB	GB2387974	Granted		22-Apr-2003	22-Apr-2021	837.70	WRAP-AROUND COOLING ARRANGEMENT FOR PRINTED CIRCUIT BOARD
82006994	F10019865	US	US6874070	Granted		22-Feb-2002	N/A	N/A	SYSTEM AND METHOD FOR MEMORY INTERLEAVING USING CELL MAP WITH ENTRY GROUPING FOR HIGHER-WAY INTERLEAVING
82006997	F10019865	JP	JP4348093	Granted		21-Feb-2003	24-Jul-2021	753.97	METHOD OF ACCESSING MEMORY IN INTERLEAVED MANNER USING MAP TABLE
82084961	F100201063	US	US6816809	Granted		23-Jul-2002	N/A	N/A	HARDWARE BASED UTILIZATION METERING
82084970	F100201063	GB	GB2393292	Granted		17-Jul-2003	17-Jul-2021	781.44	HARDWARE BASED UTILIZATION METERING
82084973	F100201063	US	US8463578	Granted		16-Jul-2004	11-Dec-2020	3,606.00	HARDWARE BASED UTILIZATION METERING
82086311	F100201656	US	US7225118	Granted		31-Oct-2002	N/A	N/A	GLOBAL DATA PLACEMENT
82086503	F100201702	US	US6952358	Granted		5-May-2003	N/A	N/A	MOLECULAR WIRE CONTENT ADDRESSABLE MEMORY
82086653	F100201725	US	US6977927	Granted		18-Sep-2000	N/A	N/A	METHOD AND SYSTEM OF ALLOCATING STORAGE RESOURCES IN A STORAGE AREA NETWORK

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82087187	F100201874	US	US6873190	Granted		18-Mar-2003	N/A	N/A	APPARATUS FOR SENSING THE PRESENCE OF AN INDUCTIVE LOAD DRIVEN BY A PULSE WIDTH MODULATED SIGNAL
82087190	F100201874	JP	JP4059859	Granted		11-Mar-2004	28-Dec-2020	1,050.55	DEVICE FOR DETECTING PRESENCE OF INDUCTIVE LOAD DRIVEN BY PULSE-WIDTH MODULATED SIGNAL
82644401	F100201874	FR	FR1460440	Granted		9-Oct-2003	9-Oct-2021	946.25	APPARATUS FOR SENSING THE PRESENCE OF AN INDUCTIVE LOAD DRIVEN BY A PULSE WIDTH MODULATED SIGNAL
82644403	F100201874	DE	DE60335237.5	Granted		9-Oct-2003	9-Oct-2021	2,272.89	APPARATUS FOR SENSING THE PRESENCE OF AN INDUCTIVE LOAD DRIVEN BY A PULSE WIDTH MODULATED SIGNAL
82644405	F100201874	GB	GB1460440	Granted		9-Oct-2003	9-Oct-2021	837.70	APPARATUS FOR SENSING THE PRESENCE OF AN INDUCTIVE LOAD DRIVEN BY A PULSE WIDTH MODULATED SIGNAL
82092221	F100204926	US	US6862179	Granted		26-Nov-2002	N/A	N/A	PARTITION FOR VARYING THE SUPPLY OF COOLING FLUID

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82030946	F10971169	US	US6910122	Granted		18-Feb-2000	N/A	N/A	METHOD AND APPARATUS FOR PRESERVING PIPELINE DATA DURING A PIPELINE STALL AND FOR RECOVERING FROM THE PIPELINE STALL
82035506	F10972013	US	US6961768	Granted		13-Jul-2001	N/A	N/A	STATUS POLLING FAILOVER OF DEVICES IN A DISTRIBUTED NETWORK MANAGEMENT HIERARCHY
82050626	F10990826	US	US6766435	Granted		31-May-2000	N/A	N/A	ADDRESS TRANSLATION REGISTERS IN A PROCESSOR
82058069	F10992475	US	US6442552	Granted		30-Jun-2000	N/A	N/A	METHOD AND APPARATUS FOR IMPLEMENTING THREE TIER CLIENT ASYNCHRONOUS TRANSPARENCY
82578805	F12151	US	US6657868	Granted		21-Nov-2001	N/A	N/A	ELECTRONIC DEVICE MOUNT ASSEMBLY
82093034	F200205338	US	US6895489	Granted		7-Aug-2002	N/A	N/A	SYSTEM AND METHOD FOR OPERATING IN ENDIAN INDEPENDENT MODE
82098413	F200207885	US	US7474229	Granted		13-Sep-2006	6-Jul-2020	7,406.00	COMPUTER SYSTEM INDICATOR PANEL WITH EXPOSED INDICATOR EDGE
82098422	F200207885	JP	JP5011490	Granted		28-Aug-2007	15-Jun-2021	753.97	COMPUTER SYSTEM INDICATOR PANEL WITH EXPOSED INDICATOR EDGE

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82098428	F200207885	GB	GB2455452	Granted		28-Aug-2007	28-Aug-2020	438.03	COMPUTER SYSTEM INDICATOR PANEL WITH EXPOSED INDICATOR EDGE
82098431	F200207885	DE	DE112007002130	Granted		28-Aug-2007	28-Aug-2020	1,093.17	COMPUTER SYSTEM INDICATOR PANEL WITH EXPOSED INDICATOR EDGE
82098434	F200207885	GB	GB2469953	Granted		28-Aug-2007	28-Aug-2020	438.03	COMPUTER SYSTEM INDICATOR PANEL WITH EXPOSED INDICATOR EDGE
82098761	F200207985	US	US6889169	Granted		31-Jan-2003	N/A	N/A	COLLECTION OF SESSION-RELATED INFORMATION USING AN EXTENDABLE SAMPLING PERIOD
82098764	F200207985	GB	GB2397913	Granted		12-Jan-2004	12-Jan-2021	753.48	COLLECTION OF SESSION-RELATED INFORMATION USING AN EXTENDABLE SAMPLING PERIOD
82101809	F200209078	US	US7075788	Granted		11-Jun-2003	N/A	N/A	COMPUTER COOLING SYSTEM AND METHOD
82102184	F200209214	US	US7543291	Granted		1-Aug-2003	N/A	N/A	PROCESSOR PURGING SYSTEM AND METHOD
82103258	F200209471	US	US7299331	Granted		21-Jan-2003	N/A	N/A	METHOD AND APPARATUS FOR ADDING MAIN MEMORY IN COMPUTER SYSTEMS OPERATING WITH MIRRORED MAIN MEMORY

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82105175	F200300007	US	US7149945	Granted		9-May-2003	N/A	N/A	SYSTEMS AND METHODS FOR PROVIDING ERROR CORRECTION CODE TESTING FUNCTIONALITY
82105178	F200300007	TW	TWI308760	Granted		25-Nov-2003	10-Apr-2021	686.40	SYSTEMS AND METHODS FOR PROVIDING ERROR CORRECTION CODE TESTING FUNCTIONALITY
82105817	F200300253	US	US7191380	Granted		10-Sep-2003	N/A	N/A	DEFECT-TOLERANT AND FAULT-TOLERANT CIRCUIT INTERCONNECTIONS
82195838	F200300253	US	US7350132	Granted		26-Apr-2005	N/A	N/A	NANOSCALE INTERCONNECTION INTERFACE
82195847	F200300253	JP	JP4685159	Granted		26-Apr-2006	18-Feb-2021	979.26	NANOSCALE INTERCONNECTION INTERFACE
82195850	F200300253	CN	CN200680022900.X	Granted		26-Apr-2006	26-Apr-2021	1,367.42	NANOSCALE INTERCONNECTION INTERFACE
82195853	F200300253	KR	KR1012242950000	Granted		26-Apr-2006	14-Jan-2021	463.28	NANOSCALE INTERCONNECTION INTERFACE
82195856	F200300253	IN	IN261309	Granted		26-Apr-2006	26-Apr-2021	644.00	NANOSCALE INTERCONNECTION INTERFACE
82195859	F200300253	US	US8112700	Granted		23-Jan-2008	7-Aug-2023	7,706.00	NANOSCALE INTERCONNECTION INTERFACE
90458834	F200300253	FR	FR1875352	Granted			26-Apr-2021	675.76	NANOSCALE INTERCONNECTION INTERFACE
90458836	F200300253	DE	DE602006053277.6	Granted			26-Apr-2021	1,590.25	NANOSCALE INTERCONNECTION INTERFACE

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90458838	F200300253	GB	GB1875352	Granted			26-Apr-2021	618.83	NANOSCALE INTERCONNECTION INTERFACE
82106237	F200300477	US	US7521264	Granted		5-Jan-2007	N/A	N/A	SPIN INJECTION CONTROL USING ELECTRIC CURRENT
82106732	F200300477	US	US6879013	Granted		30-Jul-2003	N/A	N/A	AMPLIFIERS USING SPIN INJECTION AND MAGNETIC CONTROL OF ELECTRON SPINS
82106567	F200300610	US	US7184933	Granted		28-Feb-2003	N/A	N/A	PERFORMANCE ESTIMATION TOOL FOR DATA STORAGE SYSTEMS
82117211	F200301682	US	US6980063	Granted		3-Aug-2004	N/A	N/A	TRANSMISSION LINE PARASITIC ELEMENT DISCONTINUITY CANCELLATION
82117688	F200301789	US	US7076597	Granted		14-Oct-2003	N/A	N/A	BROADCAST INVALIDATE SCHEME
82117877	F200301842	US	US6704817	Granted		31-Aug-2000	N/A	N/A	COMPUTER ARCHITECTURE AND SYSTEM FOR EFFICIENT MANAGEMENT OF BI-DIRECTIONAL BUS
82117880	F200301842	US	US6920512	Expired		17-Feb-2004	N/A	N/A	COMPUTER ARCHITECTURE AND SYSTEM FOR EFFICIENT MANAGEMENT OF BI-DIRECTIONAL BUS
82117904	F200301844	US	US6665763	Granted		31-Jul-2000	N/A	N/A	HOT-PLUG STORAGE DRIVE

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82117937	F200301852	US	US7079615	Granted		20-Nov-2001	N/A	N/A	EXPANDED COMPARATOR FOR CONTROL OF DIGITAL DELAY LINES IN A DELAY LOCKED LOOP OR PHASE LOCKED LOOP
82118069	F200301890	US	US6976184	Granted		27-Aug-2003	N/A	N/A	CLOCK FORWARD INITIALIZATION AND RESET SIGNALING TECHNIQUE
82118276	F200301945	US	US6895585	Granted		30-Mar-2001	N/A	N/A	METHOD OF MIXED WORKLOAD HIGH PERFORMANCE SCHEDULING
82119680	F200302135	US	US6978345	Granted		15-May-2001	N/A	N/A	SELF-MIRRORING HIGH PERFORMANCE DISK DRIVE
82119857	F200302179	US	US6823409	Granted		28-Sep-2001	N/A	N/A	COHERENCY CONTROL MODULE FOR MAINTAINING CACHE COHERENCY IN A MULTI-PROCESSOR-BUS SYSTEM
82119893	F200302186	US	US6884101	Granted		17-Oct-2001	N/A	N/A	INTERPOSER ONE-STEP LOAD AND SELF-LOCK SOCKET
82120106	F200302240	US	US6830394	Granted		4-Jun-2001	N/A	N/A	KEYBOARD HAVING A TRACK BALL MECHANISM AND A SCROLL MECHANISM
82120226	F200302273	US	US6667879	Granted		13-Dec-2001	N/A	N/A	SYSTEM FOR LATCHING AND EJECTING A MODULAR COMPONENT FROM AN ELECTRONIC DEVICE

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82120262	F200302284	US	US6650537	Granted		31-Oct-2001	N/A	N/A	LOW PROFILE DC DISTRIBUTION MODULE FOR A POWER SUPPLY UNIT
82120493	F200302342	US	US6657867	Granted		14-Dec-2001	N/A	N/A	HINGED DOOR FOR ACCESS TO ADD-IN CARDS
82120496	F200302343	US	US6669423	Granted		14-Dec-2001	N/A	N/A	TOOLLESS THUMB SCREW WITH ADJUSTABLE HEIGHT KNOB
82120499	F200302343	US	US6856514	Granted		27-Oct-2003	N/A	N/A	TOOLLESS THUMB SCREW WITH ADJUSTABLE HEIGHT KNOB
82121699	F200302536	US	US6898060	Granted		27-May-2003	N/A	N/A	GATED DIODE OVERVOLTAGE PROTECTION
82121840	F200302579	US	US7502895	Granted		13-Sep-2005	N/A	N/A	TECHNIQUES FOR REDUCING CASTOUTS IN A SNOOP FILTER
82133207	F200304304	US	US7076629	Granted		26-Dec-2001	N/A	N/A	METHOD FOR PROVIDING CONCURRENT NON-BLOCKING HEAP MEMORY MANAGEMENT FOR FIXED SIZED BLOCKS
82137005	F200305040	US	US6757330	Granted		1-Jun-2000	N/A	N/A	EFFICIENT IMPLEMENTATIO N OF HALF-PIXEL MOTION PREDICTION
82165532	F200308161	US	US7043516	Granted		13-Mar-1998	N/A	N/A	REDUCTION OF ADD-PIPE LOGIC BY OPERAND OFFSET SHIFT
82166030	F200308257	US	US6701387	Granted		31-Aug-2000	N/A	N/A	ADAPTIVE DATA FETCH PREDICTION ALGORITHM

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82166285	F200308323	US	US6609208	Granted		7-Jul-2000	N/A	N/A	ENERGY-BASED SAMPLING FOR PERFORMANCE MONITORING
82168928	F200309021	US	US7142647	Granted		3-Sep-2003	N/A	N/A	DATABASE FOR USE IN TELEPHONE COMMUNICATIONS
82168931	F200309021	US	US7483521	Granted		23-Oct-2006	N/A	N/A	DATABASE FOR USE IN TELEPHONE COMMUNICATIONS
82168994	F200309074	US	US7543113	Granted		2-Jul-2004	2-Dec-2020	7,406.00	CACHE MEMORY SYSTEM AND METHOD CAPABLE OF ADAPTIVELY ACCOMMODATING VARIOUS MEMORY LINE SIZES
82173998	F200311045	US	US7310681	Granted		23-Jun-2003	N/A	N/A	SYSTEM AND METHOD FOR MODELING THE MEMORY STATE OF A STREAMING MEDIA SERVER
82177961	F200312685	US	US7065697	Granted		29-Jul-2003	N/A	N/A	SYSTEMS AND METHODS OF PARTITIONING DATA TO FACILITATE ERROR CORRECTION
82177967	F200312685	US	US7051265	Granted		29-Jul-2003	N/A	N/A	SYSTEMS AND METHODS OF ROUTING DATA TO FACILITATE ERROR CORRECTION
82180217	F200313648	US	US7484237	Granted		13-May-2004	N/A	N/A	METHOD AND APPARATUS FOR ROLE-BASED SECURITY POLICY MANAGEMENT

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82184297	F200315344	US	US7269753	Granted		27-Aug-2004	N/A	N/A	MAPPING POWER SYSTEM COMPONENTS
82184303	F200315344	JP	JP4897685	Granted		18-Aug-2005	6-Jan-2021	1,006.29	MAPPING POWER SYSTEM COMPONETS
82184306	F200315344	CN	CN200580036905.3	Granted		18-Aug-2005	18-Aug-2020	1,304.37	MAPPING POWER SYSTEM COMPONETS
82206791	F200315640	US	US7330942	Granted		29-Dec-2004	N/A	N/A	METHOD FOR EFFICIENT VIRTUALIZATION OF PHYSICAL MEMORY IN A VIRTUAL-MACHINE MONITOR
82188452	F200400591	US	US7774457	Granted		25-Mar-2005	10-Feb-2022	7,406.00	RESOURCE EVALUATION FOR A BATCH JOB AND AN INTERACTIVE SESSION CONCURRENTLY EXECUTED IN A GRID COMPUTING ENVIRONMENT
82202708	F200400591	US	US7870256	Granted		12-Oct-2005	11-Jul-2022	7,706.00	REMOTE DESKTOP PERFORMANCE MODEL FOR ASSIGNING RESOURCES
82190660	F200401769	US	US7392172	Granted		28-Apr-2005	N/A	N/A	PROVIDING VIRTUAL DEVICE ACCESS VIA FIRMWARE
82190666	F200401769	TW	TWI421766	Granted		30-Mar-2006	31-Dec-2021	359.56	PROVIDING VIRTUAL DEVICE ACCESS VIA FIRMWARE
82191407	F200402006	US	US8374175	Granted		27-Apr-2005	12-Aug-2024	7,706.00	SYSTEM AND METHOD FOR REMOTE DIRECT MEMORY ACCESS OVER A NETWORK SWITCH FABRIC

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82191737	F200402148	US	US7376799	Granted		21-Jul-2005	N/A	N/A	SYSTEM FOR REDUCING THE LATENCY OF EXCLUSIVE READ REQUESTS IN A SYMMETRIC MULTI-PROCESSING SYSTEM
82192109	F200402377	US	US7262964	Granted		27-Apr-2005	N/A	N/A	AIRFLOW CONTROL BAFFLE
82194716	F200403261	US	US7650386	Granted		29-Jul-2004	19-Jul-2021	7,406.00	COMMUNICATION AMONG PARTITIONED DEVICES
82196147	F200403794	US	US7262495	Granted		7-Oct-2004	N/A	N/A	3D INTERCONNECT WITH PROTRUDING CONTACTS
82197314	F200404382	US	US7480836	Granted		25-Apr-2005	20-Jul-2020	7,406.00	MONITORING ERROR-HANDLER VECTOR IN ARCHITECTED MEMORY
82200530	F200405992	US	US7734622	Granted		25-Mar-2005	8-Dec-2021	7,706.00	MEDIA-DRIVEN BROWSING
82200926	F200406195	US	US7995339	Granted		1-Nov-2004	9-Feb-2023	7,706.00	CONTROL OF VENT TILLES CORRELATED WITH A RACK
82203158	F200406195	US	US7251547	Granted		8-Oct-2004	N/A	N/A	CORRELATION OF VENT TILE SETTINGS AND RACK TEMPERATURES
82202732	F200407050	US	US7533303	Granted		15-Apr-2005	12-Nov-2020	7,406.00	METHOD AND SYSTEM FOR PERFORMING SYSTEM-LEVEL CORRECTION OF MEMORY ERRORS
82204136	F200407697	US	US7433935	Granted		29-Apr-2005	N/A	N/A	SELF-ADAPTING PLUG-IN SERVICE

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82207985	F200501020	US	US7877803	Granted		27-Jun-2005	25-Jul-2022	7,406.00	AUTOMATED IMMUNE RESPONSE FOR A COMPUTER
82209869	F200502033	US	US7624234	Granted		31-Aug-2006	24-May-2021	7,706.00	DIRECTORY CACHES, AND METHODS FOR OPERATION THEREOF
82209872	F200502033	GB	GB2441435	Granted		29-Aug-2007	29-Aug-2021	531.28	DIRECTORY CACHES, AND METHODS FOR OPERATION THEREOF
82210976	F200502524	US	US7651871	Granted		30-Nov-2005	26-Jul-2021	7,706.00	DEVICE FOR FORMING MAGNETIC WELL FOR NANOPARTICLES
82211804	F200502942	US	US8205146	Granted		21-Jul-2005	19-Dec-2023	7,706.00	PERSISTENT ERROR DETECTION IN DIGITAL MEMORY
82218587	F200506782	US	US8370416	Granted		26-Apr-2006	5-Aug-2024	7,706.00	COMPATIBILITY ENFORCEMENT IN CLUSTERED COMPUTING SYSTEMS
82218590	F200506782	GB	GB2437649	Granted		26-Apr-2007	26-Apr-2021	531.28	COMPATIBILITY ENFORCEMENT IN CLUSTERED COMPUTING SYSTEMS
82218593	F200506782	JP	JP4726852	Granted		25-Apr-2007	22-Apr-2021	708.91	COMPATIBILITY ENFORCEMENT IN CLUSTERED COMPUTING SYSTEMS
82218863	F200506953	CN	CN200710137000.6	Granted		26-Jul-2007	26-Jul-2020	985.42	MEMORY-MAPPED BUFFERS FOR NETWORK INTERFACE CONTROLLERS

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82218860	F200506953	US	US9137179	Granted		26-Jul-2006	15-Mar-2023	3,766.00	MEMORY-MAPPED BUFFERS FOR NETWORK INTERFACE CONTROLLERS
82219073	F200507081	US	US7592679	Granted		19-Oct-2006	22-Mar-2021	7,706.00	SENSOR AND METHOD FOR MAKING THE SAME
82227227	F200507081	US	US7582975	Granted		27-Apr-2007	1-Mar-2021	7,706.00	NANOWIRE DEVICE AND METHOD OF MAKING THE SAME
82219634	F200507364	US	US7930486	Granted		30-Apr-2007	19-Oct-2022	7,406.00	CACHE CHUNKED LIST CONCRETE DATA TYPE
82219664	F200507395	US	US7376805	Granted		21-Apr-2006	N/A	N/A	DISTRIBUTED STORAGE ARRAY
82219667	F200507395	US	US7487311	Granted		14-Mar-2008	3-Aug-2020	7,406.00	SYSTEM AND METHOD FOR ASYNCHRONOUS BACKUP OF VIRTUAL DISKS IN A DISTRIBUTED STORAGE ARRAY
82220339	F200600100	US	US8390086	Granted		19-Jul-2010	5-Sep-2024	7,706.00	A SOLAR CELL EMPLOYING A NANOWIRE
82225544	F200602330	US	US8045562	Granted		31-Oct-2006	25-Apr-2023	7,706.00	ESTIMATING LINK INTERFERENCE AND BANDWIDTH
82227581	F200603189	US	US8799547	Granted		7-Jul-2008	5-Feb-2022	3,766.00	DATA PACKET PROCESSING METHOD FOR A MULTI CORE PROCESSOR
82227584	F200603189	CN	CN200880016822.1	Granted		7-Jul-2008	7-Jul-2021	1,032.98	DATA PACKET PROCESSING METHOD FOR A MULTI CORE PROCESSOR

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90037712	F200603189	FR	FR2176773	Granted		7-Jul-2008	7-Jul-2021	521.20	DATA PACKET PROCESSING METHOD FOR A MULTI CORE PROCESSOR
90037714	F200603189	DE	DE602008039979.6	Granted		7-Jul-2008	7-Jul-2021	1,178.09	DATA PACKET PROCESSING METHOD FOR A MULTI CORE PROCESSOR
90037716	F200603189	GB	GB2176773	Granted		7-Jul-2008	7-Jul-2021	443.74	DATA PACKET PROCESSING METHOD FOR A MULTI CORE PROCESSOR
82241552	F200703647	CN	CN200880128265.2	Granted		25-Mar-2008	25-Mar-2021	1,032.98	SYSTEM AND METHOD FOR TRANSFORMING PCIE SR-IOV FUNCTIONS TO APPEAR AS LEGACY FUNCTIONS
82241564	F200703647	KR	KR10-1324844	Granted		25-Mar-2008	28-Oct-2021	732.64	SYSTEM AND METHOD FOR TRANSFORMING PCIE SR-IOV FUNCTIONS TO APPEAR AS LEGACY FUNCTIONS
82241567	F200703647	US	US8386654	Granted		25-Mar-2008	26-Aug-2024	7,706.00	SYSTEM AND METHOD FOR TRANSFORMING PCIE SR-IOV FUNCTIONS TO APPEAR AS LEGACY FUNCTIONS
83240742	F200703647	DE	DE602008024431.8	Granted		25-Mar-2008	25-Mar-2021	1,178.09	SYSTEM AND METHOD FOR TRANSFORMING PCIE SR-IOV FUNCTIONS TO APPEAR AS LEGACY FUNCTIONS

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83240744	F200703647	GB	GB2257880	Granted		25-Mar-2008	25-Mar-2021	443.74	SYSTEM AND METHOD FOR TRANSFORMING PCIE SR-IOV FUNCTIONS TO APPEAR AS LEGACY FUNCTIONS
82242728	F200704017	GB	GB2458157	Granted		7-Mar-2008	7-Mar-2021	443.74	VIRTUAL MACHINE LIVENESS CHECK
82242731	F200704017	US	US8627313	Granted		9-Mar-2009	7-Jul-2021	3,766.00	VIRTUAL MACHINE LIVENESS CHECK
82243406	F200704228	GB	GB2459433	Granted		7-Mar-2008	7-Mar-2021	443.74	DISTRIBUTED NETWORK CONNECTION POLICY MANAGEMENT
82243409	F200704228	US	US9178850	Granted		9-Mar-2009	3-May-2023	3,766.00	DISTRIBUTED NETWORK CONNECTION POLICY MANAGEMENT
90046408	F200704228	US	US10165009	Granted		11-Sep-2015	25-Jun-2022	2,006.00	DISTRIBUTED NETWORK CONNECTION POLICY MANAGEMENT
82249295	F200802685	US	US9031876	Granted		19-Jun-2009	12-Nov-2022	3,606.00	MANAGING KEYS FOR ENCRYPTED SHARED DOCUMENTS
82631729	F200802734	CN	CN200980139998.0	Granted		4-Aug-2009	4-Aug-2021	1,032.98	END-TO-END NETWORK ACCESS ANALYSIS
82631733	F200802734	US	US9253038	Granted		4-Aug-2009	2-Aug-2023	3,766.00	END-TO-END NETWORK ACCESS ANALYSIS
82249913	F200803253	US	US8417954	Granted		11-Feb-2009	9-Oct-2024	7,706.00	INSTALLATION IMAGE INCLUDING DIGITAL SIGNATURE

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82852246	F200803703	US	US9094317	Granted		18-Jun-2009	28-Jan-2023	3,766.00	PROCESSOR TOPOLOGY SWITCHES
82885912	F200803703	CN	CN200980159933.2	Granted		18-Jun-2009	18-Jun-2021	1,032.98	PROCESSOR TOPOLOGY SWITCHES
82844854	F200900015	US	US9098276	Granted		21-Sep-2011	4-Feb-2023	3,766.00	REDUNDANT POWER SUPPLY SYSTEMS AND METHODS
82252169	F200900607	US	US7302399	Granted		10-Nov-1999	N/A	N/A	METHOD AND SYSTEM FOR PROCESSING TRAVEL RESERVATION DATA
82253540	F200900812	US	US7100197	Granted		10-Dec-2001	N/A	N/A	NETWORK USER AUTHENTICATIO N SYSTEM AND METHOD
82253546	F200900812	JP	JP4864289	Granted		6-Dec-2002	18-Nov-2020	2,068.54	NETWORK USER AUTHENTICATIO N SYSTEM AND METHOD
82253558	F200900812	MX	MX250877	Granted		6-Dec-2002	N/A	N/A	NETWORK USER AUTHENTICATIO N SYSTEM AND METHOD
82253561	F200900812	NZ	NZ533457	Granted		6-Dec-2002	6-Dec-2020	723.01	NETWORK USER AUTHENTICATIO N SYSTEM AND METHOD
82901625	F200900812	DE	DE60241169.6	Granted		6-Dec-2002	6-Dec-2020	2,257.04	NETWORK USER AUTHENTICATIO N SYSTEM AND METHOD
82253696	F200900854	US	US6850866	Granted		12-Sep-2002	N/A	N/A	MANAGING PERFORMANCE METRICS DESCRIBING A RELATIONSHIP BETWEEN A PROVIDER AND A CLIENT

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82255841	F200901260	US	US7680590	Granted		2-Dec-2003	16-Sep-2021	7,706.00	BOUNDARY DETECTION ALGORITHM FOR EMBEDDED DEVICES
82256702	F200901260	US	US6983202	Granted		12-Apr-2004	N/A	N/A	IMPLEMENTING GEO-FENCING ON MOBILE DEVICES
82256420	F200901682	US	US8756682	Granted		20-Dec-2004	17-Dec-2021	3,766.00	METHOD AND SYSTEM FOR NETWORK INTRUSION PREVENTION
82257263	F200901908	US	US9191989	Granted		19-Dec-2006	17-May-2023	3,766.00	APPARATUS, AND ASSOCIATED METHOD, FOR CONTROLLING CONNECTIVITY OF A COMPUTER DEVICE WITH A COMPUTER NETWORK
90095936	F200901908	US	US9584519	Granted		27-Oct-2015	28-Aug-2024	3,766.00	APPARATUS, AND ASSOCIATED METHOD, FOR CONTROLLING CONNECTIVITY OF A COMPUTER DEVICE WITH A COMPUTER NETWORK
82257851	F200902190	US	US6839706	Granted		6-Aug-2001	N/A	N/A	BLOCK DATA STORAGE WITHIN A COMPUTER NETWORK
82895030	F200903397	CN	CN200980160899.0	Granted		11-Aug-2009	11-Aug-2020	666.46	ENCLOSURE AIRFLOW CONTROLLER
90064660	F200903397	FR	FR2465030	Granted		11-Aug-2009	11-Aug-2020	364.41	ENCLOSURE AIRFLOW CONTROLLER
90064662	F200903397	DE	DE602009034106.5	Granted		11-Aug-2009	11-Aug-2020	746.71	ENCLOSURE AIRFLOW CONTROLLER
90064664	F200903397	GB	GB2465030	Granted		11-Aug-2009	11-Aug-2020	322.82	ENCLOSURE AIRFLOW CONTROLLER

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82895034	F200903397	US	US9354678	Granted		11-Aug-2009	30-Nov-2023	3,766.00	ENCLOSURE AIRFLOW CONTROLLER
82938265	F200903900	CN	CN201080064762.8	Granted		26-Feb-2010	26-Feb-2021	698.53	RESTORING STABILITY TO AN UNSTABLE BUS
82938271	F200903900	US	US8799545	Granted		26-Feb-2010	5-Feb-2022	3,766.00	RESTORING STABILITY TO AN UNSTABLE BUS
82261814	F200904727	US	US8943328	Granted		29-Jan-2010	27-Jul-2022	3,606.00	KEY ROTATION FOR ENCRYPTED STORAGE MEDIA
82262789	F200904727	US	US8489893	Granted		9-Apr-2010	16-Jan-2021	3,606.00	ENCRYPTION KEY ROTATION MESSAGES WRITTEN AND OBSERVED BY STORAGE CONTROLLERS VIA STORAGE MEDIA
82261817	F200904730	US	US9032218	Granted		29-Jan-2010	12-Nov-2022	3,606.00	KEY ROTATION FOR ENCRYPTED STORAGE MEDIA USING A MIRRORED VOLUME REVIVE OPERATION
83137890	F201000198	GB	GB2503965	Granted		12-Jul-2010	12-Jul-2021	327.01	FLEXIBLE DATA CENTER AND METHODS FOR DEPLOYMENT
83137892	F201000198	US	US9310855	Granted		12-Jul-2010	12-Oct-2023	3,766.00	FLEXIBLE DATA CENTER AND METHODS FOR DEPLOYMENT
82263854	F201000919	US	US9184382	Granted		28-Oct-2010	10-May-2023	3,766.00	MEMRISTIVE DEVICES WITH LAYERED JUNCTIONS AND METHODS FOR FABRICATING THE SAME
83168702	F201001144	KR	KR10-1448412	Granted		30-Aug-2010	30-Sep-2020	500.23	MULTILAYER MEMORY ARRAY

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83168704	F201001144	US	US9293200	Granted		30-Aug-2010	22-Sep-2023	3,766.00	MULTILAYER MEMORY ARRAY
83168698	F201001144	CN	CN201080068814.9	Granted		30-Aug-2010	30-Aug-2020	666.46	MULTILAYER MEMORY ARRAY
83681482	F201001773	US	US9223821	Granted		21-Mar-2011	29-Jun-2023	3,766.00	DATA BACKUP PRIORITIZATION
90185183	F201001773	FR	FR2689329	Granted		21-Mar-2011	21-Mar-2021	340.88	DATA BACKUP PRIORITIZATION
90185185	F201001773	DE	DE602011021284.2	Granted		21-Mar-2011	21-Mar-2021	611.36	DATA BACKUP PRIORITIZATION
90185187	F201001773	GB	GB2689329	Granted		21-Mar-2011	21-Mar-2021	283.23	DATA BACKUP PRIORITIZATION
82267325	F201002266	GB	GB2054390	Granted		23-Feb-1996	N/A	N/A	ENCLOSURE FOR ELECTRONIC CIRCUITRY
82267331	F201002266	FR	FR964814	Granted		22-Aug-1996	N/A	N/A	ENCLOSURE FOR ELECTRONIC CIRCUITRY
82270946	F201002423	US	US7299301	Granted		8-Sep-2003	N/A	N/A	METHOD AND ARCHITECTURE FOR LOGICAL AGGREGATION OF MULTIPLE SERVERS
82269671	F201002872	US	US7453815	Granted		15-Dec-2003	N/A	N/A	METHOD AND SYSTEM FOR MONITORING AND MANAGEMENT OF THE PERFORMANCE OF REAL-TIME NETWORKS
82269695	F201002879	US	US7386119	Granted		13-May-2004	N/A	N/A	FILTERED TRANSMIT CANCELLATION IN A FULL-DUPLEX MODEM DATA ACCESS ARRANGEMENT (DAA)

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82270031	F201002986	US	US6771288	Granted		8-Mar-2001	N/A	N/A	METHODS AND APPARATUS FOR UPDATING INFORMATION IN A DISPLAY CONTAINING FIXED AND VARIABLE INFORMATION
82270109	F201003023	US	US6633277	Granted		30-May-2000	N/A	N/A	COMPACT 3-STATE DATA ENTRY DEVICE
82270580	F201003193	US	US6934740	Granted		19-Sep-2000	N/A	N/A	METHOD AND APPARATUS FOR SHARING COMMON DATA OBJECTS AMONG MULTIPLE APPLICATIONS IN A CLIENT DEVICE
82271003	F201003329	US	US6874047	Granted		9-Jun-2000	N/A	N/A	SYSTEM AND METHOD FOR IMPLEMENTING AN SMBUS/I2C INTERFACE ON A NETWORK INTERFACE CARD
82271342	F201003398	US	US6614350	Granted		8-Nov-2000	N/A	N/A	METHOD AND SYSTEM FOR EFFECTING A SECURITY SYSTEM UPON MULTIPLE PORTABLE INFORMATION DEVICES
82271756	F201003538	US	US6701140	Granted		14-Sep-2000	N/A	N/A	DIGITAL RECEIVE PHASE LOCK LOOP WITH CUMULATIVE PHASE ERROR CORRECTION AND DYNAMICALLY PROGRAMMABLE CORRECTION RATE
82272137	F201003672	US	US6882622	Granted		2-Aug-2000	N/A	N/A	FLOW CONTROL SYSTEM FOR NETWORK DEVICES

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82272302	F201003754	US	US7480939	Granted		6-Jul-2001	N/A	N/A	ENHANCEMENT TO AUTHENTICATIO N PROTOCOL THAT USES A KEY LEASE
82272299	F201003754	US	US6920559	Expired		28-Apr-2000	N/A	N/A	USING A KEY LEASE IN A SECONDARY AUTHENTICATIO N PROTOCOL AFTER A PRIMARY AUTHENTICATIO N PROTOCOL HAS BEEN PERFORMED
82272392	F201003777	US	US6662332	Granted		1-Nov-2000	N/A	N/A	INTERLEAVER FOR BURST ERROR CORRECTION
82272455	F201003805	US	US6766377	Granted		24-Aug-2000	N/A	N/A	MEDIA GATEWAY PROXY
82272458	F201003805	US	US7634577	Granted		19-Apr-2004	15-Jun-2021	7,706.00	MEDIA GATEWAY PROXY
82272611	F201003858	US	US6741586	Granted		31-May-2000	N/A	N/A	SYSTEM AND METHOD FOR SHARING COMPUTER SCREENS OVER A TELEPHONY NETWORK
82272650	F201003874	US	US6965577	Granted		24-Oct-2000	N/A	N/A	IDENTIFYING AN EDGE SWITCH AND PORT TO WHICH A NETWORK USER IS ATTACHED
82272728	F201003925	US	US6966003	Granted		12-Jan-2001	N/A	N/A	SYSTEM AND METHOD FOR SWITCHING SECURITY ASSOCIATIONS

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82272782	F201003944	US	US7039049	Granted		22-Dec-2000	N/A	N/A	METHOD AND APPARATUS FOR PPPOE BRIDGING IN A ROUTING CMTS
82272836	F201003967	US	US6763348	Granted		8-Dec-2000	N/A	N/A	METHOD AND APPARATUS FOR SEARCHING DATABASES EMPLOYING A TRIE SEARCH STRUCTURE
82272899	F201004011	US	US6577500	Granted		28-Feb-2001	N/A	N/A	WIRELESS PC CARD
82272926	F201004020	US	US6938079	Granted		19-Sep-2000	N/A	N/A	SYSTEM AND METHOD FOR AUTOMATICALLY CONFIGURING A CLIENT DEVICE
82273091	F201004100	US	US6842797	Granted		10-Oct-2000	N/A	N/A	USB ADAPTER FOR BURST MODE COMMUNICATIONS
82273283	F201004220	US	US6771745	Granted		22-May-2001	N/A	N/A	METHOD AND APPARATUS FOR TELEPHONE DIALLING USING A NETWORK DEVICE
82273484	F201004324	US	US7577857	Granted		29-Aug-2001	18-Feb-2021	7,706.00	HIGH SPEED NETWORK INTERFACE WITH AUTOMATIC POWER MANAGEMENT WITH AUTO-NEGOTIATION
82273487	F201004324	US	US8046614	Granted		20-Jul-2009	N/A	N/A	AN INTEGRATED CIRCUIT HAVING A NETWORKING INTERFACE MODULE SUPPORTING A PLURALITY OF PROTOCOLS

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82861414	F201004324	US	US8291246	Granted		20-Oct-2011	16-Apr-2024	7,400.00	HIGH SPEED NETWORK INTERFACE WITH AUTOMATIC POWER MANAGEMENT WITH AUTO-NEGOTIATION
82273562	F201004343	US	US6745333	Granted		31-Jan-2002	N/A	N/A	METHOD FOR DETECTING UNAUTHORIZED NETWORK ACCESS BY HAVING A NIC MONITOR FOR PACKETS PURPORTING TO BE FROM ITSELF
82273571	F201004345	US	US7194004	Granted		28-Jan-2002	N/A	N/A	METHOD FOR MANAGING NETWORK ACCESS
82273634	F201004373	US	US6996110	Granted		31-Aug-2001	N/A	N/A	DISTRIBUTED MPLS ARCHITECTURE
82273676	F201004392	US	US7085364	Granted		20-Aug-2001	N/A	N/A	ADVANCED CONFERENCE DROP
82273709	F201004409	US	US7350076	Granted		6-Dec-2001	N/A	N/A	SCHEME FOR DEVICE AND USER AUTHENTICATION WITH KEY DISTRIBUTION IN A WIRELESS NETWORK
82273712	F201004409	CN	CN02812705.6	Granted		16-May-2002	16-May-2021	1,367.42	AUTHENTICATION METHOD
90826600	F201004409	DE	DE602500656	Granted		16-May-2002	16-May-2021	2,504.74	AUTHENTICATION METHOD
90826603	F201004409	GB	GB1391077	Granted		16-May-2002	16-May-2021	896.07	AUTHENTICATION METHOD
82273889	F201004461	US	US6674652	Granted		29-Jan-2002	N/A	N/A	INTEGRATED SHIELD WRAP

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82273958	F201004494	US	US7624434	Granted		1-Mar-2002	24-May-2021	7,706.00	SYSTEM FOR PROVIDING FIREWALL CAPABILITIES TO A COMMUNICATION DEVICE
82274012	F201004514	US	US7298834	Granted		22-Nov-2002	N/A	N/A	SYSTEM AND METHOD FOR LARGE CAPACITY CONFERENCE CALLS
82274108	F201004540	US	US7603486	Granted		26-Nov-2002	13-Apr-2021	7,706.00	NETWORK MANAGEMENT SYSTEM PROVIDING LOGIC SIGNALS OVER COMMUNICATION LINES FOR DETECTING PERIPHERAL DEVICES
82274132	F201004549	US	US7130625	Granted		1-Jul-2002	N/A	N/A	SYSTEM AND METHOD FOR A UNIVERSAL WIRELESS ACCESS GATEWAY
82274135	F201004549	CN	CN03815527.3	Granted		30-Jun-2003	30-Jun-2021	1,367.42	SYSTEM AND METHOD FOR A UNIVERSAL WIRELESS ACCESS GATEWAY
82274138	F201004549	DE	DE60332838.5	Granted		30-Jun-2003	30-Jun-2021	2,272.89	SYSTEM AND METHOD FOR A UNIVERSAL WIRELESS ACCESS GATEWAY
82274144	F201004549	FR	FR1527626	Granted		30-Jun-2003	30-Jun-2021	946.25	SYSTEM AND METHOD FOR A UNIVERSAL WIRELESS ACCESS GATEWAY

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82274147	F201004549	GB	GB1527626	Granted		30-Jun-2003	30-Jun-2021	837.70	SYSTEM AND METHOD FOR A UNIVERSAL WIRELESS ACCESS GATEWAY
82274240	F201004570	DE	DE60317155.9	Granted		4-Jan-2003	4-Jan-2021	2,272.89	NETWORK UNITS FOR USE IN AND ORGANISATION OF CASCADE SYSTEMS
82274255	F201004570	US	US7522589	Granted		7-Jan-2003	N/A	N/A	NETWORK UNITS FOR USE IN AND ORGANISATION OF CASCADE SYSTEMS
82576655	F201004570	FR	FR1760968	Granted		4-Jan-2003	4-Jan-2021	946.25	NETWORK UNIT FOR USE IN A CASCADE SYSTEM
82576658	F201004570	DE	DE603347487	Granted		4-Jan-2003	4-Jan-2021	2,272.89	NETWORK UNIT FOR USE IN A CASCADE SYSTEM
82274504	F201004631	US	US7596614	Granted		29-Jul-2005	29-Mar-2021	7,706.00	NETWORK INCLUDING SNOOPING
82274507	F201004631	US	US7975048	Granted		18-Aug-2009	5-Jan-2023	7,706.00	NETWORK INCLUDING SNOOPING
82743829	F201004631	US	US8055768	Granted		27-May-2011	8-May-2023	7,706.00	NETWORK INCLUDING SNOOPING
82274573	F201004645	US	US7802094	Granted		22-Feb-2005	21-Mar-2022	7,706.00	REDUCTION OF FALSE POSITIVE DETECTION OF SIGNATURE MATCHES IN INTRUSION DETECTION SYSTEMS
82274591	F201004649	US	US7957390	Granted		18-May-2005	7-Dec-2022	7,706.00	DETECTION OF SIGNATURES IN DISORDERED MESSAGE SEGMENTS

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83693683	F201005236	US	US9292392	Granted		30-Jun-2011	22-Sep-2023	3,766.00	MEMORY MODULE THAT INCLUDES A MEMORY MODULE COPY ENGINE FOR COPYING DATA FROM AN ACTIVE MEMORY DIE TO A SPARE MEMORY DIE
82064201	F30010410	US	US7634656	Granted		12-Sep-2002	15-Jun-2021	7,706.00	METHOD AND APPARATUS FOR IDENTIFYING A VOICE CALLER
82064207	F30010410	DE	DE60207500.9	Granted		10-Sep-2002	10-Sep-2021	2,504.74	METHOD AND APPARATUS FOR IDENTIFYING A VOICE CALLER
82064213	F30010410	GB	GB1294157	Granted		10-Sep-2002	10-Sep-2021	896.07	METHOD AND APPARATUS FOR IDENTIFYING A VOICE CALLER
82070699	F50006065	US	US6951023	Granted		29-Oct-2001	N/A	N/A	MESSAGE-BASED SOFTWARE SYSTEM
83004398	F50006065	FR	FR1202176	Expired		31-Oct-2000	N/A	N/A	MESSAGE-BASED SOFTWARE SYSTEM
83004404	F50006065	DE	DE60047121.7	Expired		31-Oct-2000	N/A	N/A	MESSAGE-BASED SOFTWARE SYSTEM
83004410	F50006065	GB	GB1202176	Expired		31-Oct-2000	N/A	N/A	MESSAGE-BASED SOFTWARE SYSTEM
82071116	F50012953	US	US6943683	Granted		21-Jan-2003	N/A	N/A	LOCATION DEVICE
83014991	F700209927	US	US8929236	Granted		30-Jul-2012	6-Jul-2022	3,766.00	NETWORK FLOW ANALYSIS
83098424	F700211111	US	US8929225	Granted		7-Dec-2012	6-Jul-2022	3,766.00	CUSTOMER EDGE DEVICE PROBLEM IDENTIFICATION

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90068832	F700213273	CN	CN201380076263.4	Granted		3-Apr-2013	3-Apr-2021	364.09	METHOD AND PRODUCT FOR MODIFYING A FLOW OF OPERATIONS TO BE EXECUTED IN PLURALITY OF EXECUTION ENVIRONMENTS
90068840	F700213273	US	US9846598	Granted		3-Apr-2013	19-Jun-2021	2,006.00	MODIFYING A FLOW OF OPERATIONS TO BE EXECUTED IN A PLURALITY OF EXECUTION ENVIRONMENTS
82578801	F9949	US	US6833634	Granted		4-Jan-2001	N/A	N/A	DISK ENCLOSURE WITH MULTIPLE POWER DOMAINS
82579241	FP007	US	US7650638	Granted		2-Dec-2002	19-Jul-2021	7,706.00	NETWORK SECURITY MONITORING SYSTEM EMPLOYING BI-DIRECTIONAL COMMUNICATION
90404678	FSGI00359	US	US9547882	Granted		10-Nov-2014	17-Jul-2024	3,766.00	SHARED MEMORY EIGENSOLVER
90404680	FSGI00359	US	US9262799	Granted		7-Nov-2014	16-Aug-2023	3,766.00	SHARED MEMORY EIGENSOLVER
90444833	FSGI00359	US	US9798594	Granted		17-Jan-2017	24-Apr-2021	2,006.00	SHARED MEMORY EIGENSOLVER

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81966803	F10001220	US	US7000151	Granted		18-Jul-2002	N/A	N/A	SYSTEM AND METHOD FOR PROVIDING RUN-TIME TYPE CHECKING
81967499	F10001459	US	US6950961	Granted		13-Feb-2001	N/A	N/A	HIGHLY AVAILABLE, MONOTONIC INCREASING SEQUENCE NUMBER GENERATION
81967625	F10001491	US	US6687872	Granted		14-Mar-2001	N/A	N/A	METHODS AND SYSTEMS OF USING RESULT BUFFERS IN PARITY OPERATIONS
81967634	F10001491	US	US7111227	Granted		4-Dec-2003	N/A	N/A	METHODS AND SYSTEMS OF USING RESULT BUFFERS IN PARITY OPERATIONS
82051124	F10002032	US	US6813705	Granted		5-Jan-2001	N/A	N/A	MEMORY DISAMBIGUATION SCHEME FOR PARTIALLY REDUNDANT LOAD REMOVAL
81970013	F10002170	US	US7263719	Granted		29-Nov-2000	N/A	N/A	SYSTEM AND METHOD FOR IMPLEMENTING NETWORK SECURITY POLICIES ON A COMMON NETWORK INFRASTRUCTURE
81970046	F10002170	US	US7376965	Granted		14-May-2001	N/A	N/A	SYSTEM AND METHOD FOR IMPLEMENTING A BUBBLE POLICY TO ACHIEVE HOST AND NETWORK SECURITY

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81970055	F10002170	US	US7400591	Granted		1-Jun-2005	N/A	N/A	METHOD OF CREATING AN ADDRESS AND A DISCONTIGUOUS MASK FOR A NETWORK SECURITY POLICY AREA
81971792	F10002673	US	US7376953	Granted		29-Oct-2001	N/A	N/A	APPARATUS AND METHOD FOR ROUTING A TRANSACTION TO A SERVER
81971828	F10002691	US	US6704687	Granted		31-Jan-2001	N/A	N/A	HISTORICAL RESULTS BASED METHOD FOR AUTOMATICALLY IMPROVING COMPUTER SYSTEM PERFORMANCE
81971849	F10002695	US	US7607135	Granted		15-Jun-2001	20-Apr-2021	7,406.00	APPARATUS AND METHOD FOR ENHANCING PERFORMANCE OF A COMPUTER SYSTEM
81974126	F10003509	US	US6851074	Granted		30-Apr-2001	N/A	N/A	SYSTEM AND METHOD FOR RECOVERING FROM MEMORY FAILURES IN COMPUTER SYSTEMS
81976325	F10004121	US	US6889335	Granted		7-Apr-2001	N/A	N/A	MEMORY CONTROLLER RECEIVER CIRCUITRY WITH TRI-STATE NOISE IMMUNITY

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81977141	F10004392	US	US6944807	Granted		25-Mar-2002	N/A	N/A	METHOD AND APPARATUS FOR ACHIEVING HIGHER PRODUCT YIELDS BY USING FRACTIONAL PORTIONS OF IMBEDDED MEMORY ARRAYS
81977306	F10004466	US	US7076647	Granted		7-Jun-2001	N/A	N/A	DYNAMIC KERNEL TUNABLES
81977471	F10004560	US	US7216184	Granted		1-May-2001	N/A	N/A	SYSTEM AND METHOD FOR IDENTIFICATION OF DEVICES ASSOCIATED WITH INPUT/OUTPUT PATHS
81978071	F10004801	US	US8621480	Granted		16-Dec-2004	30-Jun-2021	3,606.00	LOAD BALANCER WITH STARVATION AVOIDANCE
81978998	F10004983	US	US7058860	Granted		29-Jun-2001	N/A	N/A	SYSTEM AND METHOD OF AUTOMATIC PARAMETER COLLECTION AND PROBLEM SOLUTION GENERATION FOR COMPUTER STORAGE DEVICES
81980063	F10005461	US	US6918110	Granted		11-Apr-2001	N/A	N/A	DYNAMIC INSTRUMENTATION OF AN EXECUTABLE PROGAM BY MEANS OF CAUSING A BREAKPOINT AT THE ENTRY POINT OF A FUNCTION AND PROVIDING INSTRUMENTATION CODE

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81980882	F10006054	US	US6915520	Granted		6-Apr-2001	N/A	N/A	JAVA C++ PROXY OBJECTS
81982520	F10006527	US	US7236939	Granted		31-Mar-2001	N/A	N/A	A PEER-TO-PEER INTER-ENTERPRISE COLLABORATIVE PROCESS MANAGEMENT METHOD AND SYSTEM
81982832	F10006625	US	US7307962	Granted		2-Mar-2001	N/A	N/A	SYSTEM FOR INFERENCE OF NETWORK INFRASTRUCTURE DEVICES
81982979	F10006728	US	US7120832	Granted		27-Sep-2001	N/A	N/A	STORAGE DEVICE PERFORMANCE MONITOR
81983012	F10006755	US	US6976270	Granted		8-May-2001	N/A	N/A	PROCESS AND COMPONENT FOR INQUIRING ABOUT SECURITY RELATIONSHIPS
81983804	F10007099	US	US6868481	Granted		31-Oct-2000	N/A	N/A	CACHE COHERENCE PROTOCOL FOR A MULTIPLE BUS MULTIPROCESSOR SYSTEM
81983807	F10007099	JP	JP4008224	Granted		15-Oct-2001	7-Sep-2021	1,159.50	CACHE COHERENCE PROTOCOL FOR A MULTIPLE BUS MULTIPROCESSOR SYSTEM
81983810	F10007099	US	US7373457	Granted		1-Feb-2005	N/A	N/A	CACHE COHERENCE PROTOCOL FOR A MULTIPLE BUS MULTIPROCESSOR SYSTEM
81984836	F10007479	US	US6823300	Granted		10-Nov-2000	N/A	N/A	MEMORY EFFICIENT OCCURRENCE MODEL DESIGN FOR VLSI CAD

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81986702	F10008027	US	US6525936	Granted		30-Apr-2001	N/A	N/A	AIR JET COOLING ARRANGEMENT FOR ELECTRONIC SYSTEMS
81998216	F10008027	US	US6904968	Granted		14-Sep-2001	N/A	N/A	METHOD AND APPARATUS FOR INDIVIDUALLY COOLING COMPONENTS OF ELECTRONIC SYSTEMS
81998219	F10008027	US	US6876549	Granted		31-Oct-2003	N/A	N/A	METHOD AND APPARATUS FOR INDIVIDUALLY COOLING COMPONENTS OF ELECTRONIC SYSTEMS
81998222	F10008027	US	US7086459	Granted		31-Oct-2003	N/A	N/A	METHOD AND APPARATUS FOR INDIVIDUALLY COOLING COMPONENTS OF ELECTRONIC SYSTEMS
81998225	F10008027	US	US7013968	Granted		31-Oct-2003	N/A	N/A	METHOD AND APPARATUS FOR INDIVIDUALLY COOLING COMPONENTS OF ELECTRONIC SYSTEMS
81988421	F10010310	US	US6963832	Granted		9-Oct-2001	N/A	N/A	MEANING TOKEN DICTIONARY FOR AUTOMATIC SPEECH RECOGNITION
81989063	F10010654	US	US6928580	Granted		9-Jul-2001	N/A	N/A	DISTRIBUTED DATA CENTER SYSTEM PROTOCOL FOR CONTINUITY OF SERVICE IN THE EVENT OF DISASTER FAILURES

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81989453	F10010857	US	US6931571	Granted		20-Nov-2001	N/A	N/A	METHOD AND APPARATUS FOR HANDLING TRANSIENT MEMORY ERRORS
82079021	F100110160	US	US7765299	Granted		16-Sep-2002	27-Jan-2022	7,406.00	DYNAMIC ADAPTIVE SERVER PROVISIONING FOR BLADE ARCHITECTURES
82079405	F100110262	US	US7236967	Granted		3-Jun-2002	N/A	N/A	METHODS AND SYSTEMS FOR MAINTANING TRANSACTION SEMANTICS IN A COMPUTER SYSTEM
82079738	F100110378	US	US7975043	Granted		25-Feb-2003	5-Jan-2023	7,706.00	METHOD AND APPARATUS FOR MONITORING A NETWORK
82082363	F100111655	US	US7051238	Granted		30-Jul-2002	N/A	N/A	METHOD AND SYSTEM FOR USING MACHINE-ARCHITECTURE SUPPORT TO DISTINGUISH FUNCTION AND ROUTINE RETURN VALUES
81990812	F10011331	US	US6990612	Granted		18-Jul-2002	N/A	N/A	SYSTEM AND METHOD FOR PREVENTING SOFTWARE ERRORS
81991082	F10011514	US	US6928536	Granted		29-Nov-2001	N/A	N/A	DYNAMIC EXECUTION LAYER INTERFACE FOR REPLACING INSTRUCTIONS REQUIRING UNAVAILABLE HARDWARE FUNCTIONALITY WITH PATCH CODE AND CACHING

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81991304	F10011596	US	US7478394	Granted		4-Jun-2001	13-Jul-2020	7,406.00	CONTEXT-CORRUPTING CONTEXT SWITCHING
81992945	F10012198	US	US7577998	Granted		16-Nov-2001	18-Feb-2021	7,406.00	METHOD OF DETECTING CRITICAL FILE CHANGES
81993740	F10012499	US	US7594233	Granted		28-Jun-2002	22-Mar-2021	7,406.00	PROCESSING THREAD LAUNCHING USING VOLUNTEER INFORMATION
81993752	F10012506	US	US7216226	Granted		1-Apr-2002	N/A	N/A	UNIQUE AND SECURE IDENTIFICATION OF A NETWORKED COMPUTING NODE
81994424	F10012767	US	US6851110	Granted		7-Jun-2001	N/A	N/A	OPTIMIZING AN EXECUTABLE COMPUTER PROGRAM HAVING ADDRESS-BRIDGING CODE SEGMENTS
81994538	F10012818	US	US6931632	Granted		8-Nov-2001	N/A	N/A	INSTRUMENTATION OF CODE HAVING PREDICATED BRANCH-CALL AND SHADOW INSTRUCTIONS
81994541	F10012819	US	US6934943	Granted		18-Oct-2001	N/A	N/A	OPTIMIZATION OF CONTROL TRANSFERS TO DYNAMICALLY LOADED MODULES

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81994997	F10013048	US	US7111282	Granted		12-Jun-2001	N/A	N/A	INSTRUMENTING A SOFTWARE PROGRAM AND COLLECTING DATA FROM THE INSTRUMENTED SOFTWARE PROGRAM BY TYPE
81996842	F10014072	US	US6836871	Granted		29-Oct-2002	N/A	N/A	PROCESS AND SYSTEM FOR DEVELOPING DYNAMIC CIRCUIT GUILDELINES
81996848	F10014074	US	US6862694	Granted		5-Oct-2001	N/A	N/A	SYSTEM AND METHOD FOR SETTING AND EXECUTING BREAKPOINTS
81997529	F10014420	US	US7249088	Granted		11-Jul-2001	N/A	N/A	JOINT ESTIMATION OF BIDDERS' RISK ATTITUDES AND PRIVATE INFORMATION
81997724	F10014531	US	US7243368	Granted		29-Mar-2002	N/A	N/A	ACCESS CONTROL SYSTEM AND METHOD FOR A NETWORKED COMPUTER SYSTEM
81998627	F10015123	US	US7200665	Granted		17-Oct-2001	N/A	N/A	ALLOWING REQUESTS OF A SESSION TO BE SERVICED BY DIFFERENT SERVERS IN A MULTI-SERVER DATA SERVICE SYSTEM
81998681	F10015152	US	US7134050	Granted		15-Aug-2003	N/A	N/A	METHOD AND SYSTEM FOR CONTAINING SOFTWARE FAULTS

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81998687	F10015153	US	US7058786	Granted		17-Jan-2002	N/A	N/A	OPERATING SYSTEM DATA COMMUNICATIO N METHOD AND SYSTEM
82000466	F10016439	US	US6944732	Granted		8-May-2002	N/A	N/A	MEHTHOD AND APPARATUS FOR SUPPORTING SNAPSHOTS WITH DIRECT I/O IN A STORAGE AREA NETWORK
82000691	F10016624	US	US6931489	Granted		12-Aug-2002	N/A	N/A	APPARATUS AND METHODS FOR SHARING CACHE AMONG PROCESSORS
82000931	F10016687	US	US7047437	Granted		12-Dec-2001	N/A	N/A	METHOD AND SYSTEM FOR DETECTING DROPPED MICRO-PACKETS
82001030	F10016717	US	US7058702	Granted		4-Jan-2002	N/A	N/A	EFFICIENT VALIDATION OF NETWORK CONFIGURATION CHANGE COMMANDS
82002167	F10017428	US	US7203317	Granted		31-Oct-2001	N/A	N/A	SYSTEM FOR ENABLING LAZY-REVOCATION THROUGH RECURSIVE KEY GENERATION
82002176	F10017432	US	US6848841	Granted		9-Sep-2002	N/A	N/A	OPTICAL COMPONENT CONNECTOR
82002206	F10017447	US	US6967350	Granted		2-Apr-2002	N/A	N/A	MEMORY STRUCTURES
82003364	F10017977	US	US6644481	Granted		11-Feb-2002	N/A	N/A	APPARATUS AND METHOD FOR RACKMOUNTING A CHASSIS

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82004360	F10018557	US	US6718277	Granted		17-Apr-2002	N/A	N/A	ATMOSPHERIC CONTROL WITHIN A BUILDING
82007003	F10019871	US	US6912616	Granted		12-Nov-2002	N/A	N/A	MAPPING ADDRESSES TO MEMORY BANKS BASED ON AT LEAST ONE MATHEMATICAL RELATIONSHIP
82007006	F10019871	JP	JP4771654	Granted		10-Nov-2003	1-Jul-2021	753.97	MAPPING ADDRESSES TO MEMORY BANKS BASED ON AT LEAST ONE MATHEMATICAL RELATIONSHIP
82007021	F10019879	US	US6677778	Granted		23-May-2002	N/A	N/A	DEVICE AND METHOD TO CAUSE A FALSE DATA VALUE TO BE CORRECTLY SEEN AS THE PROPER DATA VALUE
82007393	F10019988	US	US7451073	Granted		25-Jun-2002	N/A	N/A	SYSTEM AND METHOD FOR INCREASING PERFORMANCE IN MULTI-CPU SIMULATION
82082729	F100200080	US	US6868682	Granted		16-Jan-2003	N/A	N/A	AGENT BASED CONTROL METHOD AND SYSTEM FOR ENERGY MANAGEMENT
82083506	F100200402	US	US7249345	Granted		28-Feb-2002	N/A	N/A	METHOD AND SYSTEM FOR AUTOMATICALLY GENERATING SOURCE CODE BASED ON A MARK-UP LANGUAGE MESSAGE DEFINITION

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82083737	F100200475	US	US7577964	Granted		28-Feb-2003	18-Feb-2021	7,706.00	SYSTEM AND METHODS FOR DEFINING A BINDING FOR WEB-SERVICES
82083740	F100200476	US	US7398307	Granted		30-Apr-2003	N/A	N/A	METHOD AND SYSTEM FOR MANAGING A NETWORK
82083773	F100200518	US	US7502803	Granted		28-May-2003	10-Sep-2020	7,406.00	SYSTEM AND METHOD FOR GENERATING ACPI MACHINE LANGUAGE TABLES
82084055	F100200646	US	US6876224	Granted		5-Nov-2002	N/A	N/A	METHOD AND APPARATUS FOR HIGH SPEED BUS HAVING ADJUSTABLE, SYMMETRICAL, EDGE-RATE CONTROLLED, WAVEFORMS
82084058	F100200646	DE	DE10338002.7	Granted		19-Aug-2003	19-Aug-2020	1,905.57	METHOD AND APPARATUS FOR HIGH SPEED BUS HAVING ADJUSTABLE, SYMMETRICAL, EDGE-RATE CONTROLLED, WAVEFORMS
82085771	F100201443	US	US7512066	Granted		30-Mar-2004	N/A	N/A	CONGESTION CONTROL SYSTEM
82088120	F100202262	US	US7310773	Granted		13-Jan-2003	N/A	N/A	REMOVAL OF EXTRANEOUS TEXT FROM ELECTRONIC DOCUMENTS
82089050	F100202807	US	US7577951	Granted		30-May-2002	18-Feb-2021	7,406.00	IMPROVED PERFORMANCE OF COMPUTER PROGRAMS WHILE THEY ARE RUNNING

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82040786	F10980964	US	US7596694	Granted		8-Mar-2004	29-Mar-2021	7,706.00	SYSTEM AND METHOD FOR SAFELY EXECUTING DOWNLOADED CODE ON A COMPUTER SYSTEM
82051859	F10991148	US	US8190554	Granted		1-Jul-2004	29-Nov-2023	7,706.00	OLAP-BASED CUSTOMER BEHAVIOR PROFILING METHOD AND SYSTEM
82093373	F200205659	US	US7512240	Granted		29-Oct-2003	N/A	N/A	MANAGEMENT OF SECURITY KEY DISTRIBUTION
82094570	F200206263	US	US7024583	Granted		31-Oct-2002	N/A	N/A	METHOD AND APPARATUS FOR DETECTING FILE SYSTEM CORRUPTION
82094615	F200206282	US	US6711021	Granted		15-Jan-2003	N/A	N/A	SYSTEMS AND METHODS THAT USE AT LEAST ONE COMPONENT TO REMOVE THE HEAT GENERATED BY AT LEAST ONE OTHER COMPONENT
82094618	F200206282	US	US6862185	Granted		10-Nov-2003	N/A	N/A	SYSTEMS AND METHODS THAT USE AT LEAST ONE COMPONENT TO REMOVE THE HEAT GENERATED BY AT LEAST ONE OTHER COMPONENT
82095152	F200206534	US	US7039736	Granted		15-Jan-2003	N/A	N/A	SYSTEMS AND METHODS FOR ACCESSING BUS-MASTERED SYSTEM RESOURCES

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82095581	F200206729	US	US6819272	Granted		6-Nov-2002	N/A	N/A	SYSTEM, METHOD AND COMPUTER READABLE MEDIUM FOR COMPRESSING A DATA SEQUENCE FOR PARTIAL DECOMPRESSIN G
82096235	F200207033	US	US6889167	Granted		27-Feb-2003	N/A	N/A	DIAGNOSTIC EXERCISER AND METHODS THEREFOR
82096241	F200207033	GB	GB2398897	Granted		6-Feb-2004	6-Feb-2021	764.74	IMPROVED DIAGNOSTIC EXERCISER AND METHODS THEREFOR
82097468	F200207492	US	US7307862	Granted		4-Sep-2003	N/A	N/A	CIRCUIT AND SYSTEM FOR ACCESSING MEMORY MODULES
82098101	F200207492	GB	GB2405715	Granted		27-Aug-2004	27-Aug-2020	682.85	CIRCUIT AND SYSTEM FOR ADDRESSING MEMORY MODULES
82098509	F200207905	US	US7948916	Granted		31-Jan-2003	24-Nov-2022	7,706.00	METHOD AND APPARATUS FOR DISCOVERING TOPOLOGY INFORMATION IN A NETWORK
82100471	F200208701	US	US6946877	Granted		12-Dec-2003	N/A	N/A	CIRCUIT AND ASSOCIATED METHODOLOGY
82100537	F200208728	US	US6954706	Granted		20-Aug-2003	N/A	N/A	METHOD FOR MEASURING INTEGRATED CIRCUIT PROCESSOR POWER DEMAND AND ASSOCIATED SYSTEM

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82101893	F200209117	US	US7088130	Granted		3-Oct-2005	N/A	N/A	PARTIAL TERMINATION VOLTAGE CURRENT SHUNTING
82102025	F200209163	US	US6857897	Granted		29-Apr-2003	N/A	N/A	REMOTE CABLE ASSIST
82103942	F200209743	US	US6940288	Granted		4-Jun-2003	N/A	N/A	APPARATUS AND METHOD FOR MONITORING AND PREDICTING FAILURES IN SYSTEM INTERCONNECT
82103948	F200209745	US	US6895353	Granted		4-Jun-2003	N/A	N/A	APPARATUS AND METHOD FOR MONITORING HIGH IMPEDANCE FAILURES IN CHIP INTERCONNECTS
82105226	F200300027	US	US7447205	Granted		9-May-2003	N/A	N/A	SYSTEMS AND METHODS TO INSERT BROADCAST TRANSACTIONS INTO A FAST DATA STREAM OF TRANSACTIONS
82106294	F200300506	US	US7577670	Granted		8-Mar-2004	18-Feb-2021	7,706.00	METHOD AND APPARATUS FOR INFERRING ADDRESS AND SUBNET RELATIONSHIPS
82106300	F200300512	US	US6837626	Granted		12-Nov-2003	N/A	N/A	ELECTRO-OPTICAL CONNECTOR
82106519	F200300601	US	US8560629	Granted		25-Apr-2003	15-Apr-2021	3,766.00	METHOD OF DELIVERING CONTENT IN A NETWORK

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82110878	F200301299	US	US7468982	Granted		7-Nov-2002	N/A	N/A	METHOD AND APPARATUS FOR CLUSTER INTERCONNECTION USING MULTI-PORT NODES AND MULTIPLE ROUTING FABRICS
82117541	F200301749	US	US6901467	Granted		23-Feb-2001	N/A	N/A	ENHANCING A PCI-X SPLIT COMPLETION TRANSACTION BY ALIGNING CACHELINES WITH AN ALLOWABLE DISCONNECT BOUNDARY'S ENDING ADDRESS
82118192	F200301923	US	US6920052	Granted		26-Sep-2003	N/A	N/A	DYNAMIC ISOLATING MOUNT FOR PROCESSOR PACKAGES
82118201	F200301926	US	US7120248	Granted		26-Mar-2001	N/A	N/A	MULTIPLE PRIME NUMBER GENERATION USING A PARALLEL PRIME NUMBER SEARCH ALGORITHM
82118339	F200301933	US	US6977908	Granted		31-Aug-2001	N/A	N/A	METHOD AND APPARATUS FOR DISCOVERING COMPUTER SYSTEMS IN A DISTRIBUTED MULTI-SYSTEM CLUSTER
82119854	F200302178	US	US6829665	Granted		28-Sep-2001	N/A	N/A	NEXT SNOOP PREDICTOR IN A HOST CONTROLLER

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82119896	F200302187	US	US6886048	Granted		15-Nov-2001	N/A	N/A	TECHNIQUES FOR PROCESSING OUT-OF -ORDER REQUESTS IN A PROCESSOR-BASED SYSTEM
82120022	F200302218	US	US7856420	Granted		7-Dec-2001	21-Jun-2022	7,406.00	ZERO LATENCY ENTERPRISE ENRICHED PUBLISH/SUBSCRIBE
82167797	F200308580	US	US7350109	Granted		14-Nov-2003	N/A	N/A	SYSTEM AND METHOD FOR TESTING A MEMORY USING DMA
82168469	F200308860	US	US7083089	Granted		20-Jan-2004	N/A	N/A	OFF-LINE PIN VERIFICATION USING IDENTITY-BASED SIGNATURES
82171451	F200310021	US	US7650040	Granted		21-Jul-2005	19-Jul-2021	7,406.00	METHOD, APPARATUS AND SYSTEM FOR DATA BLOCK REARRANGEMENT FOR LZ DATA COMPRESSION
82174313	F200310800	US	US6873530	Granted		13-Jul-2004	N/A	N/A	STACK UP ASSEMBLY
82174316	F200310800	US	US6862186	Granted		13-Jul-2004	N/A	N/A	STACK UP ASSEMBLY
82174319	F200310800	US	US6922340	Granted		13-Jul-2004	N/A	N/A	STACK UP ASSEMBLY
82174322	F200310800	US	US6900987	Granted		13-Jul-2004	N/A	N/A	STACK UP ASSEMBLY
82174325	F200310800	US	US6947286	Granted		6-Jan-2005	N/A	N/A	STACK UP ASSEMBLY

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82174070	F200311080	US	US7870188	Granted		30-Jul-2004	11-Jul-2022	7,706.00	SYSTEMS AND METHODS FOR EXPOSING WEB SERVICES
82176482	F200312027	US	US9213609	Granted		16-Dec-2003	15-Jun-2023	3,766.00	PERSISTENT MEMORY DEVICE FOR BACKUP PROCESS CHECKPOINT STATES
82178195	F200312794	US	US7502333	Granted		23-Mar-2004	N/A	N/A	PRE-CONFIGURED TOPOLOGY WITH CONNECTION MANAGEMENT
82178510	F200312917	US	US7228460	Granted		23-Jan-2004	N/A	N/A	MULTI-STATE STATUS REPORTING FOR HIGH-AVAILABILITY CLUSTER NODES
82180418	F200313751	US	US7240165	Granted		15-Jan-2004	N/A	N/A	SYSTEM AND METHOD FOR PROVIDING PARALLEL DATA REQUESTS
82181174	F200314068	US	US7027309	Granted		20-Feb-2004	N/A	N/A	ENGAGING/DISENGAGING MECHANISM
82183112	F200314843	US	US7372820	Granted		29-Oct-2004	N/A	N/A	SYSTEM AND METHOD FOR STRIPING DELAY-SENSITIVE DATA OVER MULTIPLE BURSTY CHANNELS
82185950	F200316139	US	US7853825	Granted		26-Jul-2006	14-Jun-2022	7,406.00	METHODS AND APPARATUS FOR RECOVERING FROM FATAL ERRORS IN A SYSTEM

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82186757	F200316515	US	US7519822	Granted		10-Mar-2004	N/A	N/A	METHOD AND APPARATUS FOR PROCESSING DESCRIPTIVE STATEMENTS
82187813	F200400331	US	US7416128	Granted		22-Mar-2005	N/A	N/A	METHODS AND SYSTEMS FOR DETERMINING THE POSITION OF A HAND-HELD OBJECT FROM THE ACCELERATION OF THE HAND-HELD OBJECT
82188128	F200400468	US	US7792055	Granted		19-Mar-2007	7-Mar-2022	7,706.00	METHOD AND SYSTEM FOR DETERMINING THE TOPOLOGY OF A NETWORK
82188152	F200400478	US	US7607120	Granted		20-Apr-2004	20-Apr-2021	7,706.00	METHOD AND APPARATUS FOR CREATING DATA TRANSFORMATION ROUTINES FOR BINARY DATA
82188158	F200400479	US	US7594221	Granted		20-Apr-2004	22-Mar-2021	7,706.00	METHOD AND APPARATUS FOR TRANSLATING BINARY CODE
82189361	F200401050	US	US7876694	Granted		2-Jul-2004	25-Jul-2022	7,706.00	IDENTIFYING VPN FAULTS BASED ON VIRTUAL ROUTING ADDRESS AND EDGE INTERFACE RELATIONSHIP INFORMATION
82190645	F200401757	US	US7661095	Granted		14-Apr-2005	9-Aug-2021	7,406.00	SYSTEM AND METHOD TO BUILD A CALLGRAPH FOR FUNCTIONS WITH MULTIPLE ENTRY POINTS

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82190894	F200401857	US	US7499286	Granted		31-Aug-2006	3-Sep-2020	7,406.00	MOUNTING ADAPTER FOR ELECTRONIC MODULES
82192031	F200402033	US	US7607014	Granted		30-Jun-2005	20-Apr-2021	7,706.00	AUTHENTICATING MAINTENANCE ACCESS TO AN ELECTRONICS UNIT VIA WIRELESS COMMUNICATION
82192013	F200402351	US	US7298272	Granted		29-Apr-2005	N/A	N/A	REMOTE DETECTION EMPLOYING RFID
82192016	F200402351	GB	GB2425690	Granted		11-Apr-2006	11-Apr-2021	618.83	REMOTE DETECTION EMPLOYING RFID
82194659	F200403238	US	US7548421	Granted		25-Oct-2005	16-Dec-2020	7,406.00	IMPINGEMENT COOLING OF COMPONENTS IN AN ELECTRONIC SYSTEM
82194662	F200403238	GB	GB2431777	Granted		25-Sep-2006	25-Sep-2020	524.44	IMPINGEMENT COOLING OF COMPONENTS IN AN ELECTRONIC SYSTEM
82194665	F200403238	JP	JP4809184	Granted		25-Oct-2006	26-Aug-2020	857.79	IMPINGEMENT COOLING OF COMPONENTS IN ELECTRONIC SYSTEM
82195124	F200403386	US	US8713278	Granted		25-Apr-2005	29-Oct-2021	3,606.00	SYSTEM AND METHOD FOR STRANDED FILE OPENS DURING DISK COMPRESSION UTILITY REQUESTS

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82196951	F200404192	US	US7590885	Granted		26-Apr-2005	15-Mar-2021	7,406.00	METHOD AND SYSTEM OF COPYING MEMORY FROM A SOURCE PROCESSOR TO A TARGET PROCESSOR BY DUPLICATING MEMORY WRITES
82196960	F200404193	US	US7933966	Granted		26-Apr-2005	26-Oct-2022	7,406.00	METHOD AND SYSTEM OF COPYING A MEMORY AREA BETWEEN PROCESSOR ELEMENTS FOR LOCK-STEP EXECUTION
82197773	F200404626	US	US7941569	Granted		24-Feb-2005	10-Nov-2022	7,406.00	INPUT/OUTPUT TRACING IN A PROTOCOL OFFLOAD SYSTEM
82197851	F200404670	US	US7478265	Granted		14-Oct-2004	N/A	N/A	ERROR RECOVERY FOR INPUT/OUTPUT OPERATIONS
82198019	F200404742	US	US7840725	Granted		28-Sep-2004	23-May-2022	7,406.00	CAPTURE OF DATA IN A COMPUTER NETWORK
82198130	F200404811	US	US8713550	Granted		11-Mar-2005	29-Oct-2021	3,606.00	METHODS, DEVICES AND SOFTWARE APPLICATIONS FOR FACILITATING A DEVELOPMENT OF A COMPUTER PROGRAM
82199216	F200405267	US	US7936694	Granted		30-Mar-2007	3-Nov-2022	7,706.00	SNIFFING-BASED NETWORK MONITORING
82200005	F200405671	US	US7380723	Granted		1-Nov-2005	N/A	N/A	MONITORING OBJECT MOVEMENT

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82200353	F200405859	US	US7962789	Granted		28-Jun-2006	14-Dec-2022	7,406.00	METHOD AND APPARATUS FOR AUTOMATED TESTING OF A UTILITY COMPUTING SYSTEM
82200476	F200405943	US	US7818623	Granted		18-Oct-2006	19-Apr-2022	7,406.00	KERNEL DEBUGGING IN A CLUSTER COMPUTING SYSTEM
82201253	F200406358	US	US8836717	Granted		27-Oct-2005	16-Mar-2022	3,606.00	SYSTEM, METHOD AND UTILITY TO FORMAT IMAGES RETREIVED FROM A DEVICE
82204670	F200407921	US	US7724985	Granted		27-Oct-2005	25-Nov-2021	7,406.00	DEVICE STORING VECTOR IMAGE WITH EMBEDDED IMAGE STYLE IDENTIFIER, AND METHODS AND UTILITIES FOR FORMATTING A DEVICE IMAGE WITH IMAGE STYLE ATTRIBUTES
82205024	F200408082	US	US7640332	Granted		20-Dec-2007	29-Jun-2021	7,406.00	SYSTEM AND METHOD FOR HOT DEPLOYMENT/REDEPLOYMENT IN GRID COMPUTING ENVIRONMENT
82205459	F200408376	US	US8561050	Granted		18-Oct-2006	15-Apr-2021	3,606.00	METHOD AND SYSTEM FOR UPDATING AN APPLICATION
82207715	F200500894	US	US7693045	Granted		22-Dec-2005	6-Oct-2021	7,406.00	VERIFYING NETWORK CONNECTIVITY

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82208570	F200501261	US	US8145627	Granted		10-Jun-2005	27-Sep-2023	7,706.00	USE OF CONNECTIVITY ANALYSIS TO ASSIST RULE-BASED OPTIMIZERS
82208873	F200501448	US	US7904686	Granted		13-May-2008	8-Sep-2022	7,406.00	DATA SECURITY FOR USE WITH A FILE SYSTEM
82218614	F200506797	US	US9071506	Granted		29-Jun-2007	30-Dec-2022	3,766.00	ACCESSING WEB SERVICES USING NETWORK MANAGEMENT INFORMATION
82219511	F200507304	US	US7711657	Granted		26-Jun-2006	4-Nov-2021	7,706.00	RESOURCE-RESERVATION PRICING STRUCTURES BASED ON EXPECTED ABILITY TO DELIVER
82223162	F200601205	US	US7145881	Granted		4-Oct-2000	N/A	N/A	METHOD OF DETERMINING THE ROUTE OF PACKETS THROUGH A NETWORK OF COMMUNICATING OBJECTS
82227437	F200603085	US	US8526325	Granted		31-Jan-2007	3-Mar-2021	3,766.00	DETECTING AND IDENTIFYING CONNECTIVITY IN A NETWORK
82227602	F200603199	US	US8553573	Granted		4-Apr-2008	8-Apr-2021	3,766.00	APPARATUS AND METHODS FOR ADAPTIVE THROTTLING OF TRAFFIC ACROSS MULTIPLE NETWORK NODES
82227608	F200603199	CN	CN200880019398.6	Granted		4-Apr-2008	4-Apr-2021	1,032.98	APPARATUS AND METHODS FOR ADAPTIVE THROTTLING OF TRAFFIC ACROSS MULTIPLE NETWORK NODES

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82230062	F200700051	US	US7594047	Granted		9-Jul-2007	22-Mar-2021	7,706.00	BUFFER CIRCUIT
82231238	F200700480	US	US8543711	Granted		30-Apr-2007	24-Mar-2021	3,766.00	SYSTEM AND METHOD FOR EVALUATING A PATTERN OF RESOURCE DEMANDS OF A WORKLOAD
82241726	F200703705	US	US8620859	Granted		10-Jun-2008	30-Jun-2021	3,766.00	DATA PROCESSING SYSTEM AND METHOD OF EVALUATING EFFECTIVENESS OF USAGE OF A FILE SYSTEM (AS AMENDED)
82244171	F200704470	US	US8676931	Granted		6-Oct-2006	18-Sep-2021	3,766.00	METHODS FOR MANAGING MANUAL CHANGES TO NETWORK INFRASTRUCTURES THROUGH AUTOMATED SYSTEMS
82244195	F200704474	US	US8762507	Granted		22-Dec-2006	24-Dec-2021	3,766.00	METHOD AND SYSTEM FOR MANAGING AN INFORMATION TECHNOLOGY SYSTEM
82250867	F200900112	US	US8296253	Granted		15-Jun-2009	23-Apr-2024	7,706.00	MANAGING ONLINE CONTENT BASED ON ITS PREDICTED POPULARITY
82585290	F200900907	CN	CN200980140622.1	Granted		12-Oct-2009	12-Oct-2021	1,032.98	SYSTEMS AND PROCESSES FOR SECURING SENSITIVE INFORMATION
82254551	F200901230	US	US7472421	Granted		30-Sep-2002	30-Jun-2020	7,406.00	COMPUTER MODEL OF SECURITY RISKS

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82256600	F200901720	US	US8806061	Granted		14-Sep-2004	12-Feb-2022	3,766.00	SYSTEM, METHOD, AND COMPUTER PROGRAM PRODUCT FOR AUTOMATED CATEGORIZATIO N OF DATA PROCESSING SERVICES AND COMPONENTS
82257182	F200901875	US	US7992002	Granted		7-Jul-2006	2-Feb-2023	7,706.00	DATA DEPOSITORY AND ASSOCIATED METHODOLOGY PROVIDING SECURE ACCESS PURSUANT TO COMPLIANCE STANDARD CONFORMITY
82257338	F200901933	US	US9043589	Granted		14-Nov-2007	26-Nov-2022	3,766.00	SYSTEM AND METHOD FOR SAFEGUARDING AND PROCESSING CONFIDENTIAL INFORMATION
82262333	F200905061	US	US9037843	Granted		10-Mar-2010	19-Nov-2022	3,766.00	MANAGING A TARGET COMPUTING DEVICE (AMENDED)
82262453	F201000006	US	US8532495	Granted		23-Jul-2010	10-Mar-2021	3,766.00	METHOD FOR ENERGY EFFICIENT PULSING OPERATION OF TRANSCEIVERS OF A NETWORKED DEVICE
82262639	F201000102	US	US8391717	Granted		24-May-2010	5-Sep-2024	7,706.00	FLOW-CONTROL METHODS AND SYSTEMS FOR MULTIBUS SYSTEMS

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82272218	F201003701	US	US6760372	Granted		10-Aug-2000	N/A	N/A	ADAPTIVE SIGNAL PROCESSOR USING AN EYE-DIAGRAM METRIC
82272668	F201003882	US	US6999453	Granted		9-Jul-2001	N/A	N/A	DISTRIBUTED SWITCH FABRIC ARBITRATION
82273010	F201004068	US	US7277517	Granted		15-Nov-2002	N/A	N/A	METHOD FOR ACHIEVING SYMBOL ALIGNMENT TO A PRE-EXISTING ADSL DATA EXCHANGE
82273151	F201004138	US	US7701941	Granted		28-Mar-2001	20-Oct-2021	7,706.00	NETWORK SWITCH WITH MUTUALLY COUPLED LOOK-UP ENGINE AND NETWORK PROCESSOR
82273154	F201004138	US	US8194672	Granted		2-Mar-2010	N/A	N/A	NETWORK SWITCH WITH MUTUALLY COUPLED LOOK-UP ENGINE AND NETWORK PROCESSOR
82273340	F201004234	US	US6766020	Granted		23-Feb-2001	N/A	N/A	SYSTEM AND METHOD FOR COMFORT NOISE GENERATION
82273772	F201004422	US	US7460533	Granted		15-Nov-2001	N/A	N/A	SYSTEM AND METHOD FOR MULTI-CASTING ANNOUNCEMENTS
82274021	F201004517	US	US6662119	Granted		2-Aug-2002	N/A	N/A	METHOD AND APPARATUS FOR MONITORING CONNECTOR DEGRADATION

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82274030	F201004520	US	US7522614	Granted		28-Feb-2003	N/A	N/A	MULTI-SERVICE ACCESS PLATFORM FOR TELECOMMUNICATIONS AND DATA NETWORKS
82274048	F201004523	US	US6833712	Granted		27-Sep-2002	N/A	N/A	DIFFERENTIATING BETWEEN BOARD-INSERTION POWER-ON AND CHASSIS POWER-ON
82274066	F201004527	US	US7283543	Granted		27-Nov-2002	N/A	N/A	SYSTEM AND METHOD FOR OPERATING ECHO CANCELLERS WITH NETWORKS HAVING INSUFFICIENT LEVELS OF ECHO RETURN LOSS
82274114	F201004542	US	US7463620	Granted		10-Sep-2002	N/A	N/A	ARCHITECTURE AND METHOD FOR CONTROLLING FEATURES AND SERVICES IN PACKET-BASED NETWORKS
82274168	F201004553	US	US7307998	Granted		27-Aug-2002	N/A	N/A	COMPUTER SYSTEM AND NETWORK INTERFACE SUPPORTING DYNAMICALLY OPTIMIZED RECEIVE BUFFER QUEUES
82651947	F201004683	US	US8422649	Granted		23-Feb-2011	16-Oct-2024	7,406.00	DIGITAL TELEPHONE DATA AND CONTROL SIGNAL TRANSMISSION SYSTEM

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82276151	F201005199	US	US8397302	Granted		29-Oct-2010	12-Sep-2024	7,706.00	SYSTEM AND METHOD FOR ANALYZING A PROCESS
82062713	F30004521	US	US7877799	Granted		1-Aug-2001	25-Jul-2022	7,706.00	PERFORMANCE OF A SERVICE ON A COMPUTING PLATFORM
82062719	F30004521	JP	JP4818542	Granted		9-Aug-2001	N/A	N/A	PERFORMANCE OF A SERVICE ON A COMPUTING PLATFORM
82062773	F30004640	US	US8166173	Granted		16-Oct-2001	24-Oct-2023	7,706.00	INVITING ASSISTANT ENTITY INTO A NETWORK COMMUNICATIO N SESSION
82062770	F30004640	GB	GB2368225	Expired		17-Oct-2000	N/A	N/A	INVITING ASSISTANT ENTITY INTO A NETWORK COMMUNICATIO N SESSION
82065599	F30014518	US	US6845431	Granted		28-Dec-2001	N/A	N/A	SYSTEM AND METHOD FOR INTERMEDIATIN G COMMUNICATIO N WITH A MOVEABLE MEDIA LIBRARY UTILIZING A PLURALITY OF PARTITIONS
82065602	F30014518	JP	JP4667707	Granted		24-Dec-2002	21-Jan-2021	784.98	METHOD FOR INTERMEDIATIN G COMMUNICATIO N WITH MOVABLE MEDIA LIBRARY UTILIZING A PLURALITY OF PARTITIONS

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82065905	F30016994	US	US7096409	Granted		30-Jul-2003	N/A	N/A	REED-SOLOMON DECODER AND DECODING METHOD FOR ERRORS AND ERASURES DECODING
82066025	F30017568	US	US7086052	Granted		3-Jan-2003	N/A	N/A	SOFTWARE INSTALLATION AND OPERATION WITH RANDOM SELECTION
82069286	F30990075	US	US8407092	Granted		30-Oct-2001	26-Sep-2024	7,706.00	METERING IN A DATA PROCESSING SYSTEM
83810416	F700206840	US	US9213842	Granted		17-Aug-2011	15-Jun-2023	3,766.00	TRACING DATA BLOCK OPERATIONS
83969756	F700208369	US	US9514290	Granted		30-Mar-2012	6-Jun-2024	3,766.00	AUTHORIZATION CACHE

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81966890	F10001274	US	US6665671	Granted		4-Apr-2001	N/A	N/A	SYSTEM AND METHOD FOR OPTIMIZATION OF SHARED DATA
81977510	F10004565	US	US6851024	Granted		17-Aug-2000	N/A	N/A	EXCLUSIVE CACHING IN COMPUTER SYSTEMS
81978710	F10004941	US	US7447761	Granted		5-Oct-2000	N/A	N/A	DEVICE DETECTION SYSTEM AND METHOD
81978719	F10004941	DE	DE60131348.8	Granted		5-Apr-2001	N/A	N/A	DEVICE DETECTION SYSTEM AND METHOD
81978722	F10004941	FR	FR1195942	Granted		5-Apr-2001	N/A	N/A	DEVICE DETECTION SYSTEM AND METHOD
81978725	F10004941	GB	GB1195942	Granted		5-Apr-2001	N/A	N/A	DEVICE DETECTION SYSTEM AND METHOD
81978758	F10004950	US	US6741907	Granted		23-Mar-2001	N/A	N/A	INVENTORY CONTROL APPARATUS AND METHOD FOR A DATA STORAGE SYSTEM
81982898	F10006663	US	US7185109	Granted		20-Apr-2001	N/A	N/A	RECURSIVE DISCOVERY OF CDP TYPE OF NODES IN A NETWORK OF VARIOUS NODE TYPES
81988655	F10010480	US	US7035928	Granted		25-Apr-2001	N/A	N/A	ALLOCATING COMPUTER RESOURCES FOR EFFICIENT USE BY A PROGRAM

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81990341	F10011167	US	US7044362	Granted		10-Oct-2001	N/A	N/A	ELECTRONIC TICKETING SYSTEM AND METHOD
81994154	F10012695	US	US7051166	Granted		21-Apr-2003	N/A	N/A	DIRECTORY-BASED CACHE COHERENCY SCHEME FOR REDUCING MEMORY BANDWIDTH LOSS
82001048	F10016749	US	US6938259	Granted		2-Oct-2001	N/A	N/A	API TO ENFORCE INTERNATIONALIZATION
82001261	F10016875	US	US7877607	Granted		30-Aug-2002	25-Jul-2022	7,406.00	TAMPER-EVIDENT DATA MANAGEMENT
82001303	F10016885	DE	DE10306598.9	Granted		17-Feb-2003	17-Feb-2021	2,272.89	METHOD AND SYSTEM FOR ASSESSING AVAILABILITY OF COMPLEX ELECTRONIC SYSTEMS INCLUDING COMPUTER SYSTEMS
82001777	F10017266	US	US7191322	Granted		12-Oct-2001	N/A	N/A	METHOD AND APPARATUS FOR TUNING MULTIPLE INSTANCES OF KERNEL MODULES
82002368	F10017495	US	US7228527	Granted		15-Jul-2003	N/A	N/A	METHOD AND SYSTEM FOR STRUCTURING A PROCEDURE
82002491	F10017566	US	US6950962	Granted		12-Oct-2001	N/A	N/A	METHOD AND APPARATUS FOR KERNEL MODULE TESTING

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82003943	F10018224	US	US7051195	Granted		26-Oct-2001	N/A	N/A	METHOD OF OPTIMIZATION OF CPU AND CHIPSET PERFORMANCE BY SUPPORT OF OPTIONAL READS BY CPU AND CHIPSET
82003994	F10018269	US	US7133933	Granted		28-Aug-2002	N/A	N/A	CONTENT SYNCHRONIZATION FRAMEWORKS USING DYNAMIC ATTRIBUTES AND FILE BUNDLES FOR CONNECTED DEVICES
82004738	F10018772	US	US7028302	Granted		24-Apr-2002	N/A	N/A	SYSTEM AND METHOD FOR AUTOMATICALLY TUNING A MULTIPROCESSOR COMPUTER SYSTEM
82007378	F10019983	US	US6993750	Granted		13-Dec-2001	N/A	N/A	DYNAMIC REGISTRATION OF DYNAMICALLY GENERATED CODE AND CORRESPONDING UNWIND INFORMATION
82007381	F10019983	US	US6996810	Granted		13-Dec-2001	N/A	N/A	LAZY AND PRECISE UPDATE OF UNWIND INFORMATION FOR DYNAMICALLY GENERATED CODE
82085975	F100201501	US	US6820021	Granted		1-Nov-2002	N/A	N/A	SYSTEM AND METHOD FOR GENERATING A SHMOO PLOT BY VARYING THE RESOLUTION THEREOF

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82085981	F100201506	US	US6847909	Granted		1-Nov-2002	N/A	N/A	SYSTEM AND METHOD FOR GENERATING A SHMOO PLOT BY TRACKING THE EDGE OF THE PASSING REGION
82085999	F100201509	US	US6820027	Granted		1-Nov-2002	N/A	N/A	SYSTEM AND METHOD FOR GENERATING A SHMOO PLOT BY AVOIDING TESTING IN FAILING REGIONS
82088162	F100202293	US	US7058838	Granted		17-Dec-2002	N/A	N/A	SYSTEM AND METHOD FOR SYNCHRONIZING A PLURALITY OF PROCESSORS IN A MULTIPROCESSOR COMPUTER PLATFORM EMPLOYING A GLOBAL CLOCK COUNTER
82089131	F100202851	US	US6944552	Granted		25-Jun-2003	N/A	N/A	SYSTEM AND METHOD FOR DETECTING POWER DEFICIENCIES IN A COMPUTER COMPONENT
82089614	F100203069	US	US6993639	Granted		1-Apr-2003	N/A	N/A	PROCESSING INSTRUCTION ADDRESSED BY RECEIVED REMOTE INSTRUCTION AND GENERATING REMOTE INSTRUCTION TO RESPECTIVE OUTPUT PORT FOR ANOTHER CELL

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82090145	F100203410	US	US7222121	Granted		21-Nov-2002	N/A	N/A	PLATFORM AND METHOD FOR MONITORING AND ANALYZING DATA
82091864	F100204840	US	US7055114	Granted		8-Oct-2003	N/A	N/A	SYSTEMS AND PROCESSES FOR ASYMMETRICALLY SHRINKING A VLSI LAYOUT
82092542	F100205126	US	US7254541	Granted		30-Oct-2002	N/A	N/A	SYSTEMS AND METHODS FOR PROVIDING USERS WITH INFORMATION IN AUDIBLE FORM
82092545	F100205127	US	US7136804	Granted		30-Oct-2002	N/A	N/A	SYSTEMS AND METHODS FOR PROVIDING USERS WITH INFORMATION IN AUDIBLE FORM
82093352	F200205639	US	US7360219	Granted		13-Dec-2002	N/A	N/A	SYSTEMS AND METHODS FOR FACILITATING FAIR AND EFFICIENT SCHEDULING OF PROCESSES AMONG MULTIPLE RESOURCES IN A COMPUTER SYSTEM
82093355	F200205639	JP	JP4387174	Granted		11-Dec-2003	9-Oct-2021	1,069.38	METHOD FOR DISTRIBUTING PROCESS ASSOCIATED WITH TWO OR MORE PRIORITY GROUPS AMONG TWO OR MORE RESOURCES

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82095062	F200206508	US	US6883150	Granted		14-Mar-2003	N/A	N/A	AUTOMATIC MANUFACTURING TEST CASE GENERATION METHOD AND SYSTEM
82095548	F200206688	US	US7356574	Granted		25-Feb-2003	N/A	N/A	APPARATUS AND METHOD FOR PROVIDING DYNAMIC AND AUTOMATED ASSIGNMENT OF DATA LOGICAL UNIT NUMBERS
82095560	F200206691	US	US6934711	Granted		1-Oct-2002	N/A	N/A	METHOD AND ARRANGEMENT FOR COMMUNICATING WITH SCSI DEVICES
82095911	F200206894	US	US8452945	Granted		17-Sep-2002	28-Nov-2020	3,606.00	INDIRECT INDEXING INSTRUCTIONS
82097501	F200207515	US	US6930886	Granted		30-Apr-2003	N/A	N/A	ELECTRONIC COMPONENT SECUREMENT SYSTEM
82097576	F200207606	US	US7076488	Granted		29-Jan-2003	N/A	N/A	XML-LDAP ADAPTERS AND METHODS THEREFOR
82097579	F200207608	US	US7818646	Granted		12-Nov-2003	19-Apr-2022	7,706.00	EXPECTATION BASED EVENT VERIFICATION
82097606	F200207619	US	US8862770	Granted		6-Nov-2003	14-Apr-2022	3,766.00	PROCESSOR ARCHITECTURE VERIFICATION
82098401	F200207878	US	US7103756	Granted		30-Sep-2002	N/A	N/A	DATA PROCESSOR WITH INDIVIDUALLY WRITABLE REGISTER SUBWORD LOCATIONS

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82099337	F200208211	US	US7509589	Granted		30-Sep-2003	24-Sep-2020	7,406.00	STORAGE DOMAIN GUI
82099406	F200208248	US	US7562229	Granted		23-Jan-2003	14-Jan-2021	7,406.00	CODEWORD-BASED AUDITING OF COMPUTER SYSTEMS AND METHODS THEREFOR
82099835	F200208458	US	US6861876	Granted		25-Mar-2003	N/A	N/A	PULSE EVALUATE LOGIC-LATCH
82099847	F200208463	US	US7574341	Granted		12-Nov-2003	11-Feb-2021	7,706.00	SPECULATIVE EXPECTATION BASED EVENT VERIFICATION
82101605	F200208674	GB	GB2399434	Granted		10-Mar-2004	10-Mar-2021	764.74	AN INTEGRATED CIRCUIT
82100681	F200208770	US	US6832168	Granted		4-Apr-2003	N/A	N/A	METHOD AND SYSTEM FOR VERIFYING NETWORK DEVICE POWER CABLING CONFIGURATION
82101617	F200209008	US	US6876207	Granted		1-Aug-2003	N/A	N/A	SYSTEM AND METHOD FOR TESTING DEVICES
82102124	F200209185	US	US7340630	Granted		8-Aug-2003	N/A	N/A	MULTIPROCESSOR SYSTEM WITH INTERACTIVE SYNCHRONIZATION OF LOCAL CLOCKS
82102127	F200209185	GB	GB2404761	Granted		5-Aug-2004	5-Aug-2021	764.74	MULTIPROCESSOR SYSTEM WITH INTERACTIVE SYNCHRONIZATION OF LOCAL CLOCKS
82102208	F200209233	US	US7581008	Granted		12-Nov-2003	25-Feb-2021	7,706.00	SYSTEM AND METHOD FOR ALLOCATING SERVER RESOURCES

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82205489	F200209233	US	US7886055	Granted		28-Apr-2005	8-Aug-2022	7,706.00	ALLOCATING RESOURCES IN A SYSTEM HAVING MULTIPLE TIERS
82212719	F200209233	US	US7594016	Granted		16-Jun-2005	22-Mar-2021	7,706.00	CALCULATING NUMBERS OF SERVERS FOR TIERS OF A MULTI-TIERED SYSTEM
82212722	F200209233	US	US9021094	Granted		28-Apr-2005	28-Oct-2022	3,766.00	ALLOCATION OF RESOURCES FOR TIERS OF MULTI-TIERED SYSTEM BASED ON SELECTING ITEMS FROM RESPECTIVE SETS
82103705	F200209646	US	US7523503	Granted		21-Jan-2003	N/A	N/A	METHOD FOR PROTECTING SECURITY OF NETWORK INTRUSION DETECTION SENSORS
82104731	F200210100	US	US7103785	Granted		30-May-2003	N/A	N/A	METHOD AND APPARATUS FOR POWER MANAGEMENT EVENT WAKE UP
82105928	F200300276	US	US7506085	Granted		20-Oct-2006	N/A	N/A	SYSTEM AND METHOD FOR SENDING DATA ACROSS A BUS CABLE HAVING IN-BAND AND SIDE-BAND SIGNAL CONDUCTORS
82106279	F200300497	US	US7849320	Granted		25-Nov-2003	7-Jun-2022	7,406.00	METHOD AND SYSTEM FOR ESTABLISHING A CONSISTENT PASSWORD POLICY

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82117301	F200301703	US	US6817009	Granted		30-Nov-2000	N/A	N/A	METHOD AND APPARATUS FOR VERIFYING DATA LOCAL TO A SINGLE THREAD
82117799	F200301824	US	US6859876	Granted		29-Dec-2000	N/A	N/A	SYSTEM AND METHOD FOR DETECTING AND USING A REPLACEMENT BOOT BLOCK DURING INITIALIZATION BY AN ORIGINAL BOOT BLOCK
82117943	F200301854	US	US6668335	Granted		31-Aug-2000	N/A	N/A	SYSTEM FOR RECOVERING DATA IN A MULITPROCESSOR SYSTEM COMPRISING A CONDUCTION PATH FOR EACH BIT BETWEEN PROCESSORS WHERE THE PATHS ARE GROUPLED INTO SEPARATE BUNDLES ANDROUTED ALONG DIFFERENT PATHS
82118243	F200301937	US	US6931626	Granted		17-Jan-2001	N/A	N/A	METHOD AND APPARATUS FOR VERSIONING STATICALLY BOUND FILES
82118408	F200301971	US	US6901512	Granted		12-Dec-2000	N/A	N/A	CENTRALIZED CRYPTOGRAPHIC KEY ADMINISTRATION SCHEME FOR ENABLING SECURE CONTEXT-FREE APPLICATION OPERATION

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82118465	F200301985	US	US6892259	Granted		29-Sep-2001	N/A	N/A	METHOD AND APPARATUS FOR ALLOCATING COMPUTER BUS DEVICE RESOURCES TO A PRIORITY REQUESTER AND RETRYING REQUESTS FROM NON-PRIORITY REQUESTERS
82119836	F200302174	US	US7055139	Granted		28-Mar-2002	N/A	N/A	MULTIPROCESS DEBUGGING USING MULTIPLE CONVENTIONAL DEBUGGERS
82120241	F200302277	US	US6963869	Granted		7-Jan-2002	N/A	N/A	SYSTEM AND METHOD FOR SEARCH, INDEX, PARSING DOCUMENT DATABASE INCLUDING SUBJECT DOCUMENT HAVING NESTED FIELDS ASSOCIATED START AND END META WORDS WHERE EACH META WORD IDENTIFY LOCATION AND NESTING LEVEL
82120643	F200302377	US	US7099879	Granted		26-Apr-2002	N/A	N/A	REAL-TIME MONITORING OF SERVICE PERFORMANCE THROUGH THE USE OF RELATIONAL DATABASE CALCULATION CLUSTERS

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82588205	F200302529	US	US8144716	Granted		17-Dec-2010	N/A	N/A	METHOD AND SYSTEM FOR PROVIDING TELECOMMUNICATION SUBSCRIBER SERVICES WITHOUT PROVISIONING OR MAINTENANCE
82121753	F200302551	US	US7472283	Granted		30-May-2002	N/A	N/A	METHOD AND APPARATUS FOR SECURED DIGITAL VIDEO AND ACCESS TRACKING
82121762	F200302554	US	US7168001	Granted		6-Feb-2004	N/A	N/A	TRANSACTION PROCESSING APPARATUS AND METHOD
82121792	F200302564	US	US7143275	Granted		1-Aug-2002	N/A	N/A	SYSTEM FIRMWARE BACK-UP USING A BIOS-ACCESSIBLE PRE-BOOT PARTITION
82122008	F200302620	US	US7051175	Granted		17-Jan-2003	N/A	N/A	TECHNIQUES FOR IMPROVED TRANSACTION PROCESSING
82132268	F200304082	US	US6898740	Granted		25-Jan-2001	N/A	N/A	COMPUTER SYSTEM HAVING CONFIGURABLE CORE LOGIC CHIPSET FOR CONNECTION TO A FAULT-TOLERANT ACCELERATED GRAPHICS PORT BUS AND PERIPHERAL COMPONENT INTERCONNECT BUS

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82133216	F200304307	US	US6862646	Granted		28-Dec-2001	N/A	N/A	METHOD AND APPARATUS FOR ELIMINATING THE SOFTWARE GENERATED READY-SIGNAL TO HARDWARE DEVICES THAT ARE NOT PART OF THE MEMORY COHERENCY DOMAIN
82133327	F200304328	US	US6857040	Granted		5-Dec-2001	N/A	N/A	BI-DIRECTIONAL BUS BRIDGE IN WHICH MULTIPLE DEVICES CAN ASSERT BUS CONCURRENTLY
82168619	F200308902	US	US7181575	Granted		29-Sep-2004	N/A	N/A	INSTRUCTION CACHE USING SINGLE-PORTED MEMORIES
82168961	F200309043	US	US7165187	Granted		6-Jun-2003	N/A	N/A	BATCH BASED DISTRIBUTED DATA REDUNDANCY
82169747	F200309399	US	US7509657	Granted		28-Oct-2003	24-Sep-2020	7,406.00	APPLICATION PROGRAMMING INTERFACE FOR A VIRTUAL SWITCH
82169834	F200309444	US	US7120717	Granted		13-Feb-2004	N/A	N/A	METHOD AND APPARATUS FOR CONTROLLING INTERRUPT STORMS
82170167	F200309576	US	US7237084	Granted		27-Oct-2003	N/A	N/A	METHOD AND PROGRAM PRODUCT FOR AVOIDING CACHE CONGESTION BY OFFSETTING ADDRESSES WHILE ALLOCATING MEMORY

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82170170	F200309576	CN	CN200410087955.1	Granted		27-Oct-2004	27-Oct-2021	1,310.50	METHOD FOR AVOIDING CACHE CONGESTION BY OFFSETTING ADDRESSES WHILE ALLOCATING MEMORY
82170326	F200309643	US	US8442058	Granted		30-Apr-2003	14-Nov-2020	3,606.00	LOCATING STATIONS BETWEEN PROTOCOLS
82170329	F200309643	US	US7599379	Granted		30-Apr-2003	6-Apr-2021	7,706.00	REGISTERING STATIONS BETWEEN PROTOCOLS
82170812	F200309832	US	US7936738	Granted		6-Jul-2004	3-Nov-2022	7,706.00	FAULT TOLERANT SYSTEMS
82173188	F200310748	US	US7472398	Granted		17-Nov-2003	N/A	N/A	METHOD AND SYSTEM FOR HOSTING AN APPLICATION WITH A FACADE SERVER
82173518	F200310852	US	US7027950	Granted		19-Nov-2003	N/A	N/A	REGRESSION CLUSTERING AND CLASSIFICATION
82173665	F200310901	US	US7310751	Granted		20-Feb-2004	N/A	N/A	TIMEOUT EVENT TRIGGER GENERATION
82178666	F200312986	US	US7231543	Granted		14-Jan-2004	N/A	N/A	SYSTEMS AND METHODS FOR FAULT-TOLERANT PROCESSING WITH PROCESSOR REGROUPING BASED ON CONNECTIVITY CONDITIONS
82179887	F200313560	US	US7571163	Granted		13-Jul-2004	4-Feb-2021	7,706.00	METHOD FOR SORTING A DATA STRUCTURE

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82181510	F200314221	US	US7536684	Granted		29-Dec-2003	19-Nov-2020	7,406.00	SOFTWARE DOCUMENTATION GENERATION USING DIFFERENTIAL UPGRADE DOCUMENTATION
82182356	F200314535	US	US7650275	Granted		20-Jan-2005	19-Jul-2021	7,406.00	EXTERNAL EMULATION HARDWARE
82182986	F200314774	US	US7346802	Granted		30-Jan-2004	N/A	N/A	ROUTING COMMUNICATIONS TO A STORAGE AREA NETWORK
82183328	F200314943	US	US7149831	Granted		27-Sep-2004	N/A	N/A	BATCH PROCESSING OF INTERRUPTS
82185188	F200315753	US	US7839765	Granted		5-Oct-2004	23-May-2022	7,406.00	ADVERTISING PORT STATE CHANGES IN A NETWORK
82185371	F200315833	US	US7290176	Granted		31-Jul-2004	N/A	N/A	METHOD AND SYSTEM FOR GENERATING STACKED REGISTER DUMPS FROM BACKING-STORE MEMORY
82186622	F200316432	US	US7644146	Granted		2-Jun-2004	5-Jul-2021	7,406.00	SYSTEM AND METHOD FOR DISCOVERING COMMUNITIES IN NETWORKS
82186979	F200316677	US	US7562356	Granted		22-Sep-2004	14-Jan-2021	7,706.00	AUTOMATICALLY RESOLVING PATCH DEPENDENCIES FOR A PATCH BUNDLE
82188284	F200400507	US	US7631251	Granted		16-Feb-2005	8-Jun-2021	7,406.00	METHOD AND APPARATUS FOR CALCULATING CHECKSUMS

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82188425	F200400580	US	US7484221	Granted		20-Oct-2004	27-Jul-2020	7,406.00	METHOD AND APPARATUS FOR LOGGING THE EXECUTION HISTORY OF AN OPERATING SYSTEM KERNEL
82189055	F200400868	US	US7530057	Granted		21-Oct-2004	5-Nov-2020	7,406.00	PROGRAM CODE COVERAGE
82189262	F200401011	IN	IN262409	Granted		4-Jul-2005	4-Jul-2020	644.00	METHOD FOR LATENT ERROR DETECTION
82189256	F200401011	US	US7308605	Granted		20-Jul-2004	N/A	N/A	LATENT ERROR DETECTION
82191929	F200402293	US	US7516297	Granted		10-Nov-2005	N/A	N/A	MEMORY MANAGEMENT
82194287	F200403066	US	US7353375	Granted		7-Oct-2004	N/A	N/A	METHOD AND APPARATUS FOR MANAGING PROCESSOR AVAILABILITY USING A MICROCODE PATCH
82195928	F200403684	US	US7350007	Granted		5-Apr-2005	N/A	N/A	TIME-INTERVAL-BASED SYSTEM AND METHOD TO DETERMINE IF A DEVICE ERROR RATE EQUALS OR EXCEEDS A THRESHOLD ERROR RATE
82196375	F200403900	US	US7493620	Granted		18-Jun-2004	17-Aug-2020	7,406.00	TRANSFER OF WAITING INTERRUPTS
82197896	F200404691	US	US7925841	Granted		10-Sep-2004	12-Oct-2022	7,406.00	MANAGING SHARED MEMORY USAGE WITHIN A MEMORY RESOURCE GROUP INFRASTRUCTURE

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82199510	F200404975	US	US7307902	Granted		30-Aug-2005	N/A	N/A	MEMORY CORRECTION SYSTEM AND METHOD
82199516	F200404975	US	US7599235	Granted		2-Nov-2007	6-Apr-2021	7,706.00	MEMORY CORRECTION SYSTEM AND METHOD
82199375	F200405357	US	US7797505	Granted		25-Apr-2005	14-Mar-2022	7,406.00	PROGRAM STACK HANDLING
82200386	F200405879	US	US7530064	Granted		21-Sep-2004	5-Nov-2020	7,406.00	METHOD AND APPARATUS FOR AUTOMATED REGISTRY CLEAN-UP
82204667	F200406984	US	US7631269	Granted		27-Oct-2005	8-Jun-2021	7,406.00	UTILITY, METHOD AND DEVICE PROVIDING VECTOR IMAGES THAT MAY BE UPDATED TO REFLECT THE PHYSICAL STATES OF CONFIGURABLE COMPONENTS OF A DEVICE
82202693	F200407024	US	US7460470	Granted		18-Mar-2005	N/A	N/A	SYSTEMS AND METHODS OF PRIORITY FAILOVER DETERMINATION
82203044	F200407193	US	US7730350	Granted		3-Feb-2006	1-Dec-2021	7,406.00	METHOD AND SYSTEM OF DETERMINING THE EXECUTION POINT OF PROGRAMS EXECUTED IN LOCK STEP
82203605	F200407428	US	US7822857	Granted		7-Sep-2005	26-Apr-2022	7,406.00	METHODS AND SYSTEMS FOR SHARING REMOTE ACCESS

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82204757	F200407954	US	US7710428	Granted		27-Oct-2005	4-Nov-2021	7,406.00	METHOD AND APPARATUS FOR FILTERING THE DISPLAY OF VECTORS IN A VECTOR IMAGE
82206968	F200500574	US	US7590509	Granted		23-Jun-2005	15-Mar-2021	7,406.00	SYSTEM AND METHOD FOR TESTING A PROCESSOR
82208510	F200501223	US	US7512600	Granted		10-Jun-2005	30-Sep-2020	7,406.00	USE OF MULTI-JOIN OPERATOR AND RULES AS FRAMEWORK FOR JOIN TREE PROCESSING IN DATABASE SYSTEMS
82209035	F200501515	US	US7694123	Granted		28-Mar-2006	6-Oct-2021	7,406.00	STORING FILES FOR OPERATING SYSTEM RESTORATION
82210865	F200502475	US	US7966608	Granted		26-Jul-2006	21-Dec-2022	7,406.00	METHOD AND APPARATUS FOR PROVIDING A COMPILER INTERFACE
82213955	F200504167	US	US7549085	Granted		28-Apr-2006	N/A	N/A	METHOD AND APPARATUS TO INSERT SPECIAL INSTRUCTION
82214363	F200504463	US	US7770056	Granted		17-Oct-2007	3-Feb-2022	7,406.00	SYSTEM AND METHOD FOR DYNAMIC PAGE CLASSIFICATION FOR MEMORY DUMPING
82215125	F200504900	US	US7969969	Granted		5-Jul-2007	28-Dec-2022	7,706.00	SIGNALLING GATEWAY
82215128	F200504900	FR	FR1892907	Granted		31-Jul-2006	31-Jul-2021	675.76	SIGNALLING GATEWAY
82215134	F200504900	GB	GB1892907	Granted		31-Jul-2006	31-Jul-2021	577.38	SIGNALLING GATEWAY

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82215530	F200505157	US	US8190742	Granted		25-Apr-2006	29-Nov-2023	7,706.00	DISTRIBUTED DIFFERENTIAL STORE WITH NON-DISTRIBUTED OBJECTS AND COMPRESSION-ENHANCING DATA-OBJECT ROUTING
83002048	F200505157	US	US8447864	Granted		8-May-2012	21-Nov-2020	3,606.00	DISTRIBUTED DIFFERENTIAL STORE WITH NON-DISTRIBUTED OBJECTS AND COMPRESSION-ENHANCING DATA-OBJECT ROUTING
83721498	F200505157	DE	DE602007033669.4	Granted		25-Apr-2007	25-Apr-2021	1,371.29	DISTRIBUTED DIFFERENTIAL STORE WITH NON-DISTRIBUTED OBJECTS AND COMPRESSION-ENHANCING DATA-OBJECT ROUTING
83721500	F200505157	GB	GB2011042	Granted		25-Apr-2007	25-Apr-2021	531.28	DISTRIBUTED DIFFERENTIAL STORE WITH NON-DISTRIBUTED OBJECTS AND COMPRESSION-ENHANCING DATA-OBJECT ROUTING
82215656	F200505212	US	US7734960	Granted		20-Jul-2007	8-Dec-2021	7,406.00	METHOD OF MANAGING NODES IN COMPUTER CLUSTER
82216964	F200505869	US	US8402172	Granted		10-Dec-2007	19-Sep-2024	7,706.00	PROCESSING AN INPUT/OUTPUT REQUEST ON A MULTIPROCESSOR SYSTEM

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82217411	F200506051	US	US9043465	Granted		10-Jul-2007	26-Nov-2022	3,766.00	METHOD OF PROVIDING SERVICES IN A NETWORK, NETWORK ELEMENT AND COMPUTER PROGRAM PRODUCT
82217687	F200506245	US	US8306911	Granted		31-Jan-2007	6-May-2024	7,706.00	PAYMENT OPTION ANALYZER BASED ON MEASURED UTILIZATION
82218665	F200506834	US	US8639904	Granted		22-Oct-2009	28-Jul-2021	3,606.00	METHOD AND SYSTEM FOR MANAGING HEAP ACROSS PROCESS REPLICATION
82219268	F200507174	US	US7516358	Granted		20-Dec-2005	N/A	N/A	TUNING CORE VOLTAGES OF PROCESSORS
82220312	F200600070	US	US8327389	Granted		10-Jul-2007	4-Jun-2024	7,706.00	INTERFACE MODULE
82220930	F200600397	US	US7606842	Granted		27-Sep-2006	20-Apr-2021	7,406.00	METHOD OF MERGING A CLONE FILE SYSTEM WITH AN ORIGINAL FILE SYSTEM
82224077	F200601602	US	US7610429	Granted		30-Jan-2007	27-Apr-2021	7,706.00	METHOD AND SYSTEM FOR DETERMINING DEVICE CRITICALITY IN A COMPUTER CONFIGURATION
82226375	F200602648	US	US7937565	Granted		21-Feb-2008	3-Nov-2022	7,406.00	METHOD AND SYSTEM FOR DATA SPECULATION ON MULTICORE SYSTEMS

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82227347	F200603027	US	US7929418	Granted		20-Mar-2008	19-Oct-2022	7,406.00	DATA PACKET COMMUNICATION PROTOCOL OFFLOAD METHOD AND SYSTEM
82227539	F200603142	US	US8156496	Granted		29-Jan-2008	10-Oct-2023	7,706.00	DATA PROCESSING SYSTEM AND METHOD
82227545	F200603144	US	US8566467	Granted		17-Jul-2008	22-Apr-2021	3,606.00	DATA PROCESSING SYSTEM AND METHOD
82229765	F200603986	US	US8504018	Granted		29-Jan-2008	6-Feb-2021	3,766.00	SERVICE ROUTING FOR COMMUNICATION SYSTEMS
82230662	F200700296	US	US9405921	Granted		31-Jul-2007	2-Feb-2024	3,766.00	COMPUTER-IMPLEMENTED METHOD FOR ROLE DISCOVERY IN ACCESS CONTROL SYSTEMS
82247039	F200700296	US	US9405922	Granted		5-Jan-2009	2-Feb-2024	3,766.00	COMPUTER-IMPLEMENTED METHOD FOR ROLE DISCOVERY AND SIMPLIFICATION IN ACCESS CONTROL SYSTEMS
82232756	F200701002	US	US7730218	Granted		31-Jul-2007	1-Dec-2021	7,706.00	METHOD AND SYSTEM FOR CONFIGURATION AND MANAGEMENT OF CLIENT ACCESS TO NETWORK-ATTACHED-STORAGE
82233953	F200701315	US	US8359467	Granted		7-Jul-2007	22-Jul-2024	7,706.00	ACCESS CONTROL SYSTEM AND METHOD

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82235369	F200701680	US	US8782655	Granted		1-Jul-2008	15-Jan-2022	3,606.00	CONTROLLING COMPUTING RESOURCE CONSUMPTION
82236776	F200702071	US	US8046529	Granted		25-Sep-2008	25-Apr-2023	7,706.00	UPDATING CONTROL INFORMATION IN NON-VOLATILE MEMORY TO CONTROL SELECTION OF CONTENT
82236902	F200702110	US	US8712035	Granted		31-Jan-2008	29-Oct-2021	3,606.00	ONLINE DATA CONVERSION TECHNIQUE USING A SLIDING WINDOW
82237886	F200702398	US	US8719830	Granted		21-Aug-2008	6-Nov-2021	3,606.00	SYSTEM AND METHOD FOR ALLOWING EXECUTING APPLICATION IN COMPARTMENT THAT ALLOW ACCESS TO RESOURCES
82237922	F200702406	US	US7111197	Granted		20-Sep-2002	N/A	N/A	SYSTEM AND METHOD FOR JOURNAL RECOVERY FOR MULTINODE ENVIRONMENTS
82237925	F200702406	US	US7467330	Granted		4-Aug-2006	N/A	N/A	SYSTEM AND METHOD FOR JOURNAL RECOVERY FOR MULTINODE ENVIRONMENTS
82237988	F200702406	US	US7240057	Granted		20-Sep-2002	N/A	N/A	SYSTEM AND METHOD FOR IMPLEMENTING JOURNALING IN A MULTI-NODE ENVIRONMENT

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82237991	F200702406	CA	CA2460833	Granted		20-Sep-2002	20-Sep-2020	355.98	SYSTEM AND METHOD FOR IMPLEMENTINGJ OURNALING IN A MULTI-NODE ENVIRONMENT
82237994	F200702406	CN	CN02823231.3	Granted		20-Sep-2002	20-Sep-2020	1,304.37	SYSTEM AND METHOD FOR IMPLEMENTING JOURNALING IN A MULTI-NODE ENVIRONMENT
82238009	F200702406	US	US7437386	Granted		20-Sep-2002	N/A	N/A	SYSTEM AND METHOD FOR A MULTI-NODE ENVIRONMENT WITH SHARED STORAGE
82238015	F200702406	CN	CN02823098.1	Granted		20-Sep-2002	20-Sep-2020	1,304.37	SYSTEM AND METHOD FOR A MULTI-NODE ENVIRONMENT WITH SHARED STORAGE
82238021	F200702406	JP	JP4249622	Granted		20-Sep-2002	23-Jan-2021	1,404.63	A SYSTEM AND METHOD FOR EFFICIENT LOCK RECOVERY
82238033	F200702406	US	US7266722	Granted		20-Sep-2002	N/A	N/A	SYSTEM AND METHOD FOR EFFICIENT LOCK RECOVERY
83057023	F200702406	FR	FR1428149	Granted		20-Sep-2002	20-Sep-2020	878.13	A SYSTEM AND METHOD FOR A MULTI-NODE ENVIRONMENT WITH SHARED STORAGE
83057026	F200702406	DE	DE60244008.4	Granted		20-Sep-2002	20-Sep-2020	2,108.66	A SYSTEM AND METHOD FOR A MULTI-NODE ENVIRONMENT WITH SHARED STORAGE

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83057029	F200702406	GB	GB1428149	Granted		20-Sep-2002	20-Sep-2020	826.86	A SYSTEM AND METHOD FOR A MULTI-NODE ENVIRONMENT WITH SHARED STORAGE
82237979	F200702406	US	US7496646	Granted		20-Sep-2002	24-Aug-2020	7,406.00	SYSTEM AND METHOD FOR MANAGEMENT OF A STORAGE AREA NETWORK
82238303	F200702507	US	US8712597	Granted		11-Jun-2008	29-Oct-2021	3,606.00	METHOD OF OPTIMIZING AIR MOVER PERFORMANCE CHARACTERISTICS TO MINIMIZE TEMPERATURE VARIATIONS IN A COMPUTING SYSTEM ENCLOSURE
82238624	F200702591	US	US8495662	Granted		23-Sep-2008	23-Jan-2021	3,606.00	SYSTEM AND METHOD FOR IMPROVING RUN-TIME PERFORMANCE OF APPLICATIONS WITH MULTITHREADED AND SINGLE THREADED ROUTINES
82244252	F200704490	US	US7539769	Granted		30-Apr-2001	26-Nov-2020	7,406.00	AUTOMATED DEPLOYMENT AND MANAGEMENT OF NETWORK DEVICES
82244267	F200704493	US	US7496645	Granted		18-Oct-2001	N/A	N/A	DEPLOYMENT OF BUSINESS LOGIC SOFTWARE AND DATA CONTENT ONTO NETWORK SERVERS

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82246889	F200800989	US	US8875142	Granted		23-Oct-2009	28-Apr-2022	3,606.00	JOB SCHEDULING ON A MULTIPROCESSING SYSTEM BASED ON RELIABILITY AND PERFORMANCE RANKINGS OF PROCESSORS AND WEIGHTED EFFECT OF DETECTED ERRORS (AS AMENDED)
82247372	F200801308	US	US8826138	Granted		28-Jan-2009	2-Mar-2022	3,606.00	VIRTUAL CONNECT DOMAIN GROUPS
82247375	F200801309	US	US8208616	Granted		29-Jan-2009	26-Dec-2023	7,706.00	CONFERENCE-CALL SYSTEM AND CONFERENCE-SPECIFIC ACCESS CODES
82247738	F200801487	US	US8489753	Granted		7-Sep-2009	16-Jan-2021	3,766.00	APPARATUS AND COMPUTER-IMPLEMENTED METHOD FOR CONTROLLING MIGRATION OF A VIRTUAL MACHINE
82248062	F200801728	US	US8615641	Granted		24-Jun-2009	24-Jun-2021	3,606.00	SYSTEM AND METHOD FOR DIFFERENTIAL BACKUP
82249157	F200802553	US	US9032240	Granted		23-Apr-2009	12-Nov-2022	3,606.00	METHOD AND SYSTEM FOR PROVIDING HIGH AVAILABILITY SCTP APPLICATIONS
82249511	F200802897	US	US8650396	Granted		1-Dec-2009	11-Aug-2021	3,606.00	PERMISSION-BASED DYNAMICALLY TUNABLE OPERATING SYSTEM KERNEL

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82249712	F200803029	US	US8484621	Granted		24-Jun-2009	9-Jan-2021	3,606.00	METHOD AND SYSTEM FOR DATA CENTRIC HEAP PROFILING
82250969	F200900211	US	US8769546	Granted		7-Jan-2010	1-Jan-2022	3,606.00	BUSY-WAIT TIME FOR THREADS
82251287	F200900397	US	US7769050	Granted		25-Apr-2008	3-Feb-2022	7,706.00	SYSTEM AND METHOD FOR INTERFERENCE MITIGATION FOR WIRELESS COMMUNICATIO N
82254797	F200901268	US	US7219236	Granted		26-Feb-2003	N/A	N/A	ADMINISTERING A SECURITY SYSTEM
82853154	F200902893	US	US9032517	Granted		31-Oct-2009	12-Nov-2022	3,766.00	MALICIOUS CODE DETECTION
82931336	F200902893	CN	CN200980162264. 4	Granted		31-Oct-2009	31-Oct-2021	990.04	MALICIOUS CODE DETECTION
82259072	F200902994	US	US8694819	Granted		24-Aug-2009	8-Oct-2021	3,606.00	SYSTEM AND METHOD FOR GRADUALLY ADJUSTING A VIRTUAL INTERVAL TIMER COUNTER VALUE TO COMPENSATE THE DIVERGENCE OF A PHYSICAL INTERVAL TIMER COUNTER VALUE AND THE VIRTUAL INTERVAL TIMER COUNTER VALUE
82852274	F200904049	US	US8838765	Granted		14-Dec-2009	16-Mar-2022	3,766.00	MODIFYING COMPUTER MANAGEMENT REQUEST

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82261616	F200904613	US	US7430570	Granted		28-Apr-2004	N/A	N/A	SHADOW DIRECTORY STRUCTURE IN A DISTRIBUTED SEGMENTED FILE SYSTEM
82261604	F200904613	US	US7890529	Granted		16-Feb-2007	15-Aug-2022	7,706.00	DELEGATIONS AND CACHING IN A DISTRIBUTED SEGMENTED FILE SYSTEM
82261619	F200904613	US	US8316066	Granted		20-Aug-2007	20-May-2024	7,400.00	SHADOW DIRECTORY STRUCTURE IN A DISTRIBUTED SEGMENTED FILE SYSTEM
82261622	F200904613	US	US8131782	Granted		29-Sep-2008	6-Sep-2023	7,706.00	SHADOW DIRECTORY STRUCTURE IN A DISTRIBUTED SEGMENTED FILE SYSTEM
82261628	F200904613	US	US7546319	Granted		28-Apr-2004	9-Dec-2020	7,406.00	FILE SYSTEM CONSISTENCY CHECKING IN A DISTRIBUTED SEGMENTED FILE SYSTEM
82261631	F200904613	US	US8103639	Granted		5-May-2009	24-Jul-2023	7,706.00	FILE SYSTEM CONSISTENCY CHECKING IN A DISTRIBUTED SEGMENTED FILE SYSTEM
82261808	F200904724	US	US8997084	Granted		20-Apr-2011	30-Sep-2022	3,606.00	METHOD AND APPARATUS FOR DETERMINING COMPATIBLE VERSIONS OF DEPENDENT ENTITIES IN A COMPUTER SYSTEM

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83200410	F201000810	US	US9166893	Granted		23-Sep-2010	20-Apr-2023	3,766.00	METHODS, APPARATUS AND SYSTEMS FOR MONITORING LOCATIONS OF DATA WITHIN A NETWORK SERVICE
83422495	F201000959	US	US9148430	Granted		17-Aug-2011	29-Mar-2023	3,766.00	METHOD OF MANAGING USAGE RIGHTS IN A SHARE GROUP OF SERVERS
82272038	F201002554	US	US6996621	Granted		6-Dec-2000	N/A	N/A	METHOD FOR SUPPORTING SECONDARY ADDRESS DELIVERY ON REMOTE ACCESS SERVERS
82271006	F201003330	US	US6681244	Granted		9-Jun-2000	N/A	N/A	SYSTEM AND METHOD FOR OPERATING A NETWORK ADAPTER WHEN AN ASSOCIATED NETWORK COMPUTING SYSTEM IS IN A LOW-POWER STATE
82271648	F201003502	US	US7107326	Granted		27-Nov-2000	N/A	N/A	METHOD AND SYSTEM FOR INTEGRATING IP ADDRESS RESERVATIONS WITH POLICY PROVISIONING
82271834	F201003567	US	US7222255	Granted		28-Feb-2001	N/A	N/A	SYSTEM AND METHOD FOR NETWORK PERFORMANCE TESTING

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82272068	F201003648	US	US6597151	Granted		2-Oct-2000	N/A	N/A	PORTABLE AUXILIARY BATTERY PACK FOR EXTENDED USE AND RECHARGING OF PERSONAL DIGITAL ASSISTANTS
82274162	F201004551	US	US7724740	Granted		27-Aug-2002	25-Nov-2021	7,706.00	COMPUTER SYSTEM AND NETWORK INTERFACE SUPPORTING CLASS OF SERVICE QUEUES
82274165	F201004551	US	US8358655	Granted		9-Apr-2010	N/A	N/A	COMPUTER SYSTEM AND NETWORK INTERFACE SUPPORTING CLASS OF SERVICE QUEUES
83137192	F201004551	US	US9348789	Granted		14-Dec-2012	24-Nov-2023	3,766.00	COMPUTER SYSTEM AND NETWORK INTERFACE SUPPORTING CLASS OF SERVICE QUEUES
82274399	F201004602	US	US7657926	Granted		19-Mar-2004	2-Aug-2021	7,706.00	ENABLING NETWORK COMMUNICATIO N FROM ROLE BASED AUTHENTICATIO N
82274402	F201004602	US	US8176543	Granted		17-Dec-2009	8-Nov-2023	7,706.00	ENABLING NETWORK COMMUNICATIO N FROM ROLE BASED AUTHENTICATIO N

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82274444	F201004615	US	US8943241	Granted		9-Sep-2004	27-Jul-2022	3,766.00	COMMUNICATION DEVICE INGRESS INFORMATION MANAGEMENT SYSTEM AND METHOD
84088366	F201004615	US	US9229683	Granted		15-Dec-2014	5-Jul-2023	3,766.00	COMMUNICATION DEVICE INGRESS INFORMATION MANAGEMENT SYSTEM AND METHOD
82756375	F201004987	US	US9355145	Granted		22-Sep-2011	30-Nov-2023	3,766.00	USER DEFINED FUNCTION CLASSIFICATION IN ANALYTICAL DATA PROCESSING SYSTEMS
82756415	F201004987	US	US8856151	Granted		30-Sep-2011	7-Apr-2022	3,766.00	OUTPUT FIELD MAPPING OF USER DEFINED FUNCTIONS IN DATABASES
82756427	F201004987	US	US9229984	Granted		13-Oct-2011	5-Jul-2023	3,766.00	PARAMETER EXPRESSIONS FOR MODELING USER DEFINED FUNCTION EXECUTION IN ANALYTICAL DATA PROCESSING SYSTEMS
82850182	F201004987	US	US8538954	Granted		25-Jan-2011	17-Mar-2021	3,766.00	AGGREGATE FUNCTION PARTITIONS FOR DISTRIBUTED PROCESSING
82671992	F201005823	US	US8515916	Granted		28-Sep-2011	20-Feb-2021	3,766.00	DATA ARCHIVING METHODS AND DATA ARCHIVING APPARATUS

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82062791	F30004647	US	US6996605	Granted		16-Oct-2001	N/A	N/A	OVERVIEW SUBSYSTEM FOR INFORMATION PAGE SERVER
82062788	F30004647	GB	GB2368246	Expired		17-Oct-2000	N/A	N/A	OVERVIEW SUBSYSTEM FOR INFORMATION PAGE SERVER
82062872	F30004693	US	US7113911	Granted		21-Nov-2001	N/A	N/A	VOICE COMMUNICATIO N CONCERNING A LOCAL ENTITY
82065566	F30014515	US	US7000085	Granted		28-Dec-2001	N/A	N/A	SYSTEM AND METHOD FOR SECURING DRIVE ACCESS TO DATA STORAGE MEDIA BASED ON MEDIUM IDENTIFIERS
82065569	F30014515	JP	JP4579492	Granted		24-Dec-2002	3-Sep-2021	1,024.32	SYSTEM AND METHOD FOR SECURING DRIVE ACCESS TO DATA STORAGE MEDIA BASED ON MEDIUM IDENTIFIERS
82065575	F30014515	US	US7472245	Granted		30-Dec-2005	N/A	N/A	SYSTEM AND METHOD FOR SECURING DRIVE ACCESS TO DATA STORAGE MEDIA BASED ON MEDIUM IDENTIFIERS
82070522	F50002136	US	US7150023	Granted		27-Jul-2001	N/A	N/A	DYNAMIC RESOURCE CONTROL IN A PROCESSING SYSTEM
82281425	F700203771	US	US7840850	Granted		11-Apr-2005	23-May-2022	7,406.00	DATA PROCESSING SYSTEM FOR LOGGING MEMORY ACCESS DATA

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82863311	F700205556	US	US8923837	Granted		13-Oct-2011	30-Jun-2022	3,766.00	PROVISIONING A TELEPHONY NETWORK IN RESPONSE TO AN ELECTRONIC DEVICE ATTACHING TO THE NETWORK
82670355	F700205632	US	US9069470	Granted		1-Apr-2011	30-Dec-2022	3,606.00	ZONE GROUP REASSIGNMENT USING STORAGE DEVICE SIGNATURES
83998863	F700207271	KR	KR10-1660611	Granted		30-Jan-2012	21-Sep-2021	383.94	WORD SHIFT STATIC RANDOM ACCESS MEMORY (WS-SRAM)
83998868	F700207271	US	US9589623	Granted		30-Jan-2012	7-Sep-2024	3,766.00	WORD SHIFT STATIC RANDOM ACCESS MEMORY (WS-SRAM)
83998911	F700207271	KR	KR10-1564524	Granted		30-Jan-2012	23-Oct-2021	631.63	DYNAMIC/STATIC RANDOM ACCESS MEMORY (D/SRAM)
83998916	F700207271	US	US9466352	Granted		30-Jan-2012	11-Apr-2024	3,766.00	DYNAMIC/STATIC RANDOM ACCESS MEMORY (D/SRAM)
84077872	F700207271	CN	CN201280072828.7	Granted		10-Jul-2012	10-Jul-2021	698.53	LIST SORT STATIC RANDOM ACCESS MEMORY
84077882	F700207271	US	US9384824	Granted		10-Jul-2012	5-Jan-2024	3,766.00	LIST SORT STATIC RANDOM ACCESS MEMORY
83096196	F700210418	US	US8789139	Granted		11-Jan-2013	22-Jan-2022	3,766.00	AUTOMATED TEST TO TELL COMPUTERS AND HUMANS APART

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83213710	F700213039	US	US9235639	Granted		10-May-2013	12-Jul-2023	3,766.00	FILTER REGULAR EXPRESSION
84299324	FCTXM0006	US	US9344369	Granted		12-Mar-2013	17-Nov-2023	3,766.00	SYSTEM AND METHODS FOR DISTRIBUTED QUALITY OF SERVICE ENFORCEMENT

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81986348	F10007858	US	US7240324	Granted		28-Feb-2001	N/A	N/A	EVENT-BASED SCHEDULING METHOD AND SYSTEM FOR WORKFLOW ACTIVITIES
81989396	F10010812	US	US7831731	Granted		12-Jun-2001	9-May-2022	7,706.00	METHOD AND SYSTEM FOR A MODULAR TRANSMISSION CONTROL PROTOCOL (TCP) RARE-HANDOFF DESIGN IN A STREAMS BASED TRANSMISSION CONTROL PROTOCOL/INTERNET PROTOCOL (TCP/IP) IMPLEMENTATION
82079603	F100110346	US	US6910057	Granted		17-Oct-2001	N/A	N/A	TRUTH TABLE CANDIDATE REDUCTION FOR CELLULAR AUTOMATA BASED RANDOM NUMBER GENERATORS
81992846	F10012172	US	US7099866	Granted		16-Nov-2001	N/A	N/A	METHOD OF GENERATING AND PRESENTING KERNEL DATA
81998501	F10015055	US	US7466668	Granted		24-Aug-2001	N/A	N/A	REDUCED PIN-COUNT SYSTEM INTERFACE FOR GIGABIT ETHERNET PHYSICAL LAYER DEVICES
82723764	F10015055	FR	FR1303100	Granted		13-Aug-2002	13-Aug-2021	1,036.41	REDUCED PIN-COUNT SYSTEM INTERFACE FOR GIGABIT ETHERNET PHYSICAL LAYER DEVICES

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82723766	F10015055	DE	DE60240383.9	Granted		13-Aug-2002	13-Aug-2021	2,504.74	REDUCED PIN-COUNT SYSTEM INTERFACE FOR GIGABIT ETHERNET PHYSICAL LAYER DEVICES
82723768	F10015055	GB	GB1303100	Granted		13-Aug-2002	13-Aug-2021	896.07	REDUCED PIN-COUNT SYSTEM INTERFACE FOR GIGABIT ETHERNET PHYSICAL LAYER DEVICES
82000952	F10016691	US	US7028167	Granted		4-Mar-2002	N/A	N/A	CORE PARALLEL EXECUTION WITH DIFFERENT OPTIMIZATION CHARACTERISTICS TO DECREASE DYNAMIC EXECUTION PATH
82000964	F10016693	US	US6871264	Granted		6-Mar-2002	N/A	N/A	SYSTEM AND METHOD FOR DYNAMIC PROCESSOR CORE AND CACHE PARTITIONING ON LARGE-SCALE MULTITHREADED, MULTIPROCESSOR INTEGRATED CIRCUITS
82003742	F10018138	US	US7523455	Granted		3-May-2002	21-Oct-2020	7,406.00	METHOD AND SYSTEM FOR APPLICATION MANAGED CONTEXT SWITCHING
82003964	F10018228	US	US6781858	Granted		29-Aug-2003	N/A	N/A	CUBIC MEMORY ARRAY
82087979	F100202161	US	US6889295	Granted		5-Mar-2002	N/A	N/A	RE-ORDERING REQUESTS FOR SHARED RESOURCES

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82089101	F100202822	US	US8463940	Granted		31-Jan-2003	11-Dec-2020	3,606.00	METHOD OF INDICATING A PATH IN A COMPUTER NETWORK
82090349	F100203592	US	US7325170	Granted		19-Mar-2004	N/A	N/A	METHOD AND SYSTEM FOR PROVIDING INFORMATION FOR REMOTE DEVICE SUPPORT
82058708	F10992668	US	US7069434	Granted		13-Jun-2000	N/A	N/A	SECURE DATA TRANSFER METHOD AND SYSTEM
82098827	F200208006	US	US7003591	Granted		20-Aug-2003	N/A	N/A	CONFIGURABLE MAPPING OF DEVICES TO BUS FUNCTIONS
82100006	F200208555	US	US7081684	Granted		6-Oct-2003	N/A	N/A	CONVERTING HEAT GENERATED BY A COMPONENT TO ELECTRICAL ENERGY
82100675	F200208766	US	US7533285	Granted		22-Apr-2004	12-Nov-2020	7,406.00	SYNCHRONIZING LINK DELAY MEASUREMENT OVER SERIAL LINKS
82106108	F200300376	US	US7890999	Granted		7-Aug-2003	15-Aug-2022	7,406.00	RPC PORT MAPPER INTEGRITY CHECKER TO IMPROVE SECURITY OF A PROVISIONABLE NETWORK
82110842	F200301290	US	US6765922	Granted		27-Sep-2000	N/A	N/A	SPECULATIVE TRANSMIT FOR SYSTEM AREA NETWORK LATENCY REDUCTION

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82110845	F200301290	US	US6882656	Expired		13-Apr-2004	N/A	N/A	SPECULATIVE TRANSMIT FOR SYSTEM AREA NETWORK LATENCY REDUCTION
82118663	F200302043	US	US7240186	Granted		16-Jul-2001	N/A	N/A	SYSTEM AND METHOD TO AVOID RESOURCE CONTENTION IN THE PRESENCE OF EXCEPTIONS
82119764	F200302153	US	US7167987	Granted		29-Aug-2001	N/A	N/A	USE OF BIOMETRICS TO PROVIDE PHYSICAL AND LOGIC ACCESS TO COMPUTER DEVICES
82120697	F200302391	US	US7111084	Granted		28-Dec-2001	N/A	N/A	DATA STORAGE NETWORK WITH HOST TRANSPARENT FAILOVER CONTROLLED BY HOST BUS ADAPTER
82121852	F200302581	US	US7739485	Granted		11-Oct-2002	15-Dec-2021	7,706.00	CACHED FIELD REPLACEABLE UNIT EEPROM DATA
82121996	F200302618	US	US7092258	Granted		15-Sep-2003	N/A	N/A	CABLE MANAGEMENT SYSTEM AND METHOD OF INSTALLATION AND OPERATION THEREOF
82133435	F200304361	US	US6886109	Granted		18-May-2001	N/A	N/A	METHOD AND APPARATUS FOR EXPEDITING SYSTEM INITIALIZATION
82169255	F200309194	US	US7580814	Granted		23-Mar-2004	25-Feb-2021	7,706.00	SEQUENCE SIMULATOR

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82169261	F200309196	US	US7570591	Granted		3-Aug-2004	4-Feb-2021	7,706.00	METHOD AND APPARATUS FOR NEGOTIATING LINK SPEED AND CONFIGURATION
82171562	F200310064	US	US7519996	Granted		25-Aug-2003	N/A	N/A	SECURITY INTRUSION MITIGATION SYSTEM AND METHOD
82171565	F200310064	GB	GB2405563	Granted		13-Aug-2004	13-Aug-2021	764.74	A SECURITY INTRUSION MITIGATION SYSTEM AND METHOD
82173791	F200310966	US	US7954086	Granted		19-May-2003	30-Nov-2022	7,406.00	SELF-DESCRIBING KERNEL MODULES
82175876	F200311794	US	US8000322	Granted		14-Mar-2005	16-Feb-2023	7,706.00	CROSSBAR SWITCH DEBUGGING
82175879	F200311794	CN	CN200510088233.2	Granted		29-Jul-2005	29-Jul-2021	1,367.42	CROSSBAR SWITCH DEBUGGING
82176536	F200312054	US	US7447971	Granted		14-May-2004	N/A	N/A	DATA RECOVERY SYSTEMS AND METHODS
82176917	F200312197	US	US7765550	Granted		26-May-2005	27-Jan-2022	7,406.00	SYSTEM FOR CONTROLLING CONTEXT SWITCH OF DEFERRED REQUESTS USING COUNTER AND FLAG SETTING OF THREAD ACCESSING SHARED RESOURCE OR ENTERING CODE REGION
82176923	F200312200	US	US7577945	Granted		26-May-2005	18-Feb-2021	7,406.00	MEMORY MAPPED LAZY SIGNAL BLOCKING

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82178690	F200313003	US	US7996825	Granted		31-Oct-2003	9-Feb-2023	7,706.00	CROSS-FILE INLINING BY USING SUMMARIES AND GOLBAL WORKLIST
82178723	F200313024	US	US7814467	Granted		15-Jan-2004	12-Apr-2022	7,406.00	PROGRAM OPTIMIZATION USING OBJECT FILE SUMMARY INFORMATION
82180442	F200313758	US	US7739536	Granted		25-Feb-2005	15-Dec-2021	7,706.00	INTELLIGENT FREQUENCY AND VOLTAGE MARGINING
82180508	F200313774	US	US7454514	Granted		12-Jan-2004	N/A	N/A	PROCESSING DATA WITH UNCERTAIN ARRIVAL TIME
82180757	F200313907	US	US7487255	Granted		14-Aug-2003	3-Aug-2020	7,406.00	ROUTING CACHE MANAGEMENT WITH ROUTE FRAGMENTATIO N
82180943	F200313973	US	US7600023	Granted		5-Nov-2004	6-Apr-2021	7,706.00	SYSTEMS AND METHODS OF BALANCING CROSSBAR BANDWIDTH
82181105	F200314048	US	US7672929	Granted		22-Dec-2004	2-Sep-2021	7,706.00	DATABASE MODIFICATION HISTORY
82181606	F200314251	US	US7809991	Granted		11-Jan-2005	5-Apr-2022	7,706.00	SYSTEM AND METHOD TO QUALIFY DATA CAPTURE
82181612	F200314251	US	US7228472	Granted		11-Jan-2005	N/A	N/A	SYSTEM AND METHOD TO CONTROL DATA CAPTURE
82182284	F200314251	US	US7752016	Granted		11-Jan-2005	6-Jan-2022	7,706.00	SYSTEM AND METHOD FOR DATA ANALYSIS

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82182992	F200314776	US	US7474793	Granted		2-Sep-2004	6-Jul-2020	7,406.00	METHODS FOR COMPRESSION USING A DENOISER
82182998	F200314778	US	US7624009	Granted		2-Sep-2004	24-May-2021	7,406.00	METHOD AND SYSTEM FOR PRODUCING VARIABLE LENGTH CONTEXT MODELS
82184231	F200315313	US	US7624319	Granted		23-Dec-2004	24-May-2021	7,706.00	PERFORMANCE MONITORING SYSTEM
82186253	F200316232	US	US7876689	Granted		29-Jun-2005	25-Jul-2022	7,406.00	METHOD AND APPARATUS FOR LOAD BALANCING NETWORK INTERFACE ADAPTERS BASED ON NETWORK INFORMATION
82186562	F200316383	US	US7552238	Granted		30-Sep-2004	23-Dec-2020	7,406.00	METHOD AND APPARATUS FOR MAINTAINING NETWORK DEVICE CONFIGURATIONS
82187447	F200400179	US	US7143389	Granted		28-Jul-2004	N/A	N/A	SYSTEMS AND METHODS FOR GENERATING NODE LEVEL BYPASS CAPACITOR MODELS
82187564	F200400224	US	US7743383	Granted		1-Nov-2004	22-Dec-2021	7,406.00	ADAPTIVE COOPERATIVE SCHEDULING
82189400	F200401067	US	US7752623	Granted		16-Sep-2004	6-Jan-2022	7,406.00	SYSTEM AND METHOD FOR ALLOCATING RESOURCES BY EXAMINING A SYSTEM CHARACTERISTIC

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82189718	F200401204	US	US7339490	Granted		29-Jun-2004	N/A	N/A	MODULAR SENSOR ASSEMBLY
82189787	F200401266	US	US7643434	Granted		30-Sep-2004	5-Jul-2021	7,706.00	METHOD AND SYSTEM FOR MANAGING NETWORK NODES WHICH COMMUNICATE VIA CONNECTIVITY SERVICES OF A SERVICE PROVIDER
82190012	F200401406	US	US7057509	Granted		29-Jun-2004	N/A	N/A	MONITORING AN OBJECT WITH IDENTIFICATION DATA AND TRACKING DATA
82190207	F200401511	US	US8443171	Granted		30-Jul-2004	14-Nov-2020	3,606.00	RUN-TIME UPDATING OF PREDICTION HINT INSTRUCTIONS
82190210	F200401511	CN	CN200510088159 4	Granted		29-Jul-2005	29-Jul-2021	1,367.42	RUN-TIME UPDATING OF PREDICTION HINT INSTRUCTIONS
82190213	F200401511	GB	GB2416885	Granted		12-Jul-2005	12-Jul-2021	691.79	RUN-TIME UPDATING OF PREDICTION HINT INSTRUCTIONS
82191920	F200402290	US	US8977651	Granted		14-Apr-2004	10-Sep-2022	3,606.00	METHOD AND APPARATUS FOR MULTI-PROCESS ACCESS TO A LINKED-LIST
82193288	F200402795	US	US7660937	Granted		28-Jun-2006	9-Aug-2021	7,706.00	EMULATING A USB HOST CONTROLLER
82196321	F200403866	US	US7383471	Granted		28-Dec-2004	N/A	N/A	DIAGNOSTIC MEMORY DUMPING

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82197110	F200404278	US	US7500056	Granted		21-Jul-2004	3-Sep-2020	7,406.00	SYSTEM AND METHOD TO FACILITATE RESET IN A COMPUTER SYSTEM
82197320	F200404388	US	US8930400	Granted		22-Nov-2004	6-Jul-2022	3,766.00	A SYSTEM AND METHOD FOR DISCOVERING KNOWLEDGE COMMUNITIES
82197740	F200404591	US	US7743380	Granted		21-Jan-2005	22-Dec-2021	7,406.00	MONITORING CLUSTERED SOFTWARE APPLICATIONS
82198079	F200404777	US	US7539931	Granted		8-Apr-2005	26-Nov-2020	7,406.00	STORAGE ELEMENT FOR MITIGATING SOFT ERRORS IN LOGIC
82199306	F200405310	US	US7877740	Granted		13-Jun-2005	25-Jul-2022	7,406.00	HANDLING CAUGHT EXCEPTIONS
82199318	F200405319	US	US7634773	Granted		24-Nov-2004	15-Jun-2021	7,406.00	METHOD AND APPARATUS FOR THREAD SCHEDULING ON MULTIPLE PROCESSORS
82201661	F200406544	US	US8799466	Granted		31-Jan-2005	5-Feb-2022	3,606.00	METHOD AND APPARATUS FOR AUTOMATIC VERIFICATION OF A NETWORK ACCESS CONTROL CONSTRUCT FOR A NETWORK SWITCH
82203017	F200407176	US	US7853934	Granted		23-Jun-2005	14-Jun-2022	7,406.00	HOT-SWAPPING A DYNAMIC CODE GENERATOR

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82203827	F200407611	US	US7123172	Granted		29-Jul-2005	N/A	N/A	METHOD AND SYSTEM FOR DETERMINING AN OPTIMAL OR NEAR OPTIMAL SET OF CONTEXTS BY CONSTRUCTING A MULTI-DIRECTIONAL CONTEXT TREE
82203830	F200407611	US	US8085888	Granted		13-Oct-2006	27-Jun-2023	7,706.00	METHOD AND SYSTEM FOR DETERMINING AN OPTIMAL OR NEAR OPTIMAL SET OF CONTEXTS BY CONSTRUCTING A MULTI-DIRECTIONAL CONTEXT TREE
82204691	F200407938	US	US8997102	Granted		3-Jun-2005	30-Sep-2022	3,606.00	PRIORITIZATION OF PROCESSES FOR DEACTIVATING PROCESSES TO REDUCE MEMORY PRESSURE CONDITION
82204928	F200408027	US	US7941804	Granted		31-Oct-2005	10-Nov-2022	7,406.00	ALLOCATING RESOURCES AMONG TIERED PARTITIONS OF DIFFERENT TYPES
82206494	F200500286	US	US7673305	Granted		23-Oct-2006	2-Sep-2021	7,406.00	SYSTEM AND METHOD OF EXPEDITING CERTAIN JOBS IN A COMPUTER PROCESSING SYSTEM
82206599	F200500344	US	US7373565	Granted		23-Aug-2005	N/A	N/A	START/STOP CIRCUIT FOR PERFORMANCE COUNTER

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82206602	F200500344	GB	GB2429552	Granted		2-Aug-2006	2-Aug-2021	618.83	START/STOP CIRCUIT FOR PERFORMANCE COUNTER
82206632	F200500349	US	US7711914	Granted		28-Jun-2005	4-Nov-2021	7,406.00	DEBUGGING USING VIRTUAL WATCHPOINTS
82206881	F200500508	US	US7323920	Granted		13-Jun-2005	N/A	N/A	SOFT-ERROR RATE IMPROVEMENT IN A LATCH USING LOW-PASS FILTERING
82207067	F200500606	US	US8990547	Granted		23-Aug-2005	24-Sep-2022	3,606.00	SYSTEMS AND METHODS FOR RE-ORDERING INSTRUCTIONS
82207133	F200500634	US	US8346740	Granted		22-Jul-2005	1-Jul-2020	3,606.00	FILE CACHE MANAGEMENT SYSTEM
82208279	F200501135	US	US7738681	Granted		1-Nov-2005	15-Dec-2021	7,706.00	FINGERPRINT AND PHYSICAL ATTRIBUTE DETECTION
82208402	F200501180	US	US8739288	Granted		31-Jul-2007	27-Nov-2021	3,606.00	AUTOMATIC DETECTION OF VULNERABILITY EXPLOITS
82208507	F200501222	US	US7765528	Granted		21-Sep-2005	27-Jan-2022	7,406.00	IDENTIFYING SOURCES OF MEMORY RETENTION
82208855	F200501422	US	US7903556	Granted		3-Nov-2005	8-Sep-2022	7,706.00	METHOD OF CONTROLLING DATA TRANSFERS BETWEEN NODES IN A COMPUTER SYSTEM
82209365	F200501734	US	US7816975	Granted		20-Sep-2005	19-Apr-2022	7,706.00	CIRCUIT AND METHOD FOR BIAS VOLTAGE GENERATION

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82209767	F200501965	US	US8650296	Granted		31-Oct-2006	11-Aug-2021	3,606.00	WORKLOAD REALLOCATION INVOLVING INTER-SERVER TRANSFERS OF SOFTWARE LICENSE RIGHTS AND INTRA-SERVER TRANSFER OF HARDWARE RESOURCES
82209998	F200502087	US	US8949404	Granted		24-May-2005	3-Aug-2022	3,766.00	ACQUIRING GRAPHICAL OPERATING SYSTEM POST-FAILURE SCREEN
82210232	F200502177	US	US7636643	Granted		29-Jun-2006	22-Jun-2021	7,406.00	GAUGE HAVING A DYNAMICALLY UPDATED INDICIA OF A VALUE'S NORMAL RANGE, AND METHODS AND MEANS TO FACILITATE THE DISPLAY AND UPDATE OF SAME
82210268	F200502188	US	US7594223	Granted		27-Jun-2005	22-Mar-2021	7,406.00	STRAIGHT-LINE POST-INCREMENT OPTIMIZATION FOR MEMORY ACCESS INSTRUCTIONS
82210868	F200502476	US	US8595612	Granted		26-Oct-2006	26-May-2021	3,606.00	DISPLAY OF WEB PAGE WITH AVAILABLE DATA
82211354	F200502764	US	US8391432	Granted		8-Aug-2005	5-Sep-2024	7,706.00	DATA SERIALIZER
82212575	F200503321	US	US8924590	Granted		14-Feb-2006	30-Jun-2022	3,606.00	SYSTEM AND METHOD FOR COMMUNICATIN G IN A NETWORKED SYSTEM

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82212875	F200503479	US	US8688890	Granted		5-Dec-2006	1-Oct-2021	3,766.00	BIT ORDERING FOR COMMUNICATING AN ADDRESS ON A SERIAL FABRIC
82213166	F200503643	US	US7610468	Granted		26-Oct-2006	27-Apr-2021	7,706.00	MODIFIED BUDDY SYSTEM MEMORY ALLOCATION
82213211	F200503688	US	US8738346	Granted		26-Oct-2006	27-Nov-2021	3,606.00	METHOD AND APPARATUS FOR CONTROLLING MULTIPLE SIMULATIONS
82214159	F200504348	US	US7672923	Granted		31-Oct-2006	2-Sep-2021	7,406.00	GRID NETWORK MANAGEMENT VIA AUTOMATIC TREND ANALYSIS OF A SERVICE LEVEL AGREEMENT.
82214258	F200504419	US	US8521652	Granted		19-May-2006	27-Feb-2021	3,606.00	DISCOVERING LICENSES IN SOFTWARE FILES
82215572	F200505182	US	US7970143	Granted		5-Aug-2005	28-Dec-2022	7,706.00	SYSTEM, METHOD AND APPARATUS TO OBTAIN A KEY FOR ENCRYPTION/DECRYPTION/DATA RECOVERY FROM AN ENTERPRISE CRYPTOGRAPHY KEY MANAGEMENT SYSTEM

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82815953	F200505182	DE	DE602005030748.6	Granted		5-Aug-2005	5-Aug-2021	1,822.09	SYSTEM, METHOD AND APPARATUS TO OBTAIN A KEY FOR ENCRYPTION/DECRYPTION/DATA RECOVERY FROM AN ENTERPRISE CRYPTOGRAPHY KEY MANAGEMENT SYSTEM
82815955	F200505182	GB	GB1913509	Granted		5-Aug-2005	5-Aug-2021	691.79	SYSTEM, METHOD AND APPARATUS TO OBTAIN A KEY FOR ENCRYPTION/DECRYPTION/DATA RECOVERY FROM AN ENTERPRISE CRYPTOGRAPHY KEY MANAGEMENT SYSTEM
82215986	F200505367	US	US7895409	Granted		30-Jul-2007	22-Aug-2022	7,406.00	APPLICATION INSPECTION TOOL FOR DETERMINING A SECURITY PARTITION
82216013	F200505381	US	US7657776	Granted		20-Sep-2006	2-Aug-2021	7,406.00	CONTAINING MACHINE CHECK EVENTS IN A VIRTUAL PARTITION
82216367	F200505552	US	US9038051	Granted		31-Oct-2006	19-Nov-2022	3,606.00	SELECTING PATCH SOLUTIONS BASED ON AVAILABILITY OF INFORMATION REGARDING PATCHES PREVIOUSLY INSTALLED ON USER SYSTEM

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82216469	F200505597	US	US7698545	Granted		24-Apr-2006	13-Oct-2021	7,406.00	COMPUTER CONFIGURATION CHRONOLOGY GENERATOR
82216655	F200505721	US	US7872965	Granted		22-Aug-2005	18-Jul-2022	7,406.00	NETWORK RESOURCE TEAMING PROVIDING RESOURCE REDUNDANCY AND TRANSMIT/RECEIVE LOAD-BALANCING THROUGH A PLURALITY OF REDUNDANT PORT TRUNKS
82217171	F200505962	US	US7971193	Granted		14-Jul-2006	28-Dec-2022	7,406.00	METHODS FOR PERFORMINING CROSS MODULE CONTEXT-SENSITIVE SECURITY ANALYSIS
82217174	F200505968	US	US7644204	Granted		31-Oct-2006	5-Jul-2021	7,406.00	SCSI I/O COORDINATOR
82217573	F200506169	US	US8516218	Granted		30-Oct-2006	20-Feb-2021	3,606.00	PATTERN-BASED MAPPING FOR STORAGE SPACE MANAGEMENT
82217705	F200506280	US	US8522042	Granted		31-Oct-2006	27-Feb-2021	3,766.00	METHOD AND APPARATUS FOR ENFORCEMENT OF SOFTWARE LICENSE PROTECTION
82217870	F200506400	US	US7721133	Granted		27-Apr-2006	18-Nov-2021	7,706.00	SYSTEMS AND METHODS OF SYNCHRONIZING REFERENCE FREQUENCIES
82218650	F200506827	US	US7953996	Granted		18-Dec-2006	30-Nov-2022	7,406.00	ACPI TO FIRMWARE INTERFACE

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82218854	F200506945	US	US9298668	Granted		6-Jul-2010	29-Sep-2023	3,766.00	BIT ERROR RATE REDUCTION BUFFER, METHOD AND APPARATUS
82218926	F200506982	US	US8402463	Granted		30-Oct-2006	19-Sep-2024	7,706.00	HARDWARE THREADS PROCESSOR CORE UTILIZATION
82219271	F200507176	US	US7861042	Granted		23-Oct-2006	28-Jun-2022	7,406.00	PROCESSOR ACQUISITION OF OWNERSHIP OF ACCESS COORDINATOR FOR SHARED RESOURCE
82219313	F200507184	US	US7855957	Granted		30-Aug-2006	21-Jun-2022	7,406.00	METHOD AND SYSTEM OF TRANSMIT LOAD BALANCING ACROSS MULTIPLE PHYSICAL PORTS
82219409	F200507258	US	US7502888	Granted		7-Feb-2006	N/A	N/A	SYMMETRIC MULTIPROCESSOR SYSTEM
82219514	F200507306	US	US8739162	Granted		27-Apr-2007	27-Nov-2021	3,606.00	ACCURATE MEASUREMENT OF MULTITHREADED PROCESSOR CORE UTILIZATION AND LOGICAL PROCESSOR UTILIZATION
82219718	F200507426	US	US7743244	Granted		31-Oct-2006	22-Dec-2021	7,406.00	COMPUTER SYSTEM MODEL GENERATION WITH TRACKING OF ACTUAL COMPUTER SYSTEM CONFIGURATION

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82241207	F200507596	US	US8650579	Granted		29-Oct-2007	11-Aug-2021	3,606.00	CONTAINMENT FOR COMPUTER-SOFTWARE UPDATE INSTALLATION PROCESSES
82220024	F200507702	US	US10198709	Granted		27-Mar-2006	5-Aug-2022	2,006.00	MANAGING ASSETS USING AT LEAST ONE POLICY AND ASSET LOCATIONS
82220027	F200507704	US	US8510450	Granted		22-Apr-2006	13-Feb-2021	3,606.00	RECONCILIATIO N OF WEB SERVER SESSION STATES WITH CLIENT BROWSER STATES
82220048	F200507714	US	US7710862	Granted		30-Aug-2006	4-Nov-2021	7,406.00	METHOD AND SYSTEM OF ASSIGNING MEDIA ACCESS CONTROL (MAC) ADDRESSES ACROSS TEAMED COMMUNICATIO N PORTS
82220135	F200507803	US	US7788477	Granted		31-Jan-2007	28-Feb-2022	7,406.00	METHODS, APPARATUS AND ARTICLES OF MANUFACTURE TO CONTROL OPERATING SYSTEM IMAGES FOR DISKLESS SERVERS
82220549	F200600217	US	US8799591	Granted		30-Jan-2007	5-Feb-2022	3,606.00	READ-WRITE SPINLOCK WITH NO MUTUAL EXCLUSION AMONG READERS
82220579	F200600243	US	US7774652	Granted		19-Sep-2006	10-Feb-2022	7,706.00	CIRCUITRY AND METHOD TO DETECT CONDITIONS OF DATA

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82220864	F200600374	US	US6871300	Granted		4-May-2001	N/A	N/A	EMBEDDED SERVER CHASSIS HARDWARE MASTER SYSTEM AND METHOD
82220945	F200600412	US	US7515428	Granted		31-Oct-2006	N/A	N/A	DESIGN FOR AUTOMATIC POSITIONING OF POWER SUPPLY MODULE HANDLE
82222385	F200600835	US	US7941812	Granted		30-Jan-2007	10-Nov-2022	7,406.00	INPUT/OUTPUT VIRTUALIZATIO N THROUGH OFFLOAD TECHNIQUES
82223009	F200601155	US	US7729368	Granted		19-Jan-2007	1-Dec-2021	7,406.00	NETWORK BUFFER CACHING
82224527	F200601902	US	US8739143	Granted		31-Jan-2007	27-Nov-2021	3,606.00	PROFILING METRICS FOR COMPUTER PROGRAMS
82224551	F200601915	US	US8504943	Granted		24-Oct-2006	6-Feb-2021	3,606.00	DISPLAYING GROUP ICONS REPRESENTING RESPECTIVE GROUPS OF NODES
82224686	F200601982	US	US7895581	Granted		26-Jan-2007	22-Aug-2022	7,406.00	PROFILING COLLECTOR FOR COMPUTER SYSTEM
82225349	F200602280	US	US8782779	Granted		26-Sep-2007	15-Jan-2022	3,766.00	SYSTEM AND METHOD FOR ACHIEVING PROTECTED REGION WITHIN COMPUTER SYSTEM
82226180	F200602579	US	US7730365	Granted		30-Apr-2007	1-Dec-2021	7,406.00	WORKLOAD MANAGEMENT FOR MAINTAINING REDUNDANCY OF NON-DATA COMPUTER COMPONENTS

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82228010	F200603372	US	US8966474	Granted		30-Apr-2007	24-Aug-2022	3,606.00	MANAGING VIRTUAL MACHINES USING SHARED IMAGE
82229636	F200603919	US	US8768978	Granted		30-Jul-2007	1-Jan-2022	3,606.00	SINGLE-OPERATION ON-LINE SCHEMA EVOLUTION
82231193	F200700459	US	US7765242	Granted		10-May-2007	27-Jan-2022	7,406.00	METHODS AND APPARATUS FOR STRUCTURE LAYOUT OPTIMIZATION FOR MULTI-THREADED PROGRAMS
82231262	F200700495	US	US8584138	Granted		30-Jul-2007	12-May-2021	3,606.00	DIRECT SWITCHING OF SOFTWARE THREADS BY SELECTIVELY BYPASSING RUN QUEUE BASED ON SELECTION CRITERIA
82232414	F200700918	US	US8352957	Granted		31-Jan-2008	8-Jul-2020	3,606.00	APPARATUS AND METHOD FOR PASSING METADATA IN STREAMS MODULES
82233344	F200701141	US	US9081627	Granted		31-Jul-2007	14-Jan-2023	3,766.00	WORKLOAD MANAGEMENT WITH RESOURCE TRANSFER SEQUENCE PLANNED AS A FUNCTION OF RANKING OF RESOURCE ALLOCATIONS
82233425	F200701161	US	US7671634	Granted		30-Jul-2007	2-Sep-2021	7,706.00	REDUNDANT CLOCK SWITCH CIRCUIT

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82233830	F200701258	US	US7827266	Granted		31-Jul-2007	2-May-2022	7,406.00	SYSTEM AND METHOD OF CONTROLLING MULTIPLE COMPUTER PLATFORMS
82235330	F200701661	US	US8505019	Granted		31-Oct-2008	6-Feb-2021	3,606.00	SYSTEM AND METHOD FOR INSTANT CAPACITY/WORKLOAD MANAGEMENT INTEGRATION
82235378	F200701686	US	US7783823	Granted		31-Jul-2007	24-Feb-2022	7,706.00	HARDWARE DEVICE DATA BUFFER
82235381	F200701686	GB	GB2451549	Granted		7-Jul-2008	7-Jul-2021	443.74	HARDWARD DEVICE DATA BUFFER
82237277	F200702190	US	US8621470	Granted		24-Jan-2008	30-Jun-2021	3,606.00	WAKEUP-ATTRIBUTE-BASED ALLOCATION OF THREADS TO PROCESSORS
82237688	F200702350	US	US7551039	Granted		19-Oct-2007	23-Dec-2020	7,406.00	PHASE ADJUSTMENT IN PHASE-LOCKED LOOPS USING MULTIPLE OSCILLATOR SIGNALS
82238465	F200702551	US	US7929919	Granted		25-Sep-2008	19-Oct-2022	7,706.00	SYSTEMS AND METHODS FOR A PLL-ADJUSTED REFERENCE CLOCK
82238810	F200702649	US	US9389921	Granted		15-Dec-2008	12-Jan-2024	3,766.00	SYSTEM AND METHOD FOR FLEXIBLE DEVICE DRIVER RESOURCE ALLOCATION
82240934	F200703378	US	US7518418	Granted		25-Sep-2007	N/A	N/A	RATIO GRANULARITY CLOCK DIVIDER CIRCUIT AND METHOD

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82240937	F200703378	TW	TWI435538	Granted		25-Aug-2008	20-Apr-2021	359.56	RATIO GRANULARITY CLOCK DIVIDER CIRCUIT AND METHOD
82240940	F200703379	US	US7521972	Granted		25-Sep-2007	N/A	N/A	FIFTY PERCENT DUTY CYCLE CLOCK DIVIDER CIRCUIT AND METHOD
82240943	F200703379	CN	CN200810149759.0	Granted		25-Sep-2008	25-Sep-2021	1,032.98	FIFTY PERCENT DUTY CYCLE CLOCK DIVIDER CIRCUIT AND METHOD
82240946	F200703380	US	US7567097	Granted		29-Sep-2007	28-Jan-2021	7,406.00	PRE-DRIVER CIRCUIT AND APPARATUS USING SAME
82562920	F200801253	US	US9015454	Granted		2-May-2008	21-Oct-2022	3,766.00	BINDING DATA TO COMPUTERS USING CRYPTOGRAPHIC CO-PROCESSOR AND MACHINE-SPECIFIC AND PLATFORM-SPECIFIC KEYS
82247759	F200801497	US	US8392928	Granted		28-Oct-2008	5-Sep-2020	3,606.00	AUTOMATED WORKLOAD PLACEMENT RECOMMENDATIONS FOR A DATA CENTER
82247768	F200801502	US	US9367197	Granted		28-Jan-2009	14-Dec-2023	3,766.00	DISPLAYING COMPUTER RESOURCE HIERARCHY
82247912	F200801603	US	US8527988	Granted		31-Jul-2009	3-Mar-2021	3,606.00	PROXIMITY MAPPING OF VIRTUAL-MACHINE THREADS TO PROCESSORS

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82931281	F200801779	CN	CN200980160839.9	Granted		9-Aug-2009	9-Aug-2020	666.46	ILLUMINABLE INDICATOR OF ELECTRONIC DEVICE BEING ENABLED BASED AT LEAST ON USER PRESENCE
82852934	F200801779	US	US8692683	Granted		9-Aug-2009	8-Oct-2021	3,766.00	ILLUMINABLE INDICATOR OF ELECTRONIC DEVICE BEING ENABLED BASED AT LEAST ON USER PRESENCE
82248920	F200802382	US	US8392736	Granted		31-Jul-2009	5-Sep-2020	3,606.00	MANAGING MEMORY POWER USAGE
82250024	F200803342	US	US8694974	Granted		29-Apr-2009	8-Oct-2021	3,606.00	LOAD-CHECKING ATOMIC SECTION
82250579	F200803737	US	US8607245	Granted		15-May-2009	10-Jun-2021	3,606.00	DYNAMIC PROCESSOR-SET MANAGEMENT
82251356	F200900425	US	US7797530	Granted		9-Apr-2001	14-Mar-2022	7,706.00	AUTHENTICATION AND ENCRYPTION METHOD AND APPARATUS FOR A WIRELESS LOCAL ACCESS NETWORK
82258727	F200902756	US	US8713139	Granted		29-Oct-2009	29-Oct-2021	3,606.00	AUTOMATIC FIXUP OF NETWORK CONFIGURATION ON SYSTEM IMAGE MOVE
82260449	F200903890	US	US8688838	Granted		14-Dec-2009	1-Oct-2021	3,606.00	PROFILE MANAGEMENT SYSTEMS
82260881	F200904195	US	US8401925	Granted		26-Jan-2010	19-Sep-2020	3,606.00	MULTI-PRODUCT SOFTWARE LICENSE SELECTION

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82261280	F200904423	US	US8452717	Granted		27-Apr-2010	28-Nov-2020	3,606.00	PRESENTING AN INTERACTIVE GUIDANCE STRUCTURE IN A COLLABORATIV E ENVIRONMENT
82934011	F200904474	US	US9425902	Granted		11-Jan-2010	23-Feb-2024	3,766.00	SYSTEM INCLUDING DRIVER CIRCUIT FOR ELECTRICAL SIGNALING AND OPTICAL SIGNALING
82261919	F200904777	US	US8356198	Granted		30-Mar-2010	15-Jul-2020	3,606.00	PERFORMING POWER MANAGEMENT BASED ON INFORMATION REGARDING ZONES OF DEVICES IN A SYSTEM
82263782	F201000860	US	US8353489	Granted		21-Sep-2010	15-Jan-2021	$4,260.0 0	MOUNTING KIT
82264178	F201001112	US	US8356141	Granted		28-Jun-2010	15-Jan-2021	$4,260.0 0	IDENTIFYING REPLACEMENT MEMORY PAGES FROM THREE PAGE RECORD LISTS
82595313	F201001837	US	US9049034	Granted		2-Feb-2011	2-Dec-2022	3,766.00	MULTICAST FLOW MONITORING
82271222	F201003322	US	US6898210	Granted		31-May-2000	N/A	N/A	SYSTEM AND METHOD FOR PROVIDING A LOCAL AREA NETWORK UTILIZING REMOTE TRANSCEIVERS
82271810	F201003559	US	US7133446	Granted		19-Oct-2000	N/A	N/A	PERFORMANCE INDICATOR FOR WIRELESS DIGITAL SIGNAL RECEPTION

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82272365	F201003769	US	US6763001	Granted		17-Aug-2000	N/A	N/A	DISCOVERING NON MANAGED DEVICES IN A NETWORK SUCH AS A LAN USING TELNET
82272374	F201003772	US	US6775243	Granted		15-Sep-2000	N/A	N/A	GRAPHICALLY DISTINGUISHING A PATH BETWEEN TWO POINTS ON A NETWORK
82272485	F201003815	US	US7194534	Granted		4-Apr-2001	N/A	N/A	DISPLAY OF PHONES ON A MAP OF A NETWORK
82272548	F201003843	US	US6954785	Granted		17-Aug-2000	N/A	N/A	A SYSTEM FOR IDENTIFYING DEVICES THAT HAVE THE HIGHEST TOTAL VOLUME DATA TRANSFER AND COMMUNICATE WITH AT LEAST A THRESHOLD NUMBER OF CLIENT DEVICES
82274099	F201004538	US	US7702726	Granted		10-Apr-2002	20-Oct-2021	7,706.00	SYSTEM AND METHODS FOR PROVIDING PRESENCE SERVICES IN IP NETWORK
82274312	F201004586	US	US7155622	Granted		15-May-2003	N/A	N/A	SYSTEM AND METHOD FOR THE MANAGEMENT OF POWER SUPPLIED OVER DATA LINES
82274948	F201004727	US	US8416766	Granted		2-Jun-2009	9-Oct-2024	7,706.00	METHOD FOR IMPLEMENTING DISTRIBUTED VOICE FUNCTIONS INTO SOFTWARE APPLICATIONS

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82274954	F201004727	CN	CN200910146274.0	Granted		26-Jun-2009	26-Jun-2021	1,032.98	METHOD FOR IMPLEMENTING DISTRIBUTED VOICE FUNCTIONS INTO SOFTWARE APPLICATIONS
82275887	F201005039	US	US8725781	Granted		30-Jan-2011	13-Nov-2021	3,766.00	SENTIMENT CUBE
82275890	F201005041	US	US8949211	Granted		31-Jan-2011	3-Aug-2022	3,766.00	OBJECTIVE-FUNCTION BASED SENTIMENT
82586665	F201005286	US	US8966210	Granted		4-Apr-2011	24-Aug-2022	3,606.00	ZONE GROUP CONNECTIVITY INDICATOR
82581296	F201005340	US	US8713183	Granted		27-Mar-2011	29-Oct-2021	3,766.00	RESOURCE COMPATABILITY FOR DATA CENTERS
82677110	F201005997	US	US8719478	Granted		11-Aug-2011	6-Nov-2021	3,606.00	DEADLOCK PREVENTION
82277090	F300202276	US	US7143316	Granted		8-Apr-2003	N/A	N/A	FAULT DIAGNOSIS IN A NETWORK
82069802	F30990155	US	US7096204	Granted		6-Oct-2000	N/A	N/A	ELECTRONIC COMMERCE SYSTEM
82072100	F50980009	US	US6891863	Granted		6-Oct-2000	N/A	N/A	DEVICE AND METHODS FOR PROCESSING CHANNELS IN A DATA STREAM
82664931	F700205294	US	US8478900	Granted		18-May-2011	2-Jan-2021	3,766.00	DETERMINING MISCONNECTION OF AN ELECTRONIC DEVICE TO A NETWORK DEVICE USING ZONE INFORMATION

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82774491	F700205856	US	US8578023	Granted		29-Jul-2011	5-May-2021	3,606.00	COMPUTER RESOURCE UTILIZATION MODELING FOR MULTIPLEWORK LOADS

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81967265	F10001399	US	US7032074	Expired		1-Apr-2004	N/A	N/A	METHOD AND MECHANISM TO USE A CACHE TO TRANSLATE FROM A VIRTUAL BUS TO A PHYSICAL BUS
81967427	F10001428	US	US7209248	Granted		8-Dec-2000	N/A	N/A	MANAGING THE LIFETIME OF DISTRIBUTED RESOURCE DATA USING TEMPORAL SCOPES
81969518	F10002098	US	US6557005	Granted		12-Sep-2000	N/A	N/A	METHOD AND SYSTEM FOR DYNAMICALLY GENERATING WEB FORMS IN A VARIETY OF LANGUAGES
81969818	F10002141	US	US6875930	Granted		18-Apr-2002	N/A	N/A	OPTIMIZED CONDUCTOR ROUTING FOR MULTIPLE COMPONENTS ON A PRINTED CIRCUIT BOARD
81969821	F10002141	TW	TWI255678	Granted		11-Dec-2002	20-May-2021	686.40	OPTIMIZED CONDUCTOR ROUTING FOR MULTIPLE COMPONENTS ON A PRINTED CIRCUIT BOARD
81982970	F10006721	US	US8392586	Granted		15-May-2001	5-Sep-2020	3,606.00	METHOD AND APPARATUS TO MANAGE TRANSACTIONS AT A NETWORK STORAGE DEVICE
81988511	F10010394	US	US6859892	Granted		25-Apr-2001	N/A	N/A	SYNCHRONOUS BREAKPOINT SYSTEM AND METHOD

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81989456	F10010858	US	US7020800	Granted		24-Jan-2002	N/A	N/A	SYSTEM AND METHOD FOR MEMORY FAILURE RECOVERY USING LOCKSTEP PROCESSES
82079957	F100110432	JP	JP4309215	Granted		9-Sep-2003	15-May-2021	1,069.38	CIRCUIT COOLING APPARATUS
82079963	F100110432	US	US7019973	Granted		9-Jun-2004	N/A	N/A	CIRCUIT COOLING APPARATUS
82079960	F100110432	GB	GB2393330	Granted		28-Aug-2003	28-Aug-2020	754.86	CIRCUIT COOLING APPARATUS
82080047	F100110473	US	US7218917	Granted		15-Jan-2002	N/A	N/A	METHOD FOR SEARCHING NODES FOR INFORMATION
82080056	F100110473	JP	JP4002890	Granted		15-Jan-2003	24-Aug-2021	1,655.14	A METHOD FOR SEARCHING NODES FOR INFORMATION
82080059	F100110473	DE	DE60308144.4	Granted		15-Jan-2003	15-Jan-2021	2,257.04	A METHOD FOR SEARCHING NODES FOR INFORMATION
82081022	F100111090	US	US6886353	Granted		31-Oct-2003	N/A	N/A	COOLING SYSTEM
82081025	F100111090	US	US6854287	Granted		31-Oct-2003	N/A	N/A	COOLING SYSTEM
82097813	F100111090	US	US6938433	Granted		4-Dec-2002	N/A	N/A	COOLING SYSTEM WITH EVAPORATORS DISTRIBUTED IN SERIES
82097822	F100111090	JP	JP4927335	Granted		21-Nov-2003	17-Feb-2021	663.85	COOLING SYSTEM WITH EVAPORATORS DISTRIBUTED IN SERIES

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82097831	F100111090	GB	GB1466234	Granted		21-Nov-2003	21-Nov-2020	753.48	COOLING SYSTEM WITH EVAPORATORS DISTRIBUTED IN SERIES
82097834	F100111090	DE	DE60305436.6	Granted		21-Nov-2003	21-Nov-2020	2,039.61	COOLING SYSTEM WITH EVAPORATORS DISTRIBUTED IN SERIES
82097837	F100111090	FR	FR1466234	Granted		21-Nov-2003	21-Nov-2020	837.35	COOLING SYSTEM WITH EVAPORATORS DISTRIBUTED IN SERIES
82082273	F100111613	US	US6957353	Granted		31-Oct-2001	N/A	N/A	SYSTEM AND METHOD FOR PROVIDING MINIMAL POWER-CONSUMING REDUNDANT COMPUTING HARDWARE FOR DISTRIBUTED SERVICES
81990701	F10011295	US	US8036983	Granted		18-Jan-2002	11-Apr-2023	7,706.00	SYSTEM FOR AND METHOD OF WEB BASED NON-WAGE COMPENSATION
81998180	F10014757	US	US7020145	Granted		24-Sep-2001	N/A	N/A	NETWORK TOPOLOGY MANAGER
82001252	F10016873	US	US7571143	Granted		15-Jan-2002	4-Feb-2021	7,706.00	SOFTWARE PAY-PER-USE PRICING
82006175	F10019538	US	US6912607	Granted		6-Feb-2002	N/A	N/A	METHOD AND APPARATUS FOR ASCERTAINING THE STATUS OF MULTIPLE DEVICES SIMULTANEOUS LY OVER A DATA BUS

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82006970	F10019860	US	US6832270	Granted		8-Mar-2002	N/A	N/A	VIRTUALIZATIO N OF COMPUTER SYSTEM INTERCONNECTS
82082900	F100200127	US	US7085884	Granted		30-Jun-2003	N/A	N/A	SYSTEM AND METHOD FOR STORING OPERATIONAL DATA OF A STORAGE AUTOMATION DEVICE TO A REMOVABLE NONVOLATILE MEMORY COMPONENT
82082906	F100200127	US	US8370574	Granted		13-Jun-2006	5-Aug-2020	3,606.00	SYSTEM AND METHOD FOR STORING CONFIGURATION DATA OF A STORAGE AUTOMATION DEVICE
82083239	F100200246	US	US7266598	Granted		22-Oct-2002	N/A	N/A	PROGRAMMABL E DATA CENTER
82085048	F100201076	US	US6822878	Granted		9-Oct-2002	N/A	N/A	CIRCUIT BOARD SUPPORT ARRANGEMENT, METHOD, AND METHOD FOR USING THE SAME
82085051	F100201076	GB	GB2394121	Granted		23-Sep-2003	23-Sep-2020	754.86	CIRCUIT BOARD SUPPORT ARRANGEMENT, METHOD, AND METHOD FOR USING THE SAME
82085873	F100201476	US	US7519800	Granted		27-Mar-2003	N/A	N/A	APPARATUS AND METHOD FOR ENFORCING HOMOGENEITY WITHIN PARTITIONS OF HETEROGENEOU S COMPUTER SYSTEMS

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82086638	F100201724	US	US6854284	Granted		31-Oct-2003	N/A	N/A	COOLING OF DATA CENTERS
82086647	F100201724	US	US6868683	Granted		31-Oct-2003	N/A	N/A	COOLING OF DATA CENTERS
82086650	F100201724	US	US6945058	Granted		14-May-2004	N/A	N/A	COOLING OF DATA CENTERS
82086680	F100201734	US	US6812719	Granted		28-May-2003	N/A	N/A	ELECTRONIC PROBE WITH A TIP THAT IS SECURABLE TO AN ELECTRONIC DEVICE
82087196	F100201875	US	US6924777	Granted		17-Mar-2003	N/A	N/A	ENHANCED ANTENNA USING FLEXIBLE CIRCUITRY
82087199	F100201875	JP	JP4421333	Granted		2-Mar-2004	11-Dec-2020	917.77	ANTENNA WITH ENHANCED PERFORMANCE USING FLEXIBLE CIRCUIT ELEMENT
82087886	F100202130	US	US7229050	Granted		27-Nov-2002	N/A	N/A	RACEWAY SYSTEM
82088003	F100202179	US	US7513779	Granted		4-Jun-2003	N/A	N/A	CONNECTOR HAVING A BYPASS CAPACITOR AND METHOD FOR REDUCING THE IMPEDANCE AND LENGTH OF A RETURN-SIGNAL PATH
82088006	F100202179	GB	GB2402813	Granted		19-May-2004	19-May-2021	764.74	CONNECTOR HAVING A BYPASS CAPACITOR AND METHOD FOR REDUCING THE IMPEDANCE AND LENGTH OF A RETURN-SIGNAL PATH

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82088642	F100202606	US	US7058828	Granted		12-Aug-2002	N/A	N/A	SYSTEM, METHOD AND APPARATUS FOR THE FREQUENCY MANAGEMENT OF BLADES IN A BLADED ARCHITECTURE BASED ON PERFORMANCE REQUIREMENTS
82088648	F100202606	GB	GB2393540	Granted		25-Jul-2003	25-Jul-2021	837.70	SYSTEM, METHOD AND APPARATUS FOR THE FREQUENCY MANAGEMENT OF BLADES IN A BLADED ARCHITECTURE BASED ON PERFORMANCE REQUIREMENTS
82088660	F100202606	US	US7076671	Granted		12-Aug-2002	N/A	N/A	MANAGING AN OPERATING FREQUENCY OF PROCESSORS IN A MULTI-PROCESSOR COMPUTER SYSTEM
82088894	F100202721	US	US6925409	Granted		3-Oct-2002	N/A	N/A	SYSTEM AND METHOD FOR PROTECTION OF ACTIVE FILES DURING EXTREME CONDITIONS
82089791	F100203149	US	US6854092	Granted		12-Aug-2002	N/A	N/A	REDUCING VARIATION IN RANDOMIZED NANOSCALE CIRCUIT CONNECTIONS
82090853	F100204043	US	US7360295	Granted		15-Mar-2005	N/A	N/A	SYSTEM AND METHOD FOR SECURELY POSITIONING APPARATUS WITHIN A HOUSING

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82091672	F100204699	US	US6867362	Granted		7-Mar-2003	N/A	N/A	CABLE EXTENSION FOR REDUCING EMI EMISSIONS
82093010	F200205329	US	US6856518	Granted		14-Jul-2003	N/A	N/A	ASSEMBLY FOR SUPPORTING A SHORT PRINTED CIRCUIT CARD
82093061	F200205355	US	US7673125	Granted		26-Jun-2003	2-Sep-2021	7,406.00	RESETTING MULTIPLE CELLS WITHIN A PARTITION OF A MULTIPLE PARTITION COMPUTER SYSTEM
82093649	F200205884	US	US7049796	Granted		17-Jan-2003	N/A	N/A	HOT SWAP POWER DELIVERY CIRCUIT
82093655	F200205884	GB	GB2397447	Granted		30-Dec-2003	30-Dec-2020	753.48	HOT SWAP POWER DELIVERY CIRCUIT
82093763	F200205935	US	US6877926	Granted		10-Sep-2002	N/A	N/A	SLIDE MEMBER POSITIVE COUPLING ALIGNMENT ASSEMBLY
82093766	F200205938	US	US7025430	Granted		10-Sep-2002	N/A	N/A	BALL RETAINER FORWARD LOCKING ASSEMBLY
82094612	F200206279	US	US7047471	Granted		3-Mar-2003	N/A	N/A	VOLTAGE MARGIN TESTING OF BLADED SERVERS
82095557	F200206690	US	US7039734	Granted		24-Sep-2002	N/A	N/A	SYSTEM AND METHOD OF MASTERING A SERIAL BUS

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82100279	F200208659	US	US7483142	Granted		3-May-2006	27-Jul-2020	7,406.00	SECURITY SYSTEMS AND MONITORING METHODS USING QUANTUM STATES
82100504	F200208714	US	US7068498	Granted		20-May-2003	N/A	N/A	COMPUTER SYSTEM WITH SLIDABLE MOTHERBOARD
82100846	F200208792	US	US6866540	Granted		18-Apr-2003	N/A	N/A	INDICIA-EQUIPPED ACTUATOR ASSEMBLY
82101308	F200208936	US	US7140801	Granted		22-Aug-2003	N/A	N/A	PRE-LOADING LATCH
82101962	F200209130	US	US7453701	Granted		17-Aug-2005	N/A	N/A	COMPUTER SYSTEM WITH MOVABLE CARD GUIDE
82103468	F200209593	US	US8533828	Granted		21-Jan-2003	10-Mar-2021	3,606.00	A SYSTEM FOR PROTECTING SECURITY OF A PROVISIONABLE NETWORK
82103564	F200209624	GB	GB2410846	Granted		2-Feb-2005	2-Feb-2021	691.79	REDUNDANT INPUT POWER SYSTEM
82217681	F200210205	US	US7092850	Granted		29-Sep-2005	N/A	N/A	SENSOR SIGNAL DEBOUNCING
82106249	F200300486	US	US7324685	Granted		20-Oct-2003	N/A	N/A	INSPECTION SYSTEMS AND METHODS

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82120604	F200302365	US	US7152174	Granted		6-Mar-2003	N/A	N/A	METHOD AND APPARATUS FOR OPERATING A SERVER SYSTEM INCLUDING DETERMINING THE POWER SUPPLIED BY ONE OF A PLURALITY OF POWER SUPPLIES BY MEASURING VOLTAGE ON A LOAD SHARE SIGNAL LINE
82121690	F200302533	US	US7015682	Granted		30-Jan-2003	N/A	N/A	CONTROL OF A POWER FACTOR CORRECTED SWITCHING POWER SUPPLY
82121813	F200302570	US	US6858792	Granted		19-Dec-2002	N/A	N/A	TOOL-LESS COUPLING ASSEMBLY
82167731	F200308561	US	US7539027	Granted		29-Oct-2007	26-Nov-2020	7,406.00	FORCE DISTRIBUTING SPRING ELEMENT
82167908	F200308604	US	US7035096	Granted		31-Oct-2003	N/A	N/A	LOCKING MECHANISM FOR REMOVABLE COMPONENTS
82169174	F200309140	US	US6989523	Granted		11-Apr-2003	N/A	N/A	PHOTON NUMBER RESOLVING SYSTEMS AND METHODS
82180925	F200309140	US	US7002133	Granted		3-Oct-2003	N/A	N/A	DETECTING ONE OR MORE PHOTONS FROM THEIR INTERACTIONS WITH PROBE PHOTONS IN A MATTER SYSTEM

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82169510	F200309294	US	US7578733	Granted		27-Jul-2004	25-Feb-2021	7,706.00	ENCLOSURES WITH REDUNDANT FANS IN DOORS WITH INTERLOCKS
82169516	F200309297	US	US7447043	Granted		22-Dec-2003	N/A	N/A	POWER CABLING ASSEMBLY
82170770	F200309815	US	US7608194	Granted		6-Jul-2007	27-Apr-2021	7,706.00	PHOTONIC STRUCTURES, DEVICES, AND METHODS
82171055	F200309900	US	US8825902	Granted		27-Oct-2003	2-Mar-2022	3,606.00	CONFIGURATION VALIDATION CHECKER
82173314	F200310798	US	US7275068	Granted		19-Dec-2003	N/A	N/A	DISCOVERING COMMUNITIES-OF-PRACTICE
82174166	F200311115	US	US7222246	Granted		26-Sep-2003	N/A	N/A	METHOD FOR DETERMINING NUMBER OF DYNAMICALLY TEMPERATURE-ADJUSTED POWER SUPPLY UNITS NEEDED TO SUPPLY POWER ACCORDING TO MEASURE OPERATING TEMPERATURE OF POWER SUPPLY UNITS
82178384	F200312862	US	US7496740	Granted		26-Jul-2004	24-Aug-2020	7,406.00	ACCESSING INFORMATION ASSOCIATED WITH AN ADVANCED CONFIGURATION AND POWER INTERFACE ENVIRONMENT

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82179812	F200313515	US	US7502699	Granted		29-Jul-2005	10-Sep-2020	7,406.00	SYSTEM AND METHOD FOR MONITORING POWER IN A FRONT END RECTIFIER POWER SYSTEM
82180610	F200313804	US	US7277292	Granted		28-Apr-2004	N/A	N/A	EXPANDABLE BRACING APPARATUS AND METHOD
82181489	F200314217	US	US7133173	Granted		26-Jul-2004	N/A	N/A	NONLINEAR ELECTROMAGNETIC QUANTUM INFORMATION PROCESSING
82181498	F200314217	JP	JP4684294	Granted		28-Jun-2005	18-Feb-2021	1,249.62	NONLINEAR ELECTROMAGNETIC QUANTUM INFORMATION PROCESSING
82181501	F200314217	CN	CN200580024861.2	Granted		28-Jun-2005	28-Jun-2021	1,367.42	NONLINEAR ELECTROMAGNETIC QUANTUM INFORMATION PROCESSING
82184933	F200315657	US	US7512825	Granted		27-Sep-2004	30-Sep-2020	7,406.00	RESPONDING TO DC POWER DEGRADATION
82184936	F200315657	GB	GB2418502	Granted		13-Sep-2005	13-Sep-2020	610.84	RESPONDING TO DC POWER DEGRADATION
82185953	F200316140	US	US7380146	Granted		22-Apr-2005	N/A	N/A	POWER MANAGEMENT SYSTEM
82191062	F200401898	US	US7330119	Granted		29-Apr-2005	N/A	N/A	REMOTE MEASUREMENT EMPLOYING RFID
82191953	F200401898	JP	JP5022417	Granted		11-Sep-2009	22-Jun-2021	844.09	REMOTE MEASUREMENT OF MOTION EMPLOYING RFID

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82193378	F200402827	US	US7031870	Granted		28-May-2004	N/A	N/A	DATA CENTER EVALUATION USING AN AIR RE-CIRCULATION INDEX
82193786	F200402979	US	US7643458	Granted		25-May-2005	5-Jul-2021	7,406.00	COMMUNICATIN G BETWEEN WIRELESS COMMUNITIES
82199909	F200405637	US	US7514816	Granted		19-May-2005	N/A	N/A	OUTPUT CURRENT THRESHOLD ADJUSTMENT FOR A POWER SUPPLY
82201862	F200406613	US	US7492803	Granted		10-Jun-2005	17-Aug-2020	7,406.00	FIBER-COUPLED SINGLE PHOTON SOURCE
82201871	F200406613	JP	JP5068256	Granted		9-Jun-2006	24-Aug-2020	307.99	FIBER-COUPLED SINGLE PHOTON SOURCE
82201952	F200406639	US	US7289690	Granted		15-Apr-2005	N/A	N/A	PHOTONIC CRYSTAL DEVICE FOR FLUID SENSING
82202276	F200406843	US	US7544072	Granted		29-Oct-2007	9-Dec-2020	7,406.00	RETRACTABLE PROTECTION APPARATUS FOR ELECTRONIC DEVICE PINS
82208555	F200501254	US	US7742310	Granted		29-Sep-2006	22-Dec-2021	7,706.00	SEQUENCER
82208558	F200501254	GB	GB2442308	Granted		12-Sep-2007	12-Sep-2020	438.03	SEQUENCER
82208633	F200501301	US	US7186150	Granted		27-Oct-2005	N/A	N/A	SPLIT KEY IN A PRESS-FIT CONNECTOR
82210004	F200502098	US	US8000462	Granted		12-Aug-2005	16-Feb-2023	7,706.00	SCREENING OF CALLS IN A PACKET-BASED NETWORK

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82210010	F200502098	CN	CN200680038219.4	Granted		7-Aug-2006	7-Aug-2020	985.42	SCREENING OF CALLS IN A PACKET-BASED NETWORK
82210016	F200502098	IN	IN280291	Granted		7-Aug-2006	7-Aug-2020	416.00	SCREENING OF CALLS IN A PACKET-BASED NETWORK
83881516	F200502098	DE	DE602006041022.0	Granted		7-Aug-2006	7-Aug-2020	1,272.38	SCREENING OF CALLS IN A PACKET-BASED NETWORK
83881518	F200502098	GB	GB1920586	Granted		7-Aug-2006	7-Aug-2020	524.44	SCREENING OF CALLS IN A PACKET-BASED NETWORK
82213148	F200503639	US	US7474810	Granted		15-May-2007	6-Jul-2020	7,406.00	METHOD AND APPARATUS FOR CONTROLLING LIGHT FLUX WITH SUB-MICRON PLASMON WAVEGUIDES
82214672	F200504645	US	US7924413	Granted		29-Feb-2008	12-Oct-2022	7,706.00	NANOWIRE-BASED PHOTONIC DEVICES
82214693	F200504645	US	US7465954	Granted		28-Apr-2006	N/A	N/A	NANOWIRE DEVICES AND SYSTEMS, LIGHT-EMITTING NANOWIRES, AND METHODS OF PRECISELY POSITIONING NANOPARTICLES
82214696	F200504645	US	US7910915	Granted		23-Oct-2008	22-Sep-2022	7,706.00	NANOWIRE DEVICES AND SYSTEMS, LIGHT-EMITTING NANOWIRES, AND METHODS OF PRECISELY POSITIONING NANOPARTICLES

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82216058	F200505397	US	US9015308	Granted		17-Jan-2007	21-Oct-2022	3,766.00	MULTILAYER DISTRIBUTED PROCESSING SYSTEM
82216061	F200505397	GB	GB2449037	Granted		17-Jan-2007	17-Jan-2021	531.28	MULTILAYER DISTRIBUTED PROCESSING SYSTEM
82217819	F200506362	US	US7540746	Granted		6-Apr-2006	N/A	N/A	ELECTRICAL ENCODING OF CABLE TYPES AND CONFIGURATIONS
82219115	F200507109	CN	CN200780028366.8	Granted		11-Jul-2007	11-Jul-2020	985.42	COMPACT SYSTEMS FOR GENERATING POLARIZATION-ENTANGLED PHOTONS
83087119	F200507109	FR	FR2047319	Granted		11-Jul-2007	11-Jul-2020	483.88	COMPACT SYSTEMS FOR GENERATING POLARIZATION-ENTANGLED PHOTONS
83087121	F200507109	DE	DE602007026575.4	Granted		11-Jul-2007	11-Jul-2020	1,093.17	COMPACT SYSTEMS FOR GENERATING POLARIZATION-ENTANGLED PHOTONS
83087123	F200507109	GB	GB2047319	Granted		11-Jul-2007	11-Jul-2020	438.03	COMPACT SYSTEMS FOR GENERATING POLARIZATION-ENTANGLED PHOTONS
82219103	F200507109	US	US7639953	Granted		27-Jul-2006	29-Jun-2021	7,706.00	COMPACT SYSTEMS FOR GENERATING POLARIZATION-ENTANGLED PHOTONS

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82219112	F200507109	JP	JP4842378	Granted		11-Jul-2007	14-Oct-2021	1,069.38	COMPACT SYSTEMS FOR GENERATING POLARIZATION-ENTANGLED PHOTONS
82219238	F200507162	CN	CN200780035137.9	Granted		11-Jul-2007	11-Jul-2020	985.42	COMPACT, SINGLE-CHIP-BASED, ENTANGLED POLARIZATION-STATE PHOTON SOURCES AND METHODS FOR GENERATING PHOTONS IN ENTANGLED POLARIZATION STATES
82219226	F200507162	US	US7373059	Granted		22-Sep-2006	N/A	N/A	COMPACT, SINGLE CHIP-BASED, ENTANGLED POLARIZATION-STATE PHOTON SOURCES AND METHODS FOR GENERATING PHOTONS IN ENTANGLED POLARIZATION STATES
82219235	F200507162	JP	JP4864143	Granted		11-Jul-2007	18-Nov-2020	1,006.29	COMPACT, SINGLE-CHIP-BASED, ENTANGLED POLARIZATION-STATE PHOTON SOURCES AND METHODS FOR GENERATING PHOTONS IN ENTANGLED POLARIZATION STATES
82222280	F200600747	US	US7519245	Granted		31-Oct-2006	N/A	N/A	MODULAR ARRAY COMPUTER WITH OPTICAL INTERCELL COMMUNICATIONS PATHWAYS

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82222283	F200600749	US	US9052916	Granted		21-Sep-2006	9-Dec-2022	3,766.00	SYSTEM ROM WITH AN EMBEDDED DISK IMAGE
82222934	F200601104	US	US8387053	Granted		25-Jan-2007	26-Aug-2020	3,606.00	METHOD AND SYSTEM FOR ENHANCING COMPUTER PROCESSING PERFORMANCE
83019366	F200601661	US	US8357926	Granted		1-Jun-2012	22-Jul-2020	3,606.00	GAIN-CLAMPED SEMICONDUCTOR OPTICAL AMPLIFIERS
82224152	F200601661	US	US8212235	Granted		25-Apr-2007	3-Jan-2024	7,706.00	NANOWIRE-BASED OPTO-ELECTRONIC DEVICES
82224158	F200601661	CN	CN200880013724 2	Granted		25-Apr-2008	25-Apr-2021	1,032.98	NANOWIRE-BASED OPTO-ELECTRONIC DEVICES
82224167	F200601661	KR	KR101455706	Granted		25-Apr-2008	22-Oct-2021	463.28	NANOWIRE-BASED OPTO-ELECTRONIC DEVICES
82225475	F200602319	US	US8612973	Granted		26-Sep-2007	17-Jun-2021	3,766.00	METHOD AND SYSTEM FOR HANDLING INTERRUPTS WITHIN COMPUTER SYSTEM DURING HARDWARE RESOURCE MIGRATION
82226066	F200602534	US	US7498524	Granted		23-Apr-2007	3-Sep-2020	7,406.00	ENCLOSURE AND GASKET ASSEMBLY FOR REDUCING EMI
82227224	F200603002	US	US7466410	Granted		26-Jan-2007	N/A	N/A	PHOTONIC-BASED SENSORS AND METHODS FOR DETECTING ANALYTES

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82227767	F200603277	US	US7805041	Granted		21-Mar-2007	28-Mar-2022	7,706.00	ELECTROMAGNETIC RADIATION AMPLIFICATION SYSTEMS BASED ON PHOTONIC GRATINGS
82227773	F200603277	CN	CN200880009047.7	Granted		21-Mar-2008	21-Mar-2021	1,032.98	ELECTROMAGNETIC RADIATION AMPLIFICATION SYSTEMS BASED ON PHOTONIC GRATINGS
82232504	F200700946	CN	CN200880109804.8	Granted		30-Jul-2008	30-Jul-2020	985.42	SYSTEM AND METHODS FOR ROUTING OPTICAL SIGNALS
82232498	F200700946	US	US7499615	Granted		1-Aug-2007	3-Sep-2020	7,406.00	SYSTEM AND METHODS FOR ROUTING OPTICAL SIGNALS
82232513	F200700946	KR	KR10-1508619	Granted		30-Jul-2008	30-Mar-2021	486.67	SYSTEM AND METHODS FOR ROUTING OPTICAL SIGNALS
82405250	F200700946	US	US8811778	Granted		6-May-2008	19-Feb-2022	3,766.00	SYSTEMS AND METHODS FOR ROUTING OPTICAL SIGNALS
82234532	F200701455	US	US7929865	Granted		27-Jul-2007	19-Oct-2022	7,706.00	FREE SPACE WDM SIGNAL DETECTOR
82234544	F200701455	JP	JP5133414	Granted		16-Jul-2008	16-Nov-2020	390.76	FREE SPACE WDM SIGNAL DETECTOR
82234658	F200701481	US	US7477441	Granted		24-Jul-2007	13-Jul-2020	7,406.00	MEMS DEVICE WITH NANOWIRE STANDOFF LAYER
82235153	F200701619	US	US8351204	Granted		31-Jan-2008	8-Jul-2020	3,606.00	MODULAR DATA PROCESSING COMPONENTS AND SYSTEMS

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82235141	F200701619	CN	CN200880128462.4	Granted		31-Jan-2008	31-Jan-2021	1,032.98	MODULAR DATA PROCESSING COMPONENTS AND SYSTEMS
82235150	F200701619	KR	KR10-1434239	Granted		31-Jan-2008	20-Aug-2021	415.63	MODULAR DATA PROCESSING COMPONENTS AND SYSTEMS
82235552	F200701730	US	US8738658	Granted		23-Apr-2008	27-Nov-2021	3,766.00	METHOD FOR USING PATHS IN A DIRECTORY FOR LOCATING OBJECTS
82237004	F200702142	US	US9032397	Granted		28-May-2008	12-Nov-2022	3,766.00	VIRTUAL MACHINE MIGRATION WITH DIRECT PHYSICAL ACCESS CONTROL
82239494	F200702925	CN	CN200880128457.3	Granted		31-Jan-2008	31-Jan-2021	990.04	FREE SPACE OPTICAL INTERCONNECT
82239500	F200702925	JP	JP5205473	Granted		31-Jan-2008	22-Feb-2021	366.26	FREE SPACE OPTICAL INTERCONNECT
82239503	F200702925	KR	KR10-1395169	Granted		31-Jan-2008	8-May-2021	451.15	FREE SPACE OPTICAL INTERCONNECT
82245326	F200702925	JP	JP5155444	Granted		7-May-2008	14-Dec-2020	406.20	ARRAYS, SYSTEM AND METHOD FOR BI-DIRECTIONAL DATA TRANSMISSION
82245329	F200702925	KR	KR10-1453946	Granted		7-May-2008	16-Oct-2021	530.62	ARRAYS, SYSTEM AND METHOD FOR BI-DIRECTIONAL DATA TRANSMISSION
82405286	F200702925	US	US8611758	Granted		7-May-2008	17-Jun-2021	3,766.00	ARRAYS, SYSTEM AND METHOD FOR BI-DIRECTIONAL DATA TRANSMISSION

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82240844	F200703347	US	US8355251	Granted		21-Aug-2008	15-Jul-2020	3,606.00	REMOTE EXHAUST FOR RACK SYSTEMS
82241627	F200703656	US	US8108645	Granted		26-Jun-2008	31-Jul-2023	7,706.00	OPTIMIZED MEMORY ALLOCATION VIA FEATURE EXTRACTION
82595701	F200800383	CN	CN200880130639.4	Granted		31-Jul-2008	31-Jul-2020	985.42	NANO-WIRE OPTICAL BLOCK DEVICES FOR AMPLIFYING, MODULATING, AND DETECTING OPTICAL SIGNALS
82595703	F200800383	DE	DE112008003958	Granted		31-Jul-2008	31-Jul-2020	913.97	NANO-WIRE OPTICAL BLOCK DEVICES FOR AMPLIFYING, MODULATING, AND DETECTING OPTICAL SIGNALS
82595705	F200800383	JP	JP5474065	Granted		31-Jul-2008	14-Feb-2021	397.69	NANO-WIRE OPTICAL BLOCK DEVICES FOR AMPLIFYING, MODULATING, AND DETECTING OPTICAL SIGNALS
82595707	F200800383	KR	KR10-1510356	Granted		31-Jul-2008	1-Apr-2021	593.23	NANO-WIRE OPTICAL BLOCK DEVICES FOR AMPLIFYING, MODULATING, AND DETECTING OPTICAL SIGNALS
82595709	F200800383	US	US8873893	Granted		31-Jul-2008	28-Apr-2022	3,766.00	NANO-WIRE OPTICAL BLOCK DEVICES FOR AMPLIFYING, MODULATING, AND DETECTING OPTICAL SIGNALS

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82247651	F200801450	US	US8127124	Granted		19-Mar-2009	28-Aug-2023	7,706.00	REMOTE CONFIGURATION OF COMPUTING PLATFORMS
82934043	F200801450	US	US8370610	Granted		24-Feb-2012	5-Aug-2024	7,706.00	REMOTE CONFIGURATION OF COMPUTING PLATFORMS
82654452	F200802164	CN	CN200880130978.2	Granted		4-Sep-2008	4-Sep-2020	985.42	DIELECTRIC WAVEGUIDE INTERSECTION WITH REDUCED LOSSES
82654456	F200802164	JP	JP5376544	Granted		4-Sep-2008	4-Oct-2021	397.69	DIELECTRIC WAVEGUIDE INTERSECTION WITH REDUCED LOSSES
82654458	F200802164	KR	KR10-1515870	Granted		4-Sep-2008	22-Apr-2021	664.27	DIELECTRIC WAVEGUIDE INTERSECTION WITH REDUCED LOSSES
82654460	F200802164	US	US8655124	Granted		4-Sep-2008	18-Aug-2021	3,766.00	DIELECTRIC WAVEGUIDE INTERSECTION WITH REDUCED LOSSES
82249022	F200802452	US	US8363654	Granted		7-Nov-2008	29-Jul-2020	3,606.00	PREDICTIVE PACKET FORWARDING FOR A NETWORK SWITCH
82250468	F200803661	US	US8477045	Granted		29-Oct-2009	2-Jan-2021	3,606.00	CONFIGURATION INFORMATION PROVIDED TO CONFIGURABLE ELECTRONIC DEVICE RESIDING IN A SHIPPING BOX
82938863	F200803670	US	US8780908	Granted		28-Oct-2009	15-Jan-2022	3,606.00	METHOD AND APPARATUS FOR TRACING A MULTICAST FLOW

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82259093	F200903003	US	US8521940	Granted		27-Oct-2009	27-Feb-2021	3,766.00	PAIRED NODE CONTROLLERS
82259711	F200903377	US	US8537859	Granted		26-Feb-2010	17-Mar-2021	3,766.00	REASSEMBLY OF MINI-PACKETS IN A BUFFER
82263698	F201000775	US	US8424826	Granted		12-Oct-2010	23-Oct-2024	7,406.00	ATTACHMENT APPARATUS FOR AN EXTERNAL POWER SUPPLY
83161099	F201001120	CN	CN201080068233.5	Granted		26-Jul-2010	26-Jul-2020	666.46	MITIGATION OF DETECTED PATTERNS IN A NETWORK DEVICE
83733017	F201001270	CN	CN201180071455.7	Granted		8-Aug-2011	8-Aug-2021	698.53	FABRIC CHIP HAVING TRUNKED LINKS
83733023	F201001270	US	US9369296	Granted		8-Aug-2011	14-Dec-2023	3,766.00	FABRIC CHIP HAVING TRUNKED LINKS
82264643	F201001462	US	US8353718	Granted		17-Dec-2010	15-Jan-2021	$4,260.00	HANDLE ASSEMBLY FOR ELECTRICAL CONNECTION WITH A GROUNDING MECHANISM
82271798	F201003557	US	US6829314	Granted		10-Aug-2000	N/A	N/A	ADAPTER FOR NEAR END CROSSTALK AND ECHO CANCELLER FOR BI-DIRECTIONAL DIGITAL COMMUNICATIONS
82271858	F201003574	US	US6882661	Granted		14-Sep-2000	N/A	N/A	SYSTEM FOR DETECTION OF ASYNCHRONOUS PACKET RATES AND MAINTENANCE OF MAXIMUM THEORETICAL PACKET RATE

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82271987	F201003620	US	US6694388	Granted		31-May-2000	N/A	N/A	DYNAMIC QUEUING SYSTEM INCORPORATING MULTIPLE QUEUES SHARING A SINGLE MEMORY
82272107	F201003667	US	US7286652	Granted		31-May-2000	N/A	N/A	FOUR CHANNEL AUDIO RECORDING IN A PACKET BASED NETWORK
82272131	F201003671	US	US6762995	Granted		14-Jun-2000	N/A	N/A	NETWORK SWITCH INCLUDING HYSTERESIS IN SIGNALLING FULLNESS OF TRANSMIT QUEUES
82272152	F201003677	US	US6807175	Granted		25-Aug-2000	N/A	N/A	DISTRIBUTED MULTICAST ROUTING IN PACKET-BASED COMMUNICATIO N NETWORK DEVICES
82272170	F201003682	US	US9112768	Granted		15-Sep-2000	18-Feb-2023	3,766.00	DISCOVERING NON MANAGED DEVICES IN A NETWORK SUCH AS A LAN USING HTTP
82272197	F201003693	US	US7512685	Granted		30-Nov-2000	N/A	N/A	METHOD AND SYSTEM FOR IMPLEMENTING WIRELESS DATA TRANSFERS BETWEEN A SELECTED GROUP OF MOBILE COMPUTING DEVICES

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82272332	F201003764	US	US7233601	Granted		14-Sep-2000	N/A	N/A	CASCADE ARCHITECTURE AND OPERATION FOR PACKET-BASED COMMUNICATIO N SYSTEMS
82272380	F201003773	US	US6928059	Granted		15-Sep-2000	N/A	N/A	EFFICIENT METHOD OF DEDUCING NETWORK TOPOLOGY INCLUDING ENDSTATIONS
82272401	F201003780	US	US6574414	Granted		8-Jan-2001	N/A	N/A	LIGHT TRANSMISSION APPARATUS AND METHOD
82272431	F201003795	US	US6856683	Granted		28-Feb-2001	N/A	N/A	METHOD FOR REDUCING NOISE FROM A NON-LINEAR DEVICE THAT SHARES A CUSTOMER LOOP WITH AN ASYMMETRIC DIGITAL SUBSCRIBER LINE MODEM
82272446	F201003802	US	US6801950	Granted		25-Sep-2000	N/A	N/A	STACKABLE NETWORK UNIT INCLUDING REGISTER FOR IDENTIFYING TRUNK CONNECTION STATUS OF STACKED UNITS
82272479	F201003814	US	US6912206	Granted		15-Sep-2000	N/A	N/A	DISCOVERY OF PHONES ON A NETWORK, SUCH AS A LAN

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82272509	F201003831	US	US6857027	Granted		14-Nov-2000	N/A	N/A	INTELLIGENT NETWORK TOPOLOGY AND CONFIGURATION VERIFICATION USING A METHOD OF LOOP DETECTION
82272587	F201003853	US	US7673034	Granted		9-Aug-2000	2-Sep-2021	7,706.00	SELF SERVICE DATA INTERFACE
82272593	F201003853	US	US7463732	Granted		9-Aug-2000	N/A	N/A	FLEXIBLE DATA OUTLET
82272701	F201003916	US	US6847635	Granted		20-Jun-2000	N/A	N/A	METHOD TO TRANSMIT SILENCE COMPRESSED VOICE OVER IP EFFICIENTLY IN DOCSIS CABLE NETWORKS
82272746	F201003933	US	US6865223	Granted		5-Feb-2001	N/A	N/A	EQUALIZER ADAPTER FOR A PULSE AMPLITUDE MODULATION RECEIVER
82272749	F201003934	US	US6996062	Granted		28-Feb-2001	N/A	N/A	POLICY-BASED WEIGHTED RANDOM EARLY DETECTION METHOD FOR AVOIDING CONGESTION IN INTERNET TRAFFIC
82272767	F201003939	US	US6694360	Granted		9-Jun-2000	N/A	N/A	MULTI-MODE NETWORK INTERFACE HAVING LOADABLE SOFTWARE IMAGES

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82272824	F201003964	US	US7062569	Granted		19-Jan-2001	N/A	N/A	CASCADE CONTROL ARCHITECTURE AND OPERATION FOR PACKET-BASED COMMUNICATIO N SYSTEMS
82272863	F201003994	US	US6829309	Granted		5-Feb-2001	N/A	N/A	PHASE DETECTOR FOR BAUD RATE-SAMPLED MULTI-STATE SIGNAL RECEIVER
82272998	F201004060	US	US7366168	Granted		3-Apr-2001	N/A	N/A	TCP CONTROL PACKET DIFFERENTIAL SERVICE
82273007	F201004067	US	US6914952	Granted		19-Jan-2001	N/A	N/A	SUPERFRAME ALIGNMENT TO A PRE-EXISTING ADSL DATA EXCHANGE
82273139	F201004136	US	US6920172	Granted		2-Jan-2001	N/A	N/A	DUAL PURPOSE SPREAD SPECTRUM RADIO RECEIVERS WITH CONTROLLED FREQUENCY REJECTION
82273160	F201004139	US	US6839360	Granted		20-Feb-2001	N/A	N/A	FIFO STORAGE INCLUDING POINTER MISALIGNMENT DETECTION
82273172	F201004141	US	US6819680	Granted		26-Mar-2001	N/A	N/A	LINK AGGREGATION CONTROL FOR NETWORK DEVICES
82273190	F201004170	US	US6973513	Granted		9-Apr-2001	N/A	N/A	METHOD FOR EFFICIENT USE OF A TRANSMIT ENGINE

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82273208	F201004177	US	US6854015	Granted		28-Feb-2001	N/A	N/A	SYSTEM FOR ISOLATING ETHERNET NETWORK TRAFFIC
82273253	F201004202	US	US6963921	Granted		16-Feb-2001	N/A	N/A	METHOD AND APPARATUS FOR HARDWARE ASSISTED TCP PACKET RE-ASSEMBLY
82273268	F201004211	US	US6963541	Granted		27-Feb-2001	N/A	N/A	UPSTREAM TRANSMISSION PROFILES FOR A DOCSIS OR DOCSIS-LIKE SYSTEM
82273295	F201004225	US	US6873701	Granted		29-Mar-2001	N/A	N/A	SYSTEM AND METHOD FOR DTMF DETECTION USING LIKELIHOOD RATIOS
82273307	F201004227	US	US6868088	Granted		26-Apr-2001	N/A	N/A	AUTOMATIC DETECTOR OF MEDIA INTERFACE PROTOCOL TYPE
82273313	F201004228	US	US7340515	Granted		10-Jul-2001	N/A	N/A	OPTIMISATION OF NETWORK CONFIGURATION
82273319	F201004229	US	US7385939	Granted		2-Jul-2001	N/A	N/A	NETWORK MANAGEMENT APPARATUS AND METHOD FOR DETERMINING THE TOPOLOGY OF A NETWORK
82273325	F201004230	US	US7673035	Granted		2-Jul-2001	2-Sep-2021	7,706.00	APPARATUS AND METHOD FOR PROCESSING DATA RELATING TO EVENTS ON A NETWORK

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82273337	F201004232	US	US7016955	Granted		2-Jul-2001	N/A	N/A	NETWORK MANAGEMENT APPARATUS AND METHOD FOR PROCESSING EVENTS ASSOCIATED WITH DEVICE REBOOT
82273376	F201004271	US	US7010588	Granted		2-Jul-2001	N/A	N/A	A SYSTEM USING A SERIES OF EVENT PROCESSORS FOR PROCESSING NETWORK EVENTS TO REDUCE NUMBER OF EVENTS TO BE DISPLAYED
82273394	F201004275	US	US7065670	Granted		31-Oct-2002	N/A	N/A	SERVER MONITORING AND FAILOVER MECHANISM
82273406	F201004278	US	US7028086	Granted		22-Aug-2001	N/A	N/A	APPARATUS, METHOD, AND COMPUTER PROGRAM FOR DETECTION OF SERVER-LIKE DEVICES ON A COMPUTER NETWORK BASED ON INGRESS TO EGRESS NETWORK TRAFFIC RATIOS
82273439	F201004307	US	US6877145	Granted		2-Aug-2001	N/A	N/A	AUTOMATIC GENERATION OF INTERCONNECT LOGIC COMPONENTS
82273496	F201004328	US	US7392518	Granted		21-Feb-2002	N/A	N/A	ROBUST REMOTE FLASH ROM UPGRADE SYSTEM AND METHOD

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82273550	F201004338	US	US6970921	Granted		27-Jul-2001	N/A	N/A	NETWORK INTERFACE SUPPORTING VIRTUAL PATHS FOR QUALITY OF SERVICE
82273604	F201004359	US	US7225236	Granted		7-Aug-2001	N/A	N/A	LOAD BALANCING BETWEEN LNSS USING VIRTUAL LNS WITH MINIMAL LAC CONFIGURATION
82273751	F201004415	US	US7340536	Granted		22-Jan-2002	N/A	N/A	METHOD AND APPARATUS FOR DETERMINING UNMANAGED NETWORK DEVICES IN THE TOPOLOGY OF A NETWORK
82273757	F201004416	US	US6915448	Granted		24-Apr-2002	N/A	N/A	STORAGE DISK FAILOVER AND REPLACEMENT SYSTEM
82273814	F201004432	US	US7042889	Granted		4-Mar-2002	N/A	N/A	NETWORK SWITCH WITH PARALLEL WORKING OF LOOK-UP ENGINE AND NETWORK PROCESSOR
82273865	F201004452	US	US7274703	Granted		16-Jul-2002	N/A	N/A	STACKABLE NETWORK UNITS WITH RESILIENCY FACILITY
82273868	F201004452	GB	GB2386524	Granted		29-Aug-2002	29-Aug-2021	896.07	STACKABLE NETWORKS UNITS WITH RESILIENCE FACILITY

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82273871	F201004453	US	US7249183	Granted		4-Jun-2002	N/A	N/A	METHOD TO ENABLE CONTINUOUS MOBILITY ACROSS WIRED AND WIRELESS NETWORK INTERFACES
82273874	F201004454	US	US7564861	Granted		22-Aug-2002	21-Jan-2021	7,706.00	SYSTEMS AND METHODS FOR COMPRESSING DATA
82273883	F201004458	US	US7283555	Granted		25-Jun-2002	N/A	N/A	METHOD AND APPARATUS FOR DETERMINING A POLLING INTERVAL IN A NETWORK MANAGEMENT SYSTEM
82273907	F201004475	US	US7564835	Granted		6-Nov-2002	21-Jan-2021	7,406.00	SYSTEM AND METHOD FOR MAXIMIZING THE USE OF BANDWIDTH OPTIMIZATION TECHNIQUES IN VOICE-OVER-PACKET CONNECTIONS
82273931	F201004480	US	US7123615	Granted		11-Mar-2002	N/A	N/A	STACKED NETWORK ROUTERS
82273988	F201004504	US	US8307063	Granted		25-Jun-2002	6-May-2024	7,706.00	METHOD AND APPARATUS FOR MANAGING DATA TRAFFIC ASSOCIATED WITH A USER ON A NETWORK
82274069	F201004528	US	US6807266	Granted		30-Aug-2002	N/A	N/A	METHOD AND APPARATUS FOR PROVISIONING A SOFT SWITCH
82274084	F201004533	US	US6839239	Granted		17-Jul-2002	N/A	N/A	ELECTRONIC DEVICE PACKAGING

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82274096	F201004537	US	US7089424	Granted		10-May-2002	N/A	N/A	PERIPHERAL DEVICE FOR PROTECTING DATA STORED ON HOST DEVICE AND METHOD AND SYSTEM USING THE SAME
82274120	F201004543	US	US7274750	Granted		27-Sep-2002	N/A	N/A	GAIN AND PHASE IMBALANCE COMPENSATION FOR OFDM SYSTEMS
82274231	F201004569	US	US7490155	Granted		13-Mar-2003	N/A	N/A	MANAGEMENT AND CONTROL FOR INTERACTIVE MEDIA SESSIONS
82274267	F201004572	US	US7420968	Granted		6-Jun-2003	N/A	N/A	HIGH-SPEED SWITCH ARCHITECTURE
82274273	F201004573	US	US7362750	Granted		17-Jun-2003	N/A	N/A	SWITCH MODULE ARCHITECTURE
82274282	F201004575	US	US7391784	Granted		30-Dec-2002	N/A	N/A	METHOD AND SYSTEM FOR COMMUNICATING STATE INFORMATION BETWEEN DEVICES OF A COMMUNICATIONS NETWORK
82274294	F201004582	US	US7480723	Granted		8-Apr-2003	N/A	N/A	METHOD AND SYSTEM FOR PROVIDING DIRECTORY BASED SERVICES
82576918	F201006045	US	USD732547	Granted		31-Jan-2011	N/A	N/A	BEZEL WITH DOCKING RECESS
83852687	F201006045	US	USD753664	Granted		1-Apr-2014	N/A	N/A	BEZEL WITH DOCKING RECESS

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84161772	F201006045	US	USD765088	Granted		24-Feb-2015	N/A	N/A	BEZEL WITH DOCKING RECESS
82062347	F30003063	US	US6941476	Granted		10-May-2001	N/A	N/A	INFORMATION STORAGE
82062344	F30003063	GB	GB2362970	Expired		31-May-2000	N/A	N/A	IMPROVEMENTS RELATING TO INFORMATION STORAGE
82065557	F30014514	US	US7363425	Granted		28-Dec-2001	N/A	N/A	SYSTEM AND METHOD FOR SECURING DRIVE ACCESS TO MEDIA BASED ON MEDIUM IDENTIFICATION NUMBERS
82065560	F30014514	JP	JP4716478	Granted		19-Dec-2002	8-Apr-2021	1,069.38	SYSTEM AND METHOD FOR SECURING DRIVE ACCESS TO MEDIA BASED ON MEDIUM IDENTIFICATION NUMBERS
82664940	F700205218	US	US8661279	Granted		19-Jul-2011	25-Aug-2021	3,766.00	POWER CAPPING USING C-STATES
82965470	F700207896	US	US8966313	Granted		30-Apr-2012	24-Aug-2022	3,766.00	SYSTEMS AND METHODS FOR A SHARED DEBUG PIN

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81974582	F10003624	US	US6862691	Granted		19-Sep-2001	N/A	N/A	REDUNDANT COMPONENT SYSTEM AND METHOD FOR FACILITATING ENDSYSTEM FUNCTIONALITY
81984005	F10007152	US	US6954928	Granted		8-Aug-2001	N/A	N/A	METHOD FOR SELECTING A SET OF PATCHES TO UPDATE A SYSTEM OF PROGRAMS
81986741	F10008034	US	US6708515	Granted		31-Aug-2001	N/A	N/A	PASSIVE SPRAY COOLANT PUMP
81986753	F10008038	US	US6886117	Granted		20-Nov-2001	N/A	N/A	FIELD REPAIRABLE EMBEDDED MEMORY IN SYSTEM-ON-A-CHIP
81986756	F10008039	US	US6910155	Granted		25-Jun-2001	N/A	N/A	SYSTEM AND METHOD FOR CHIP TESTING
81988508	F10010393	US	US6964035	Granted		3-Jul-2001	N/A	N/A	DEBUGGING AN OPERATING SYSTEM KERNEL WITH DEBUGGER SUPPORT IN A NETWORK INTERFACE CARD
81988553	F10010441	US	US6981104	Granted		12-Jul-2002	N/A	N/A	METHOD FOR CONDUCTING CHECKPOINTING WITHIN A WRITEBACK CACHE
81989051	F10010651	US	US6883091	Granted		30-May-2001	N/A	N/A	REDUCING BOOT TIMES VIA INTRUSION MONITORING

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83087160	F100110476	US	US9053458	Granted		7-Aug-2012	N/A	N/A	SYSTEM AND METHOD FOR PROFILING CLIENTS WITHIN A SYSTEM FOR HARVESTING COMMUNITY KNOWLEDGE
81990020	F10011053	US	US7076539	Granted		30-Jul-2001	N/A	N/A	NETWORK CONNECTIVITY ESTABLISHMENT AT USER LOG-IN
81991103	F10011520	US	US6976073	Granted		29-Nov-2001	N/A	N/A	TRANSPARENT REMOTE DATA STORAGE DEVICE AND METHOD
81991115	F10011521	US	US6907519	Granted		19-Mar-2002	N/A	N/A	SYSTEMS AND METHODS FOR INTEGRATING EMULATED AND NATIVE CODE
81993140	F10012290	US	US6874050	Granted		16-Jan-2002	N/A	N/A	CIRCUIT AND METHOD FOR EXPANDING A SERIAL BUS
81994784	F10012965	US	US7046587	Granted		23-Aug-2001	N/A	N/A	SYSTEMS AND METHODS FOR PROVIDING AUTOMATIC ACCESS TO DATA MEDIA IN A DATA STORAGE SYSTEM
81994793	F10012965	DE	DE60220350.3	Granted		22-Aug-2002	22-Aug-2020	2,108.66	SYSTEMS AND METHODS FOR PROVIDING AUTOMATIC ACCESS TO DATA MEDIA IN A DATA STORAGE SYSTEM

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81994799	F10012965	GB	GB1288937	Granted		22-Aug-2002	22-Aug-2020	826.86	SYSTEMS AND METHODS FOR PROVIDING AUTOMATIC ACCESS TO DATA MEDIA IN A DATA STORAGE SYSTEM
81995162	F10013118	US	US6901303	Granted		31-Jul-2001	N/A	N/A	METHOD AND APPARATUS FOR CONTROLLING FANS AND POWER SUPPLIES TO PROVIDE ACCELERATED RUN-IN TESTING
81996422	F10013826	US	US6889349	Granted		22-Aug-2001	N/A	N/A	DIGITAL EVENT SAMPLING CIRCUIT AND METHOD
81996431	F10013830	US	US6851064	Granted		22-Aug-2001	N/A	N/A	FINE-GRAINED THERMAL CONTROL IN MEMORY SUBSYSTEMS
82000199	F10016250	US	US6918027	Granted		30-Jul-2001	N/A	N/A	SYSTEM AND METHOD FOR IN-SYSTEM PROGRAMMING THROUGH AN ON-SYSTEM JTAG
82002023	F10017351	US	US6857047	Granted		10-Jun-2002	N/A	N/A	MEMORY COMPRESSION FOR COMPUTER SYSTEMS
82002458	F10017545	US	US7318120	Granted		24-Dec-2004	N/A	N/A	HARDWARE ASSISTED COMMUNICATIO N BETWEEN PROCESSORS
82002905	F10017839	US	US6909577	Granted		7-Jun-2002	N/A	N/A	LOW-OVERHEAD STORAGE MAGAZINE

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82002914	F10017840	US	US6883109	Granted		30-Jul-2001	N/A	N/A	METHOD FOR ACCESSING SCAN CHAINS AND UPDATING EEPROM-RESIDENT FPGA CODE THROUGH A SYSTEM MANGEMENT PROCESSOR AND JTAG BUS
82003640	F10018117	US	US7480815	Granted		10-Jun-2005	N/A	N/A	CONTROLLER COMMUNICATIONS OVER AN ALWAYS-ON CONTROLLER INTERCONNECT
82004525	F10018651	US	US7340749	Granted		3-Dec-2002	N/A	N/A	METHOD AND APPARATUS TO DETECT PRESENCE OF OR A SIZE OF A DATA CARTRIDGE
82004534	F10018651	DE	DE60307027.2	Granted		21-Nov-2003	21-Nov-2020	2,039.61	MEDIA-DETECTION SYSTEMS
82004993	F10019017	US	US6980884	Granted		16-Jul-2002	N/A	N/A	INTRUSION MONITORS FOR MEDIA STORAGE SYSTEMS
82005002	F10019017	DE	DE60332514.9	Granted		11-Jul-2003	11-Jul-2021	2,272.89	INTRUSION MONITORS FOR MEDIA STORAGE SYSTEMS
82005005	F10019017	FR	FR1383121	Granted		11-Jul-2003	11-Jul-2021	946.25	INTRUSION MONITORS FOR MEDIA STORAGE SYSTEMS
82005008	F10019017	GB	GB1383121	Granted		11-Jul-2003	11-Jul-2021	837.70	INTRUSION MONITORS FOR MEDIA STORAGE SYSTEMS
82086674	F10019724	US	US7263192	Granted		20-Mar-2002	N/A	N/A	ESTABLISHING AN ENCRYPTED SESSION

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82006889	F10019840	US	US6909570	Granted		25-Nov-2002	N/A	N/A	HARD DISK DRIVE STORAGE SYSTEM
82006910	F10019852	US	US7256435	Granted		2-Jun-2003	N/A	N/A	MULTILEVEL IMPRINT LITHOGRAPHY
82082915	F100200135	US	US7529966	Granted		20-Aug-2004	5-Nov-2020	7,406.00	STORAGE SYSTEM WITH JOURNALING
82084247	F100200743	US	US6858162	Granted		1-Apr-2002	N/A	N/A	SINGLE MOLECULE REALIZATION OF THE SWITCH AND DOIDE COMBINATION
82085375	F100201208	US	US7219230	Granted		8-May-2002	N/A	N/A	OPTIMIZING COSTS ASSOCIATED WITH MANAGING ENCRYPTED DATA
82085789	F100201450	GB	GB2391582	Granted		10-Jun-2003	10-Jun-2021	837.70	FAN-SECURING DEVICE FOR USE WITH A HEAT TRANSFER DEVICE
82085792	F100201450	US	US6879487	Granted		30-Sep-2003	N/A	N/A	FAN-SECURING DEVICE FOR USE WITH A HEAT TRANSFER DEVICE
82087094	F100201843	US	US6976119	Granted		14-Jun-2002	N/A	N/A	METHOD AND SYSTEM FOR PROVIDING A LOCATION OF A DATA INTERFACE
82087100	F100201843	GB	GB2393291	Granted		4-Jun-2003	4-Jun-2021	837.70	METHOD AND SYSTEM FOR PROVIDING A LOCATION OF A DATA INTERFACE
82087247	F100201886	US	US6907314	Granted		16-Sep-2003	N/A	N/A	INVENTORY CONTROL DEVICE

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82088090	F100202247	US	US7334978	Granted		23-Jun-2003	N/A	N/A	CARTRIDGE-HANDLING APPARATUS FOR A MEDIA STORAGE SYSTEM
82088099	F100202247	DE	DE60326440.9	Granted		29-Dec-2003	29-Dec-2021	2,272.89	CARTRIDGE-HANDLING APPARATUS FOR A MEDIA STORAGE SYSTEM
82088105	F100202247	GB	GB1492104	Granted		29-Dec-2003	29-Dec-2020	753.48	CARTRIDGE-HANDLING APPARATUS FOR A MEDIA STORAGE SYSTEM
82090061	F100203351	US	US7886430	Granted		13-Dec-2002	15-Aug-2022	7,406.00	METHOD OF INSTALLING CIRCUIT BOARD COMPONENT
82090346	F100203591	US	US7188171	Granted		23-Jan-2003	N/A	N/A	METHOD AND APPARATUS FOR SOFTWARE AND HARDWARE EVENT MONITORING AND REPAIR
82091372	F100204291	US	US6896541	Granted		18-Feb-2003	N/A	N/A	INTERFACE CONNECTOR THAT ENABLES DETECTION OF CABLE CONNECTION
82091852	F100204836	US	US6895460	Granted		19-Jul-2002	N/A	N/A	SYNCHRONIZATION OF ASYNCHRONOUS EMULATED INTERRUPTS
82578862	F109	US	US7502903	Granted		7-Nov-2005	N/A	N/A	METHOD AND APPARATUS FOR MANAGING DATA STORAGE SYSTEMS

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82578875	F109	US	US7444489	Granted		7-Nov-2005	N/A	N/A	APPLICATIONS FOR NON-DISRUPTIVELY MOVING DATA BETWEEN LOGICAL DISK REGIONS IN A DATA STORAGE SYSTEM
82031588	F10971442	US	US7062702	Granted		14-Mar-2001	N/A	N/A	EFFICIENT PARITY OPERATIONS
82578819	F12535	US	US7093278	Granted		8-May-2002	N/A	N/A	REMOTE CONSOLE FOR MONITOR AND CONTROL OF SYSTEM FIRMWARE
82578822	F12537	US	US7111157	Granted		8-May-2002	N/A	N/A	SPURIOUS INPUT DETECTION FOR FIRMWARE
82578829	F12540	US	US7124324	Granted		22-Aug-2002	N/A	N/A	METHOD OF TESTING FIBRE CHANNEL PORTS IN A STORAGE SERVER AT FULL BANDWIDTH WITHOUT CONNECTION TO EXTERNAL DEVICES
82093328	F200205608	US	US7469370	Granted		23-Dec-2002	N/A	N/A	ENABLING MULTIPLE TESTING DEVICES
82094180	F200206068	US	US6880146	Granted		31-Jan-2003	N/A	N/A	MOLECULAR-WIRE-BASED RESTORATIVE MULTIPLEXER, AND METHOD FOR CONSTRUCTING A MULTIPLEXER BASED ON A CONFIGURABLE, MOLECULAR-JUNCTION-NANOWIRE CROSSBAR

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82094192	F200206075	US	US6898098	Granted		31-Jan-2003	N/A	N/A	MOLECULAR-JUNCTION-NANOWIRE-CROSSBAR-BASED ASSOCIATIVE ARRAY
82094783	F200206363	US	US6856926	Granted		3-Mar-2003	N/A	N/A	FREQUENCY MARGIN TESTING OF BLADED SERVERS
82095791	F200206843	US	US6820146	Granted		1-Oct-2002	N/A	N/A	FILTER DRIVER FOR BLOCKING ACCESS BY HOST TO DEVICES
82097240	F200207344	US	US7493450	Granted		14-Apr-2003	N/A	N/A	METHOD OF TRIGGERING READ CACHE PRE-FETCH TO INCREASE HOST READ THROUGHPUT
82097885	F200207703	US	US7228345	Granted		15-Oct-2002	N/A	N/A	SERVER WITH LAN SWITCH THAT CONNECTS PORTS BASED ON BOOT PROGRESS INFORMATION
82098389	F200207865	US	US7100273	Granted		3-Mar-2003	N/A	N/A	INTERCONNECT VALIDATION INSTRUMENTS
82099109	F200208131	US	US7873723	Granted		30-Jan-2003	18-Jul-2022	7,706.00	DEVICE DATA
82220018	F200208131	US	US7686229	Granted		27-Mar-2006	30-Sep-2021	7,706.00	RFID READER DEVICE HAVING CLOSELY PACKED ANTENNAS
82220252	F200208131	US	US7806333	Granted		18-Oct-2006	5-Apr-2022	7,706.00	TRACKING RFID TAGS WITH OVERLAPPING ANTENNAS

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82099112	F200208132	US	US6796506	Granted		10-Mar-2003	N/A	N/A	TRACKING ELECTRONIC DEVICES
82099676	F200208397	US	US7546475	Granted		13-May-2003	N/A	N/A	POWER-AWARE ADAPTATION IN A DATA CENTER
82099691	F200208401	US	US7045996	Granted		30-Jan-2003	N/A	N/A	POSITION DETERMINATION BASED ON PHASE DIFFERENCE
82103501	F200209613	US	US7590909	Granted		24-Aug-2005	15-Mar-2021	7,406.00	IN-CIRCUIT TESTING SYSTEM AND METHOD
82103666	F200209639	US	US7145775	Granted		30-Jul-2004	N/A	N/A	CHASSIS CONDUCTED COOLING THERMAL DISSIPATION APPARATUS FOR SERVERS
82103681	F200209643	US	US8621304	Granted		7-Oct-2004	30-Jun-2021	3,606.00	BUILT-IN- SELF-TEST SYSTEM AND METHOD FOR AN INTEGRATED CIRCUIT
82105283	F200300040	US	US6868899	Granted		25-Aug-2003	N/A	N/A	VARIABLE HEIGHT THERMAL INTERFACE
82105697	F200300182	US	US6982570	Granted		30-Oct-2003	N/A	N/A	RECONFIGURAB LE DEVICE
82117616	F200301772	US	US6874103	Granted		13-Nov-2001	N/A	N/A	ADAPTER-BASED RECOVERY SERVER OPTION
82118564	F200302016	US	US7284067	Granted		20-Feb-2002	N/A	N/A	METHOD FOR INTEGRATED LOAD BALANCING AMONG PEER SERVERS

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82119695	F200302139	US	US8370468	Granted		8-Nov-2006	5-Aug-2024	7,706.00	METHOD AND APPARATUS FOR CREATING A SECURE EMBEDDED I/O PROCESSOR FOR A REMOTE SERVER MANAGEMENT CONTROLLER
82119701	F200302141	US	US7047462	Granted		4-Jan-2002	N/A	N/A	METHOD AND APPARATUS FOR PROVIDING JTAG FUNCTIONALITY IN A REMOTE SERVER MANAGEMENT CONTROLLER
82119902	F200302189	US	US6912599	Granted		19-Oct-2001	N/A	N/A	METHOD AND APPARATUS FOR SENSING POSITIONS OF DEVICE ENCLOSURES WITHIN MULTI-SHELF CABINETS
82119950	F200302202	US	US6889345	Granted		19-Oct-2001	N/A	N/A	SYSTEM AND METHOD FOR LOCATING A FAILED STORAGE DEVICE IN A DATA STORAGE SYSTEM
82120214	F200302270	US	US6870436	Granted		11-Mar-2002	N/A	N/A	METHOD AND APPARATUS TO ATTENUATE POWER PLANE NOISE ON A PRINTED CIRCUIT BOARD USING HIGH ESR CAPACITORS
82120691	F200302389	US	US7028177	Granted		31-Jan-2002	N/A	N/A	ARRAY CONTROLLER ROM CLONING IN REDUNDANT CONTROLLERS

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82120694	F200302390	US	US7093043	Granted		27-Dec-2001	N/A	N/A	DATA ARRAY HAVING REDUNDANCY MESSAGING BETWEEN ARRAY CONTROLLERS OVER THE HOST BUS
82121663	F200302525	US	US6901458	Granted		11-Jul-2002	N/A	N/A	MULTI-MODE SCSI BACKPLANE AND DETECTION LOGIC
82168088	F200308692	US	US6922496	Granted		31-Jan-2003	N/A	N/A	INTEGRATED VCSELS ON ASIC MODULE USING FLEXIBLE ELECTRICAL CONNECTIONS
82168127	F200308692	US	US6975514	Granted		31-Jan-2003	N/A	N/A	INTEGRATED VCSELS ON TRADITIONAL VLSI PACKAGING
82168292	F200308761	US	US7028106	Granted		5-Dec-2003	N/A	N/A	REMAPPING ROUTING INFORMATION ENTRIES IN AN EXPANDER
82171157	F200309939	US	US8023828	Granted		17-Oct-2005	20-Mar-2023	7,706.00	QUANTUM INFORMATION CONVERSION BETWEEN MATTER AND LIGHT REPRESENTATIONS
82171166	F200309939	JP	JP5437634	Granted		21-Jul-2006	20-Dec-2020	467.95	QUANTUM INFORMATION CONVERSION BETWEEN MATTER AND LIGHT REPRESENTATIONS

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82171169	F200309939	CN	CN200680038674.4	Granted		21-Jul-2006	21-Jul-2020	959.27	QUANTUM INFORMATION CONVERSION BETWEEN MATTER AND LIGHT REPRESENTATIONS
82174472	F200311229	US	US7930539	Granted		3-Aug-2004	19-Oct-2022	7,706.00	COMPUTER SYSTEM RESOURCE ACCESS CONTROL
82179221	F200313243	US	US8028174	Granted		4-May-2005	27-Mar-2023	7,706.00	CONTROLLING UPATE OF CONTENT OF A PROGRAMMABLE READ-ONLY MEMORY
82179365	F200313243	US	US7296146	Granted		12-Jan-2004	N/A	N/A	SECURITY MEASURES IN A PARTITIONABLE COMPUTING SYSTEM
82179857	F200313535	US	US7484065	Granted		20-Apr-2004	N/A	N/A	SELECTIVE MEMORY ALLOCATION
82203497	F200313719	US	US7307732	Granted		31-May-2005	N/A	N/A	PHOTONIC CRYSTAL INTERFEROMETER
82180394	F200313719	US	US7492979	Granted		27-Sep-2004	17-Aug-2020	7,406.00	PHOTONIC CRYSTAL LASER SENSORS AND METHODS
82187561	F200400222	US	US7519973	Granted		29-Sep-2004	N/A	N/A	PROVIDING UNIQUE EVENT NOTIFICATION TO ENABLE FIRMWARE TO REQUEST THAT AN OPERATING SYSTEM PERFORM A UNIQUE ACTION

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82187903	F200400362	US	US7386537	Granted		23-Jul-2004	N/A	N/A	METHOD AND SYSTEM FOR DETERMINING SIZE OF A DATA CENTER
82188296	F200400516	US	US7610526	Granted		24-Jan-2005	27-Apr-2021	7,706.00	ON-CHIP CIRCUITRY FOR BUS VALIDATION
82189034	F200400854	US	US7607123	Granted		21-Sep-2004	20-Apr-2021	7,706.00	SYSTEMS AND METHODS FOR VALIDATING DEBUG INFORMATION FOR OPTIMIZED CODE
82192358	F200402482	US	US8375114	Granted		9-Apr-2004	12-Aug-2024	7,706.00	DEVICE LOADING IN STORAGE NETWORKS
82192430	F200402517	US	US7633928	Granted		27-Mar-2006	15-Jun-2021	7,706.00	COMMUNICATIO N DATA METHOD AND SYSTEM FOR VOICE APPLICATIONS EXCECUTABLE BY USER EQUIPMENT.
82193402	F200402838	US	US8694423	Granted		21-May-2004	8-Oct-2021	3,606.00	SYSTEMS AND METHODS FOR BROKERING DATA IN A TRANSACTIONA L GATEWAY
82193606	F200402914	US	US7447889	Granted		20-Apr-2005	N/A	N/A	METHOD AND APPARATUS FOR CONFIGURING A COMPUTER SYSTEM UTILIZING A READ ONLY MEMORY STORING AN OPTION FILE CONTAINING SELECTABLE CONFIGURATION OPTIONS AND A SCRIPT FILE

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82194782	F200403286	US	US8059539	Granted		29-Dec-2004	15-May-2023	7,706.00	LINK THROUGHPUT ENHANCER
82198589	F200405003	US	US7555644	Granted		21-Jul-2006	30-Dec-2020	7,406.00	SYSTEM AND METHOD FOR OPERATING SYSTEM IMAGE PROVISIONING IN A UTILITY COMPUTING ENVIRONMENT
82199369	F200405354	US	US7581242	Granted		30-Apr-2005	25-Feb-2021	7,706.00	AUTHENTICATING PRODUCTS
82201619	F200406527	US	US8782186	Granted		31-Jul-2006	15-Jan-2022	3,766.00	SYSTEMS AND METHODS FOR ADDRESSING MANAGED ELEMENTS
82204112	F200407681	US	US8392546	Granted		28-Oct-2005	5-Sep-2024	7,706.00	DISTRIBUTED MANAGED SYSTEM, SYSTEM COMPONENTS, AND METHODS OF COMMUNICATING COMMANDS
82204703	F200407943	US	US7831768	Granted		30-Oct-2007	9-May-2022	7,706.00	METHOD AND APPARATUS FOR WRITING DATA TO A DISK ARRAY
82205429	F200408352	US	US7825512	Granted		12-Sep-2005	2-May-2022	7,706.00	ELECTRONIC PACKAGE WITH COMPLIANT ELECTRICALLY-CONDUCTIVE BALL INTERCONNECT
82208054	F200501046	US	US7926042	Granted		31-Oct-2005	12-Oct-2022	7,406.00	SYSTEM AND METHOD FOR DYNAMIC INSTRUMENTATION
82209239	F200501635	GB	GB2426841	Granted		4-Jun-2005	4-Jun-2021	691.79	MEMORY CONTROLLER

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82209242	F200501635	US	US7461216	Granted		23-Feb-2006	N/A	N/A	MEMORY CONTROLLER
82213925	F200504155	US	US9032127	Granted		14-Sep-2006	12-Nov-2022	3,606.00	METHOD OF BALANCING I/O DEVICE INTERRUPT SERVICE LOADING IN A COMPUTER SYSTEM
82215089	F200504853	US	US8369212	Granted		29-Aug-2006	5-Aug-2020	3,606.00	NETWORK PATH VALIDATION BASED ON USER-SPECIFIED CRITERIA
82217183	F200505971	US	US7984242	Granted		1-Jun-2009	19-Jan-2023	7,706.00	PROGRAM THREAD SYNCHRONIZATION
82218749	F200505971	US	US7587555	Granted		10-Nov-2005	8-Mar-2021	7,706.00	PROGRAM THREAD SYNCHRONIZATION
82221359	F200600469	US	US7600111	Granted		20-Sep-2006	6-Apr-2021	7,706.00	METHOD OF RESTARTING A COMPUTER PLATFORM
82222361	F200600469	US	US7962734	Granted		15-Mar-2007	14-Dec-2022	7,706.00	METHOD OF RESTARTING A COMPUTER PLATFORM
82222121	F200600653	US	US7933993	Granted		24-Apr-2006	26-Oct-2022	7,406.00	RELOCATABLE VIRTUAL PORT FOR ACCESSING EXTERNAL STORAGE
82226867	F200602849	US	US7877645	Granted		30-Jul-2007	25-Jul-2022	7,406.00	USE OF OPERATIONAL CONFIGURATION PARAMETERS TO PREDICT SYSTEM FAILURES
82230503	F200700250	US	US8929741	Granted		30-Jul-2007	6-Jul-2022	3,766.00	OPTICAL INTERCONNECT

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82232561	F200700952	US	US8255513	Granted		14-Dec-2001	28-Feb-2024	7,706.00	A TOPOLOGY INFORMATION SYSTEM FOR A MANAGED WORLD
82233401	F200701159	US	US7984150	Granted		31-Jul-2007	19-Jan-2023	7,706.00	CELL COMPATIBILTY IN MULTIPROCESSOR SYSTEMS
82233404	F200701159	CN	CN200810129477.4	Granted		31-Jul-2008	31-Jul-2021	1,032.98	CELL COMPATIBILTY IN MULTIPROCESSOR SYSTEMS
82235156	F200701620	US	US8357980	Granted		15-Oct-2007	22-Jul-2020	3,606.00	PLASMONIC HIGH-SPEED DEVICES FOR ENHANCING THE PERFORMANCE OF MICROELECTRONIC DEVICES
82235162	F200701620	CN	CN200880112331.7	Granted		15-Oct-2008	15-Oct-2021	1,032.98	PLASMONIC HIGH-SPEED DEVICES FOR ENHANCING THE PERFORMANCE OF MICROELECTRONIC DEVICES
82235165	F200701620	DE	DE112008002737	Granted		15-Oct-2008	15-Oct-2021	1,178.09	PLASMONIC HIGH-SPEED DEVICES FOR ENHANCING THE PERFORMANCE OF MICROELECTRONIC DEVICES
82235168	F200701620	JP	JP5222950	Granted		15-Oct-2008	15-Mar-2021	397.69	PLASMONIC HIGH-SPEED DEVICES FOR ENHANCING THE PERFORMANCE OF MICROELECTRONIC DEVICES

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82235171	F200701620	KR	KR10-1517423	Granted		15-Oct-2008	28-Apr-2021	451.15	PLASMONIC HIGH-SPEED DEVICES FOR ENHANCING THE PERFORMANCE OF MICROELECTRONIC DEVICES
82235777	F200701831	US	US8053748	Granted		20-Oct-2008	8-May-2023	7,706.00	INTEGRATED CIRCUITS WITH PHASE CHANGE DEVICES
82854022	F200701831	US	US8212230	Granted		25-Sep-2011	3-Jan-2024	7,706.00	INTEGRATED CIRCUITS WITH PHASE CHANGE DEVICES
82236662	F200702022	US	US8254996	Granted		21-Aug-2008	28-Feb-2024	7,706.00	SYSTEMS AND METHODS FOR MANAGING ACCESS CHANNELS
82240685	F200703283	US	US9389649	Granted		25-Mar-2008	12-Jan-2024	3,766.00	LOCKING MECHANISM WITH MOVABLE AND FIXED MEMBERS EACH HAVING SINGLE AND DOUBLE LOCKING FEATURES
82241528	F200703619	US	US8373061	Granted		28-Oct-2008	12-Aug-2020	3,606.00	PHOTOVOLTAIC CELLS WITH STACKED LIGHT-ABSORPTION LAYERS AND METHODS OF FABRICATING THE SAME
82573265	F200704722	CN	CN200880130176.1	Granted		2-Jul-2008	2-Jul-2020	1,081.10	VERIFICATION OF REMOTE COPIES OF DATA
82756289	F200801174	US	US8368118	Granted		16-Dec-2008	5-Aug-2020	3,606.00	SEMICONDUCTOR STRUCTURE HAVING AN ELOG ON A THERMALLY AND ELECTRICALLY CONDUCTIVE MASK

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82853054	F200802102	CN	CN200980158980.5	Granted		27-Apr-2009	27-Apr-2021	1,032.98	ENERGY-EFFICIENT STANDBY MODE IN A SWITCHING POWER SUPPLY
82853058	F200802102	US	US9401635	Granted		27-Apr-2009	26-Jan-2024	3,766.00	SWITCHING POWER SUPPLY FOR A LOAD IN STANDBY MODE
82852232	F200802394	US	US8664605	Granted		28-Apr-2009	4-Sep-2021	3,766.00	COVERT LABEL STRUCTURE
82249742	F200803068	US	US8370688	Granted		22-Apr-2010	5-Aug-2020	3,606.00	IDENTIFYING A STORAGE DEVICE AS FAULTY FOR A FIRST STORAGE VOLUME WITHOUT IDENTIFYING THE STORAGE DEVICE AS FAULTY FOR A SECOND STORAGE VOLUME
82249793	F200803147	US	US8370571	Granted		8-Apr-2009	5-Aug-2020	3,606.00	TRANSFER CONTROL OF A STORAGE VOLUME BETWEEN STORAGE CONTROLLERS IN A CLUSTER
82854071	F200803277	US	US9494419	Granted		31-Jul-2009	15-May-2024	3,766.00	BEAM DIRECTION SENSOR
82925991	F200803277	CN	CN200980160709.5	Granted		31-Jul-2009	31-Jul-2021	1,032.98	BEAM DIRECTION SENSOR
82250642	F200803771	US	US9311319	Granted		27-Aug-2009	12-Oct-2023	3,766.00	METHOD AND SYSTEM FOR ADMINISTRATION OF STORAGE OBJECTS
82250732	F200900008	US	US7939967	Granted		25-Jun-2009	10-Nov-2022	7,706.00	MULTIPLE POWER SUPPLY CONTROL

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82257317	F200901894	US	US8930010	Granted		5-Feb-2007	6-Jul-2022	3,606.00	INTELLIGENT ASSEMBLY SYSTEM AND METHOD OF USE
82853115	F200902751	US	US8634321	Granted		18-Dec-2009	21-Jul-2021	3,606.00	PROXY AGENTS IN A NETWORK
82635896	F200903834	TW	TW477810	Granted		31-Jan-2011	20-Mar-2021	359.56	OPTICAL DEVICES BASED ON NON-PERIODIC SUB-WAVELENGTH GRATINGS
82853254	F200903834	US	US8952403	Granted		29-Jan-2010	10-Aug-2022	3,766.00	OPTICAL DEVICES BASED ON NON-PERIODIC SUB-WAVELENGTH GRATINGS
84121874	F200903834	US	US10061139	Granted		14-Jan-2015	28-Feb-2022	2,006.00	OPTICAL DEVICES BASED ON NON-PERIODIC SUB-WAVELENGTH GRATINGS
82654418	F200904389	TW	TWI440907	Granted		1-Mar-2011	10-Jun-2021	359.56	TELECENTRIC OPTICAL ASSEMBLY
83119816	F200904389	US	US8947796	Granted		7-May-2010	3-Aug-2022	3,766.00	TELECENTRIC OPTICAL ASSEMBLY
83164626	F200904841	US	US9158647	Granted		20-Jul-2010	13-Apr-2023	3,766.00	FORMATTING SYSTEM MONITORING INFORMATION
83235817	F201001046	JP	JP5777722	Granted		29-Oct-2010	17-Jul-2021	476.28	SMALL-MODE-VOLUME, VERTICAL-CAVITY, SURFACE-EMITTING LASER
83235820	F201001046	US	US9991676	Granted		29-Oct-2010	5-Dec-2021	2,006.00	SMALL-MODE-VOLUME, VERTICAL-CAVITY, SURFACE-EMITTING LASER

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82265270	F201001847	US	US8726261	Granted		6-Apr-2011	13-Nov-2021	3,766.00	ZERO DOWNTIME HARD DISK FIRMWARE UPDATE
83546345	F201001922	KR	KR101603135	Granted		10-Feb-2011	8-Mar-2021	342.80	GRATING-BASED POLARIZERS AND OPTICAL ISOLATORS
82271360	F201003405	US	US6665543	Granted		4-Oct-2000	N/A	N/A	ANTENNA EXTRACTION ON REMOVAL OF STYLUS FOR HANDHELD DEVICE
82272962	F201004041	US	US7002932	Granted		12-Jan-2001	N/A	N/A	METHOD AND SYSTEM FOR PROVIDING NETWORK CONNECTIVITY AND MOBILITY WHILE ROAMING
82273352	F201004237	US	US7137047	Granted		5-Apr-2004	N/A	N/A	METHOD AND APPARATUS FOR SELECTION OF ARQ PARAMETERS AND ESTIMATION OF IMPROVED COMMUNICATIONS
82273664	F201004389	US	US8346938	Granted		25-Sep-2002	1-Jul-2024	7,706.00	EFFICIENT ESTABLISHMENT OF WIRELESS CONNECTIONS
82273793	F201004428	US	US7424532	Granted		15-Feb-2002	N/A	N/A	METHOD AND SYSTEM FOR AUTOMATIC NETWORK RESOURCE SELECTION AND CONFIGURATION IN A NETWORK ENVIRONMENT

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82274156	F201004550	US	US9479464	Granted		14-Apr-2009	25-Apr-2024	3,766.00	COMPUTER SYSTEM AND NETWORK INTERFACE WITH HARDWARE BASED PACKET FILTERING AND CLASSIFICATION
82274387	F201004599	US	US7702903	Granted		8-Aug-2005	20-Oct-2021	7,706.00	LICENSE RE-ALLOCATION SYSTEM AND METHOD
82274405	F201004603	GB	GB2411540	Granted		25-Feb-2004	25-Feb-2021	764.74	CASCADE CONTROL SYSTEM FOR NETWORK UNITS
82274408	F201004603	US	US7660323	Granted		28-Jun-2004	9-Aug-2021	7,706.00	CASCADE CONTROL SYSTEM FOR NETWORK UNITS
82274432	F201004608	US	US8327026	Granted		1-Jul-2004	4-Jun-2024	7,706.00	METHOD AND SYSTEM FOR SELECTING A DATA COMPRESSION TECHNIQUE FOR DATA TRANSFER THROUGH A DATA NETWORK
82274459	F201004619	US	US7480260	Granted		13-May-2004	N/A	N/A	METHOD AND APPARATUS FOR IMPLEMENTING A PRESENCE-BASED UNIVERSAL CAMP-ON FEATURE IN PACKET-BASED TELEPHONY SYSTEMS
82274465	F201004621	GB	GB2414623	Granted		27-May-2004	27-May-2021	764.74	DISTRIBUTED BRIDGING WITH SYNCHRONIZATION OF FORWARDING DATABASES

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82274468	F201004621	US	US7483999	Granted		9-Jul-2004	N/A	N/A	DISTRIBUTED BRIDGING WITH SYNCHRONIZATION FORWARDING DATABASES
82274471	F201004622	US	US7555751	Granted		11-Aug-2004	N/A	N/A	METHOD AND SYSTEM FOR PERFORMING A LIVE SYSTEM UPGRADE
82274480	F201004624	US	US8792475	Granted		11-Mar-2005	29-Jan-2022	3,606.00	METHOD AND SYSTEM FOR PROVIDING PASS THROUGH WEB CONFIGURATION ON AN INTERNET PROTOCOL (IP) TELEPHONE
82274483	F201004625	US	US9036618	Granted		11-Mar-2005	19-Nov-2022	3,606.00	METHOD AND SYSTEM FOR PROVIDING VOICE ASSISTED CONFIGURATION ON AN INTERNET PROTOCOL (IP) TELEPHONE
82274519	F201004633	US	US7480299	Granted		22-Feb-2005	N/A	N/A	RULES ENGINE FOR ACCESS CONTROL LISTS IN NETWORK UNITS
82274522	F201004635	GB	GB2420468	Granted		17-Nov-2004	17-Nov-2020	681.61	PACKET METERING IN HIGH-SPEED NETWORK UNITS
82274525	F201004635	US	US7349335	Granted		11-Jan-2005	N/A	N/A	PACKET METERING IN HIGH-SPEED NETWORK UNITS
82274528	F201004636	US	US8767974	Granted		15-Jun-2005	1-Jan-2022	3,606.00	SYSTEM AND METHOD FOR GENERATING COMFORT NOISE

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82274531	F201004637	US	US7526081	Granted		5-Oct-2004	N/A	N/A	TELEPHONE RECORDING AND STORING ARBITRARY KEYSTROKES SEQUENCE WITH REPLAY WITH A SINGLE STROKE
82274534	F201004637	US	US8218533	Granted		13-Mar-2009	10-Jan-2024	7,706.00	TELEPHONE RECORDING AND STORING ARBITRARY KEYSTROKES SEQUENCE WITH REPLAY WITH A SINGLE STROKE
82274555	F201004642	US	US7480300	Granted		22-Feb-2005	N/A	N/A	CONTENT ADDRESSABLE MEMORY ORGANIZED TO SHARE ENTRIES BETWEEN DIFFERENT ENTITIES SUCH AS PORTS OF A NETWORK UNIT
82274777	F201004678	US	US7711744	Granted		18-Jan-2006	4-Nov-2021	7,406.00	SIMPLE AND FAST DIRECTORY SEARCH WITH REDUCED KEYSTROKES AND REDUCED SERVER CALLS
82274798	F201004688	US	US7532474	Granted		21-Feb-2006	12-Nov-2020	7,406.00	APPARATUS FOR DISSIPATING HEAT FROM ELECTRONIC COMPONENTS IN AN ENCLOSED HOUSING
82062101	F30003028	US	US6925288	Granted		29-Mar-2001	N/A	N/A	GATHERING INFORMATION FROM SHORT-RANGE WIRELESS PORTALS
82065014	F30012087	US	US6873270	Granted		30-Oct-2002	N/A	N/A	DATA STORAGE AND ANALYSIS

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82070618	F50004606	US	US6920492	Granted		18-Jun-2001	N/A	N/A	PROCESS FOR CONTROLLING DEVICES OF AN INTRANET NETWORK THROUGH THE WEB
82070621	F50004606	DE	DE60039975.3	Expired		19-Jun-2000	N/A	N/A	PROCESS FOR CONTROLLING DEVICES OF AN INTRANET NETWORK THROUGH THE WEB
82070627	F50004606	GB	GB1168711	Expired		19-Jun-2000	N/A	N/A	PROCESS FOR CONTROLLING DEVICES OF AN INTRANET NETWORK THROUGH THE WEB
82070990	F50011154	US	US7062672	Granted		7-Jun-2002	N/A	N/A	METHOD OF AND COMPUTER NETWORK ARRANGEMENT FOR RESTORING AN IMPAIRED SOFTWARE IMAGE
82801074	F700205328	US	US8862577	Granted		15-Aug-2011	14-Apr-2022	3,766.00	VISUALIZING SENTIMENT RESULTS WITH VISUAL INDICATORS REPRESENTING USER SENTIMENT AND LEVEL OF UNCERTAINTY
82689078	F700205361	US	US8539113	Granted		16-Jun-2011	17-Mar-2021	3,766.00	INDICATORS FOR STREAMS ASSOCIATED WITH MESSAGES
83791163	F700205461	KR	KR101602811	Granted		29-Jul-2011	7-Mar-2021	383.94	OPTICAL POWER SPLITTERS
83791132	F700205462	KR	KR10-1563608	Granted		29-Jul-2011	21-Oct-2021	463.28	FIBER OPTICS CONNECTORS

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83791138	F700205462	US	US9052475	Granted		29-Jul-2011	9-Dec-2022	3,766.00	FIBER OPTICS CONNECTORS
82654416	F700205946	US	US8549219	Granted		7-Dec-2010	1-Apr-2021	3,766.00	PREVENTING HARD DRIVE FAILURE AND DATA LOSS DUE TO VIBRATION
82755131	F700206210	US	US8924667	Granted		3-Oct-2011	30-Jun-2022	3,766.00	BACKUP STORAGE MANAGEMENT
83698837	F700206222	CN	CN201180070805.8	Granted		18-Jul-2011	18-Jul-2020	666.46	OPTICAL INTERCONNECT
83698845	F700206222	US	US9170377	Granted		18-Jul-2011	27-Apr-2023	3,766.00	OPTICAL INTERCONNECT
82753547	F700206817	US	US9218527	Granted		29-Sep-2011	22-Jun-2023	3,766.00	ANOMALY DETECTION IN STREAMING DATA
82859781	F700206858	US	US9413358	Granted		29-Apr-2012	9-Feb-2024	3,766.00	FORWARD COUNTER BLOCK
84049818	F700207121	US	US9164250	Granted		14-Mar-2012	20-Apr-2023	3,766.00	REPLACEABLE MODULAR OPTICAL CONNECTION ASSEMBLY
82871690	F700207287	US	US8811210	Granted		13-Feb-2012	19-Feb-2022	3,766.00	EFFECTIVE APPLICATION DENSITIES FOR FABRICS
83930310	F700207642	US	US9341780	Granted		9-Dec-2011	17-Nov-2023	3,766.00	OPTICAL CONNECTIONS
82978201	F700207679	US	US8883616	Granted		31-Jul-2012	11-May-2022	3,766.00	GERMANIUM ON INSULATOR APPARATUS
82850245	F700207691	US	US8711693	Granted		21-Feb-2012	29-Oct-2021	3,766.00	GATEWAY CHANNEL UTILIZATION

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83996161	F700208065	US	US9372522	Granted		20-Apr-2012	21-Dec-2023	3,766.00	OVERVOLTAGE PROTECTION SYSTEMS AND METHOD
83991414	F700208157	US	US9413623	Reviving		26-Apr-2012	9-Feb-2024	3,606.00	MULTICAST ROUTING PATH CHECK
83992351	F700208617	US	US9161105	Granted		11-Apr-2012	13-Apr-2023	3,766.00	ROUTING OPTICAL SIGNALS
83150130	F700209140	US	US9246774	Granted		21-Feb-2013	26-Jul-2023	3,766.00	SAMPLE BASED DETERMINATION OF NETWORK POLICY VIOLATIONS
84076180	F700209670	US	US9520946	Granted		26-Jul-2012	13-Jun-2024	3,766.00	OPTICAL ENGINE
83992436	F700209695	US	US9176279	Granted		25-Apr-2012	3-May-2023	3,766.00	ANALYZING LIGHT BY MODE INTERFERENCE
83206779	F700212807	US	US9058295	Granted		25-Apr-2013	16-Dec-2022	3,766.00	ENCRYPT DATA OF STORAGE DEVICE
90142920	F700214270	US	US9715431	Granted		15-Jul-2013	25-Jan-2021	2,006.00	REBUILDING DRIVE DATA
83777585	F700215692	US	US9329965	Granted		31-Jan-2014	3-Nov-2023	3,766.00	EXTRACTING LOG FILES FROM STORAGE DEVICES
84293496	FARBA0002	CN	CN200780041079.0	Granted		3-Jul-2007	3-Jul-2021	1,032.98	A METHOD AND SYSTEM FOR DYNAMIC METRIC AND WIRELESS HELLO PROTOCOL
84268251	FARBA0042	US	US8351546	Granted		17-Dec-2008	8-Jul-2024	7,706.00	SENSING DEVICE ORIENTATION IN WIRELESS NETWORKS

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84268551	FARBA0118	US	US7983163	Granted		23-Dec-2008	19-Jan-2023	7,706.00	SYSTEM AND METHOD FOR IMPLEMENTING ADAPTIVE LOAD SHARING TO BALANCE NETWORK TRAFFIC

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81966353	F10001098	US	US6857086	Expired		21-Apr-2003	N/A	N/A	HIERARCHY OF FAULT ISOLATION TIMERS
81969824	F10002142	US	US7124180	Expired		27-Apr-2000	N/A	N/A	INTERNET USAGE DATA RECORDING SYSTEM AND METHOD EMPLOYING A CONFIGURABLE RULE ENGINE FOR THE PROCESSING AND CORRELATION OF NETWORK DATA
81971150	F10002493	US	US6813275	Expired		21-Apr-2000	N/A	N/A	METHOD AND APPARATUS FOR PREVENTING UNDERFLOW AND OVERFLOW ACROSS AN ASYNCHRONOUS CHANNEL
81971252	F10002509	US	US6912679	Expired		29-Apr-2000	N/A	N/A	SYSTEM AND METHOD FOR ELECTRICAL DATA LINK TESTING
81971258	F10002511	US	US6647469	Expired		1-May-2000	N/A	N/A	USING READ CURRENT TRANSACTIONS FOR IMPROVED PERFORMANCE IN DIRECTORY-BASED COHERENT I/O SYSTEMS
81971459	F10002566	US	US6928525	Expired		28-Apr-2000	N/A	N/A	PER CACHE LINE SEMAPHORE FOR CACHE ACCESS ARBITRATION
81972005	F10002818	US	US6671792	Expired		28-Apr-2000	N/A	N/A	SHARE MASKS AND ALIAS FOR DIRECTORY COHERENCY

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81972032	F10002825	US	US6651124	Expired		28-Apr-2000	N/A	N/A	METHOD AND APPARATUS FOR PREVENTING DEADLOCK IN A DISTRIBUTED SHARED MEMORY SYSTEM
81972035	F10002825	US	US6865634	Expired		16-Oct-2003	N/A	N/A	METHOD AND APPARATUS FOR DEADLOCK PREVENTION IN A DISTRIBUTED SHARED MEMORY SYSTEM
81972050	F10002834	US	US6647517	Expired		27-Apr-2000	N/A	N/A	APPARATUS AND METHOD FOR PROVIDING ERROR ORDERING INFORMATION AND ERROR LOGGING INFORMATION
81972209	F10002924	US	US6799287	Expired		1-May-2000	N/A	N/A	METHOD AND APPARATUS FOR VERIFYING ERROR CORRECTING CODES
81977594	F10004587	US	US7032086	Granted		28-Feb-2003	N/A	N/A	SYSTEM AND METHOD FOR ADJUSTING STORAGE DEVICE LAYOUT WITH AT LEAST ONE STATUS FOR THE ADJUSTING
81986432	F10007913	US	US7424461	Granted		28-Jun-2001	N/A	N/A	MULTI-MODULE GENETIC PROGRAMMING WITH MULTIPLE GENETIC DATA REPRESENTATIO NS
82082450	F100111713	US	US7224891	Granted		13-Feb-2002	N/A	N/A	DIGITAL PHOTOGRAPH PRESENTATION USING DVD PLAYERS

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81994958	F10013045	US	US7774611	Granted		6-May-2002	10-Feb-2022	7,706.00	ENFORCING FILE AUTHORIZATION ACCESS
81996038	F10013647	US	US7502839	Granted		28-Sep-2001	10-Sep-2020	7,406.00	MODULE-BUILDING METHOD FOR DESIGNING INTERCONNECT FABRICS
81996071	F10013661	US	US8032828	Granted		4-Mar-2002	4-Apr-2023	7,706.00	METHOD AND SYSTEM OF DOCUMENT TRANSFORMATION BETWEEN A SOURCE EXTENSIBLE MARKUP LANGUAGE (XML) SCHEMA AND A TARGET XML SCHEMA
81999323	F10015521	US	US8051176	Granted		7-Nov-2002	1-May-2023	7,706.00	METHOD AND SYSTEM FOR PREDICTING CONNECTIONS IN A COMPUTER NETWORK
82085489	F100201273	US	US8798964	Granted		6-Nov-2002	5-Feb-2022	3,766.00	METHODS AND APPARATUS FOR DESIGNING THE RANKING AND WIRING CONFIGURATIONS FOR PIECES OF HARDWARE
82095059	F100201387	US	US8799501	Granted		27-Jun-2002	5-Feb-2022	3,766.00	SYSTEM AND METHOD FOR ANONYMOUSLY SHARING AND SCORING INFORMATION POINTERS, WITHIN A SYSTEM FOR HARVESTING COMMUNITY KNOWLEDGE
82087874	F100202128	US	US7024758	Granted		28-May-2003	N/A	N/A	ASSEMBLY FOR ALIGNING A COMPONENT

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82089530	F100203011	US	US6829142	Granted		25-Oct-2002	N/A	N/A	CELL THERMAL CONNECTOR
82090361	F100203618	US	US7073029	Granted		27-Jan-2003	N/A	N/A	STORAGE SYSTEM USING FAST STORAGE AND LOG-STRUCTURED STORAGE
81956231	F1094649	GB	GB2048314	Expired		21-Jun-1995	N/A	N/A	MEDIA AUTOCHANGER SUCH AS AN OPTICAL DISK AUTOCHANGER
82008596	F10950142	GB	GB2048315	Expired		21-Jun-1995	N/A	N/A	CONTROL MODULE FOR A COMPUTER PERIPHERAL SUCH AS A MEDIA AUTOCHANGER
82035512	F10972015	US	US6728951	Expired		14-Apr-2000	N/A	N/A	SYSTEM AND METHOD FOR PERFORMING AUTOMATED INCREMENTAL COMPILATION OF COMPUTER PROGRAMS
82040858	F10980981	US	US8171266	Granted		2-Aug-2001	N/A	N/A	LOOK-AHEAD LOAD PRE-FETCH IN A PROCESSOR
82041722	F10981145	US	US6941569	Expired		3-Dec-2002	N/A	N/A	SYSTEM AND METHOD UTILIZING A CONDUCTIVE BRUSH FOR PROVIDING POWER SIGNALS TO A CARTRIDGE ACCESS DEVICE
82047860	F10990153	DE	DE49906067.9	Granted		22-Jun-1999	N/A	N/A	BEZEL FOR RACK MOUNTED DEVICE

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82052933	F10991388	US	US6888836	Expired		26-May-1999	N/A	N/A	METHOD FOR ALLOCATING WEB SITES ON A WEB HOSTING CLUSTER
82054217	F10991599	US	US7143315	Expired		16-Oct-2003	N/A	N/A	DATA STORAGE SYSTEMS AND METHODS
82055057	F10991802	US	US6671802	Expired		13-Apr-2000	N/A	N/A	PERFORMANCE OPTIMIZATION OF COMPUTER SYSTEM BY DYNAMICALLY AND IMMEDIATELY UPDATING A CONFIGURATION SETTING BASED ON DETECTED CHANGE IN PREFERRED USE
82058666	F10992650	US	US6487636	Expired		24-Apr-2000	N/A	N/A	METHOD AND APPARATUS FOR MAPPING DATA IN A HETEROGENEOUS DISK ARRAY STORAGE SYSTEM
82094639	F200206289	US	US7983422	Granted		25-Jul-2003	19-Jan-2023	7,706.00	QUANTUM CRYPTOGRAPHY
82094648	F200206289	JP	JP4829788	Granted		22-Jul-2004	22-Sep-2020	1,770.42	QUANTUM CRYPTOGRAPHY WITH QUANTUM CHANNEL CHECK
82094651	F200206289	DE	DE602004010270.9	Granted		22-Jul-2004	22-Jul-2020	1,690.52	QUANTUM CRYPTOGRAPHY WITH QUANTUM CHANNEL CHECK
82094657	F200206289	GB	GB1652334	Granted		22-Jul-2004	22-Jul-2020	682.85	QUANTUM CRYPTOGRAPHY WITH QUANTUM CHANNEL CHECK

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82096223	F200207002	US	US7607136	Granted		28-Oct-2003	20-Apr-2021	7,706.00	METHOD AND APPARATUS FOR INTERFACING WITH A DISTRIBUTED COMPUTING SERVICE
82096484	F200207094	US	US7337018	Granted		31-Jul-2003	N/A	N/A	HEAT SINK FAN MANAGEMENT BASED ON PERFORMANCE REQUIREMENTS
82096487	F200207094	GB	GB2404792	Granted		29-Jul-2004	29-Jul-2020	682.85	HEAT SINK FAN MANAGEMENT BASED ON PERFORMANCE REQUIREMENTS
82096490	F200207095	US	US7054156	Granted		2-Sep-2003	N/A	N/A	FAN ROTOR SYSTEMS HAVING COLLAPSIBLE FAN BLADES
82101161	F200208889	US	US6896539	Granted		30-Jun-2003	N/A	N/A	PIVOT COMPONENT COUPLED WITH FIRST CIRCUIT BOARD FOR CONTROL OF RELATIVE ALIGNMENT OF FIRST CIRCUIT BOARD CONNECTION COMPONENT WITH SECOND CIRCUIT BOARD CONNECTION COMPONENT
82103495	F200209610	US	US7082032	Granted		25-Aug-2003	N/A	N/A	HEAT DISSIPATION DEVICE WITH TILTED FINS
82103654	F200209636	US	US7079390	Granted		5-Jun-2003	N/A	N/A	SYSTEM AND METHOD FOR HEAT DISSIPATION AND AIR FLOW REDIRECTION IN A CHASSIS

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82104851	F200210142	US	US7480797	Granted		31-Jul-2004	20-Jul-2020	7,406.00	METHOD AND SYSTEM FOR PREVENTING CURRENT-PRIVILEGE-LEVEL-INFORMATION LEAKS TO NON-PRIVILEGED CODE
82104926	F200210171	US	US7643983	Granted		27-Mar-2003	5-Jul-2021	7,706.00	DATA STORAGE SYSTEM EMULATION
82105160	F200300004	US	US7107600	Granted		17-Mar-2003	N/A	N/A	SYSTEM AND METHOD FOR CLEANING ELECTRICAL DELIVERY SYSTEMS
82117313	F200301707	US	US6456510	Expired		31-Aug-2000	N/A	N/A	REGULATED DC POWER SUPPLY
82117337	F200301713	US	US6442067	Expired		23-May-2000	N/A	N/A	RECOVERY ROM FOR ARRAY CONTROLLERS
82117649	F200301781	US	US6678840	Granted		31-Aug-2000	N/A	N/A	FAULT CONTAINMENT AND ERROR RECOVERY IN A SCALABLE MULTIPROCESSOR
82117652	F200301781	US	US7152191	Expired		23-Oct-2003	N/A	N/A	FAULT CONTAINMENT AND ERROR RECOVERY IN A SCALABLE MULTIPROCESSOR

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82118051	F200301885	US	US6832282	Expired		1-Jul-2003	N/A	N/A	SYSTEM AND METHOD FOR PROVIDING FORWARD PROGRESS AND AVOIDING STARVATION AND LIVELOCK IN A MULTIPROCESSOR COMPUTER SYSTEM
82122050	F200302633	US	US7023708	Granted		20-Dec-2002	N/A	N/A	MULTILEVEL CABLE SUPPORT ARM AND SYSTEM AND METHOD INCORPORATING SAME
82132523	F200304132	US	US6842833	Expired		30-Jun-1998	N/A	N/A	COMPUTER SYSTEM AND METHOD FOR TRANSFERRING DATA BETWEEN MULTIPLE PEER-LEVEL STORAGE UNITS
82166255	F200308314	US	US6654902	Expired		11-Apr-2000	N/A	N/A	PERSISTENT RESERVATION IO BARRIERS
82166258	F200308314	US	US7346801	Expired		1-Aug-2003	N/A	N/A	PERSISTENT RESERVATION IO BARRIERS
82166381	F200308347	US	US7114020	Expired		28-Apr-2000	N/A	N/A	SOFTWARE MECHANISM FOR UNIQUE IDENTIFICATION OF SCSI DEVICE
82167758	F200308575	US	US7348498	Granted		17-Jul-2003	N/A	N/A	PARTIALLY VOIDED ANTI-PADS

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82168118	F200308700	US	US7333293	Granted		29-Jun-2004	N/A	N/A	STORAGE SYSTEM HAVING A READER WITH A LIGHT SENSING PORTION INCLINED WITH RESPECT TO AN AXIS OF A LABEL OF A STORAGE MEDIUM
82171787	F200310143	US	US7761421	Granted		16-May-2003	20-Jan-2022	7,706.00	READ, WRITE, AND RECOVERY OPERATIONS FOR REPLICATED DATA
82174301	F200311171	US	US7697690	Granted		21-Jul-2003	13-Oct-2021	7,706.00	WINDOWED BACKWARD KEY ROTATION
82176806	F200312160	US	US7505261	Granted		18-Mar-2004	17-Sep-2020	7,406.00	ELECTRICAL-OPTICAL SIGNAL CONVERSION FOR AUTOMATED STORAGE SYSTEMS
82176827	F200312171	US	US7230792	Granted		19-Nov-2003	N/A	N/A	MEDIA SELECTION SYSTEMS AND METHODS HAVING A COUPLER FOR SLIDABLY ENGAGING A STORAGE MEDIUM IN A STORAGE SYSTEM
82179566	F200313377	US	US7336490	Granted		24-Nov-2004	N/A	N/A	MULTI-CHIP MODULE WITH POWER SYSTEM
82179569	F200313377	US	US7499281	Granted		2-Jan-2008	3-Sep-2020	7,406.00	MULTI-CHIP MODULE WITH POWER SYSTEM

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82179656	F200313407	US	US7451302	Granted		10-Mar-2004	N/A	N/A	SYSTEM AND METHOD FOR MANAGING CONFIGURATION DATA FOR A MULTI-CELL COMPUTER SYSTEM
82180403	F200313720	US	US7289221	Granted		27-Sep-2004	N/A	N/A	MACH ZEHNDER PHOTONIC CRYSTAL SENSORS AND METHODS
82184357	F200315378	US	US7823156	Granted		3-Feb-2005	26-Apr-2022	7,706.00	METHOD OF HASHING ADDRESS SPACE TO STORAGE SERVERS
82186991	F200316679	US	US7480113	Granted		8-Aug-2007	20-Jul-2020	7,406.00	TAPE DRIVE APPARATUS
82216535	F200401087	US	US7436209	Granted		30-Oct-2006	N/A	N/A	NANOSCALE ELECTRONIC LATCH
82189427	F200401087	US	US7307448	Granted		24-May-2005	N/A	N/A	INTERCONNECTABLE NANOSCALE COMPUTATIONAL STAGES
82189433	F200401087	US	US7257016	Granted		24-May-2005	N/A	N/A	ENHANCED NANOWIRE-CROSSBAR LATCH ARRAY
82189598	F200401152	US	US7529060	Granted		2-Feb-2004	5-Nov-2020	7,406.00	READ AND WRITE HEAD ELEMENT ARRANGEMENT
82190375	F200401591	US	US7546600	Granted		30-Apr-2004	9-Dec-2020	7,406.00	METHOD OF ASSIGNING VIRTUAL PROCESS IDENTIFIER TO PROCESS WITHIN PROCESS DOMAIN

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82191587	F200402090	US	US7289321	Granted		16-Nov-2004	N/A	N/A	VENTILATED CASING FOR AN ELECTRONIC DEVICE
82193519	F200402893	US	US7552434	Granted		30-Apr-2004	23-Dec-2020	7,406.00	METHOD OF PERFORMING KERNEL TASK UPON INITIAL EXECUTION OF PROCESS AT USER LEVEL
82194107	F200403003	US	US8364829	Granted		24-Sep-2004	29-Jul-2020	3,606.00	SYSTEM AND METHOD FOR ASCRIBING RESOURCE CONSUMPTION TO ACTIVITY IN A CAUSAL PATH OF A NODE DISTRIBUTED COMPUTING SYSTEM
82194314	F200403103	US	US7471638	Granted		8-Oct-2004	N/A	N/A	TESTING FOR A MISCONNECTION BETWEEN FIRST AND SECOND NETWORKS
82194803	F200403293	US	USD523859	Expired		4-Apr-2005	N/A	N/A	MEDIA CARTRIDGE
82195382	F200403483	US	US8627213	Granted		10-Aug-2004	7-Jul-2021	3,766.00	CHAT ROOM SYSTEM
82196798	F200404117	US	US8392900	Granted		17-Mar-2005	5-Sep-2020	3,606.00	METHODS AND SYSTEMS FOR BARRIER REDUCTION IN PARALLEL PROCESSING SYSTEMS
82197119	F200404283	US	US7467329	Granted		23-Jun-2005	16-Jun-2020	7,406.00	METHOD OF ESTIMATING STORAGE SYSTEM RELIABILITY
82197158	F200404313	US	US9053501	Granted		31-Oct-2004	9-Dec-2022	3,766.00	SPONTANEOUS SHARING OF MEDIA ASSET REFERENCES

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82201010	F200406253	US	US7544591	Granted		18-Jan-2007	9-Dec-2020	7,406.00	METHOD OF CREATING ISOLATED ELECTRODES IN A NANOWIRE-BASED DEVICE
82201907	F200406631	US	US7242199	Granted		21-Apr-2005	N/A	N/A	ACTIVE INTERCONNECTS AND CONTROL POINTS IN INTEGRATED CIRCUITS
82205042	F200408089	US	US7480424	Granted		19-Sep-2005	20-Jul-2020	7,406.00	METHOD AND APPARATUS FOR MODIFYING AN ELECTROMAGNETIC RADIATION BEAM
82207400	F200408089	US	US8098971	Granted		19-Sep-2005	17-Jul-2023	7,706.00	METHOD AND APPARATUS FOR ELECTROMAGNETIC RESONANCE USING NEGATIVE INDEX MATERIAL
82207409	F200408089	JP	JP4829971	Granted		21-Jul-2006	22-Sep-2020	1,031.63	METHOD AND APPARATUS FOR ELECTROMAGNETIC RESONANCE USING NEGATIVE INDEX MATERIAL
82207415	F200408089	DE	DE602006009536.8	Granted		21-Jul-2006	21-Jul-2020	1,272.38	METHOD AND APPARATUS FOR ELECTROMAGNETIC RESONANCE USING NEGATIVE INDEX MATERIAL
82207418	F200408089	FR	FR1938429	Granted		21-Jul-2006	21-Jul-2020	555.56	METHOD AND APPARATUS FOR ELECTROMAGNETIC RESONANCE USING NEGATIVE INDEX MATERIAL

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82207421	F200408089	GB	GB1938429	Granted		21-Jul-2006	21-Jul-2020	524.44	METHOD AND APPARATUS FOR ELECTROMAGNETIC RESONANCE USING NEGATIVE INDEX MATERIAL
82218434	F200408089	US	US7352941	Granted		31-Oct-2006	N/A	N/A	METHOD AND APPARATUS FOR ELECTROMAGNETIC RESONANCE AND AMPLIFICATION USING NEGATIVE INDEX MATERIAL
82206395	F200500206	US	US7836111	Granted		29-Apr-2005	16-May-2022	7,706.00	DETECTING CHANGE IN DATA
82206401	F200500206	US	US7505868	Granted		29-Apr-2005	17-Sep-2020	7,406.00	PERFORMING QUALITY DETERMINATION OF DATA
82206671	F200500369	US	US8781977	Granted		29-Mar-2005	15-Jan-2022	3,766.00	SYSTEM AND METHOD OF PRICING RESOURCES
82208927	F200501467	US	US7437338	Granted		21-Mar-2006	N/A	N/A	PROVIDING INFORMATION REGARDING A TREND BASED ON OUTPUT OF A CATEGORIZER
82210514	F200502276	US	US7474823	Granted		12-Oct-2006	6-Jul-2020	7,406.00	TUNABLE DISPERSION COMPENSATION
82210871	F200502477	US	US7251092	Granted		25-Jul-2005	N/A	N/A	DATA TRANSFER APPARATUS AND METHOD FOR TRANSFERRING DATA

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82211144	F200502628	US	US7289868	Granted		22-Aug-2005	N/A	N/A	SYSTEM AND METHOD FOR CALCULATING A SHIFT VALUE BETWEEN PATTERN INSTANCES
82212551	F200503308	US	US7502971	Granted		12-Oct-2005	N/A	N/A	DETERMINING A RECURRENT PROBLEM OF A COMPUTER RESOURCE USING SIGNATURES
82213670	F200503906	US	US7489583	Granted		6-Sep-2005	N/A	N/A	CONSTANT-WEIGHT-CODE-BASED ADDRESSING OF NANOSCALE AND MIXED MICROSCALE/NANOSCALE ARRAYS
82214174	F200504358	US	US8606894	Granted		27-Apr-2006	10-Jun-2021	3,766.00	SERVER CONSOLIDATION
82214600	F200504603	US	US7546013	Granted		31-May-2006	N/A	N/A	NANOPARTICLE COUPLED TO WAVEGUIDE
82214609	F200504603	JP	JP4871994	Granted		22-May-2007	25-Nov-2020	873.50	NANOPARTICLE COUPLED TO WAVEGUIDE
82214642	F200504613	US	US7530032	Granted		28-Oct-2005	5-Nov-2020	7,406.00	NANOWIRE CROSSBAR IMPLEMENTATIONS OF LOGIC GATES USING CONFIGURABLE, TUNNELING RESISTOR JUNCTIONS
82216148	F200505468	US	US7447026	Granted		31-Aug-2006	N/A	N/A	SYSTEM FOR HOT SWAPPING HEAT EXCHANGERS

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82217930	F200506432	US	US7823154	Granted		16-Sep-2005	26-Apr-2022	7,706.00	SYSTEM AND METHOD FOR PROVIDING, BY A PLURALITY OF SCHEDULERS, DIFFERENTIATED SERVICE TO CONSUMERS OF DISTRIBUTED RESOURCES
82218791	F200506906	US	US7243877	Granted		7-Apr-2006	N/A	N/A	TAPE REEL
82218968	F200507008	US	US8214838	Granted		26-Jul-2006	3-Jan-2024	7,400.00	SYSTEM AND METHOD FOR ATTRIBUTING TO A CORRESPONDING VIRTUAL MACHINE CPU UTILIZATION OF A NETWORK DRIVER DOMAIN BASED ON WEIGHTED COMMUNICATION
82219595	F200507343	US	US7517794	Granted		21-Oct-2005	N/A	N/A	METHOD FOR FABRICATING NANOSCALE FEATURES
82219769	F200507436	US	US8732307	Granted		25-Jul-2006	20-Nov-2021	3,766.00	PREDICTIVE CONTROL FOR RESOURCE ENTITLEMENT
82220357	F200600115	US	US7707215	Granted		17-Oct-2006	27-Oct-2021	7,706.00	PARIMUTUEL CONTENT PROVISIONING
82222718	F200601010	US	US7610383	Granted		11-Aug-2006	27-Apr-2021	7,706.00	DATA-OBJECT-RELATED-REQUEST ROUTING IN A DYNAMIC, DISTRIBUTED DATA-STORAGE SYSTEM

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82223486	F200601309	US	US8347726	Granted		25-Apr-2007	8-Jul-2020	3,606.00	FREE-STANDING NANOWIRE SENSOR AND METHODS FOR FORMING AND USING THE SAME
82223495	F200601311	US	US8773882	Granted		15-Apr-2010	8-Jan-2022	3,766.00	MIXED-SCALE ELECTRONIC INTERFACES
82225259	F200602234	US	USD627772	Granted		26-Mar-2007	N/A	N/A	AN OPERATOR CONTROL PANEL WITH DISPLAY AND MULTIPLE FUNCTION BUTTONS FOR A STORAGE LIBRARY
82233167	F200602441	US	US8024514	Granted		17-Jul-2007	20-Mar-2023	7,706.00	ACCESS CONTROL MANAGEMENT
82226204	F200602589	US	US8395896	Granted		24-Feb-2007	12-Sep-2020	3,606.00	REDUNDANT COOLING SYSTEMS AND METHODS
82230137	F200700096	US	US7757023	Granted		1-Aug-2007	13-Jan-2022	7,706.00	STORAGE-CENTRIC MANAGEABILITY IN A SYSTEM
82231646	F200700635	US	US7962480	Granted		31-Jul-2007	14-Dec-2022	7,406.00	USING A WEIGHTED TREE TO DETERMINE DOCUMENT RELEVANCE
82231916	F200700731	US	US8793264	Granted		18-Jul-2007	29-Jan-2022	3,766.00	DETERMINING A SUBSET OF DOCUMENTS FROM WHICH A PARTICULAR DOCUMENT WAS DERIVED
82232318	F200700875	US	US8392708	Granted		29-Sep-2008	5-Sep-2020	3,606.00	AUDITING DATA INTEGRITY

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82239869	F200700875	US	US8281151	Granted		1-Oct-2008	2-Apr-2024	7,706.00	AUDITOR ASSISTED EXTRACTION AND VERIFICATION OF CLIENT DATA RETURNED FROM A STORAGE PROVIDED WHILE HIDING CLIENT DATA FROM THE AUDITOR
82232477	F200700945	US	US7477809	Granted		31-Jul-2007	13-Jul-2020	7,406.00	PHOTONIC GUIDING DEVICE
82232483	F200700945	US	US7835602	Granted		23-Oct-2008	16-May-2022	7,706.00	PHOTONIC GUIDING DEVICE
82232486	F200700945	CN	CN200880101515.3	Granted		30-Jul-2008	30-Jul-2021	990.04	PHOTONIC GUIDING DEVICE
82232495	F200700945	KR	KR10-1588348	Granted		30-Jul-2008	19-Jan-2021	260.52	PHOTONIC GUIDING DEVICE
82239827	F200702994	US	US8732308	Granted		1-Oct-2008	20-Nov-2021	3,766.00	COORDINATED MANAGEMENT IN VIRTUALIZED SYSTEMS USING MANAGEMENT BROKERS AND MANAGEMENT CHANNELS
82245341	F200702994	US	US9395786	Granted		9-Oct-2008	19-Jan-2024	3,766.00	CROSS-LAYER POWER MANAGEMENT IN A MULTI-LAYER SYSTEM
82239983	F200703037	US	US8812508	Granted		14-Dec-2007	19-Feb-2022	3,766.00	SYSTEMS AND METHODS FOR EXTRACTING PHASES FROM TEXT
82241663	F200703681	US	US8694991	Granted		22-Aug-2008	8-Oct-2021	3,766.00	SERVER VIRTUALIZED USING VIRTUALIZATION PLATFORM

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82654469	F200703809	US	US8677365	Granted		27-Aug-2008	18-Sep-2021	3,766.00	PERFORMING ZONE BASED WORKLOAD SCHEDULING ACCORDING TO ENVIRONMENTAL CONDITIONS
82242488	F200703973	US	US7925927	Granted		30-Oct-2008	12-Oct-2022	7,706.00	SIMULATOR FOR DETERMINING DATA LOSS IN A FAULT TOLERANT SYSTEM
82242503	F200703974	US	US8677208	Granted		19-Sep-2008	18-Sep-2021	3,766.00	GENERATING A PARALLEL RECOVERY PLAN FOR A DATA STORAGE SYSTEM
82242506	F200703974	CN	CN200880117051.5	Granted		19-Sep-2008	19-Sep-2020	985.42	GENERATING A PARALLEL RECOVERY PLAN FOR A DATA STORAGE SYSTEM
82243097	F200704122	US	US8019765	Granted		29-Oct-2008	13-Mar-2023	7,706.00	IDENTIFYING FILES ASSOCIATED WITH A WORKFLOW
82620394	F200704234	US	US8774625	Granted		8-Aug-2008	8-Jan-2022	3,766.00	METHOD AND SYSTEMS FOR IMPLEMENTING HIGH-RADIX SWITCH TOPOLOGIES ON RELATIVELY LOWER-RADIX SWITCH PHYSICAL NETWORKS
82244438	F200704554	GB	GB2461899	Granted		17-Jul-2008	17-Jul-2021	443.74	CONTROLLING MOTION OF STORAGE MEDIA
82244441	F200704554	US	US7911727	Granted		1-Oct-2008	22-Sep-2022	7,706.00	CONTROLLING MOTION OF STORAGE MEDIA

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82641262	F200704721	US	US8386494	Granted		7-Aug-2008	26-Aug-2020	3,606.00	PROVIDING DATA STRUCTURES FOR DETERMINING WHETHER KEYS OF AN INDEX ARE PRESENT IN A STORAGE SYSTEM
82245164	F200800251	US	US8347070	Granted		30-Oct-2008	1-Jul-2024	7,706.00	METHOD FOR CONTROLLING RESOURCE UTILIZATION RATE AND COMPUTER SYSTEM
82245167	F200800252	US	US8677375	Granted		29-Jan-2009	18-Sep-2021	3,766.00	SELECTING EXECUTING REQUESTS TO PREEMPT
82247732	F200801486	US	US8516099	Granted		26-Jan-2009	20-Feb-2021	3,606.00	SCALING MANAGEMENT TASKS PERFORMED BY A MANAGEMENT SYSTEM ACCORDING TO A DETERMINED SIZE OF A MANAGED ENVIRONMENT
82910274	F200802535	US	US9179580	Granted		10-Jun-2010	3-May-2023	3,766.00	DATA CENTER COOLER WITH CHILLER AND COOLING TOWER (AS AMENDED)
82249292	F200802683	US	US8355828	Granted		13-Mar-2009	15-Jul-2020	3,606.00	DETERMINING OPTIMAL SETTINGS FOR RESOURCE ACTUATORS
82853976	F200803285	US	US8774638	Granted		31-Jul-2009	8-Jan-2022	3,766.00	PHOTONIC QUANTUM SYSTEM ALIGNMENT USING MULTIPLE BEAMS

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82925997	F200803285	CN	CN200980160706.1	Granted		31-Jul-2009	31-Jul-2021	1,032.98	PHOTONIC QUANTUM SYSTEM ALIGNMENT USING MULTIPLE BEAMS
82250756	F200900032	US	US8390705	Granted		27-Oct-2009	5-Sep-2024	7,706.00	NANOWIRE PHOTODIODES
82250801	F200900057	US	US8402016	Granted		27-May-2009	19-Sep-2020	3,606.00	FETCHING OPTIMIZATION IN MULTI-WAY PIPELINED DATABASE JOINS
82922683	F200900329	US	US8569900	Granted		20-Jul-2009	29-Apr-2021	3,766.00	NANOWIRE SENSOR WITH ANGLED SEGMENTS THAT ARE DIFFERENTLY FUNCTIONALIZED
82251176	F200900333	US	US8327721	Granted		26-Oct-2009	11-Jun-2024	7,706.00	SENSOR FABRIC FOR SHAPE PERCEPTION
82251317	F200900411	US	US8374622	Granted		12-Dec-2007	12-Aug-2024	7,706.00	CALL ADMISSION CONTROL FOR WI FI
82918780	F200902356	CN	CN200980161379.1	Granted		10-Jul-2009	10-Jul-2020	666.46	MEMRISTIVE JUNCTION WITH INTRINSIC RECTIFIER
82258220	F200902356	TW	TWI517465	Granted		9-Jul-2010	10-Jan-2021	237.00	MEMRISTIVE JUNCTION WITH INTRINSIC RECTIFIER
82852408	F200902356	US	US8710483	Granted		10-Jul-2009	29-Oct-2021	3,766.00	MEMRISTIVE JUNCTION WITH INTRINSIC RECTIFIER
82918782	F200902356	KR	KR10-1530118	Granted		10-Jul-2009	12-Jun-2021	664.27	MEMRISTIVE JUNCTION WITH INTRINSIC RECTIFIER

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82258373	F200902417	TW	TWI523290	Granted		27-Jul-2010	20-Feb-2021	237.00	MEMRISTORS WITH ASYMMETRIC ELECTRODES
82853070	F200902417	US	US9171613	Granted		28-Jul-2009	27-Apr-2023	3,766.00	MEMRISTORS WITH ASYMMETRIC ELECTRODES
82258460	F200902461	US	US9405731	Granted		26-Aug-2009	2-Feb-2024	3,766.00	ENERGY BASED WAVELET THRESHOLDING
82259390	F200903200	US	US8431474	Granted		25-Sep-2009	30-Oct-2024	7,406.00	THREE DIMENSIONAL MULTILAYER CIRCUIT
82259435	F200903225	US	US8392168	Granted		3-Nov-2009	5-Sep-2020	3,606.00	SIMULATING AN APPLICATION DURING A SAMPLING PERIOD AND A NON-SAMPLING PERIOD
82259600	F200903307	US	US8402461	Granted		15-Nov-2009	19-Sep-2020	3,606.00	SWITCHING BETWEEN DIRECT MODE AND INDIRECT MODE FOR VIRTUAL MACHINE I/O REQUESTS
90045005	F200903800	JP	JP5969677	Granted		5-Oct-2015	15-Jul-2020	182.67	MULTIMODE VERTICAL-CAVITY SURFACE-EMITTING LASER ARRAYS
83034236	F200903989	US	US8904176	Granted		28-Apr-2010	2-Jun-2022	3,766.00	PROTECTING THE INFORMATION ENCODED IN A BLOOM FILTER USING ENCODED BITS OF DATA

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90648620	F200903989	DE	DE602010053953.9	Granted		28-Apr-2010	28-Apr-2021	804.57	PROTECTING THE INFORMATION ENCODED IN A BLOOM FILTER USING ENCODED BITS OF DATA
90648624	F200903989	GB	GB2564346	Granted		28-Apr-2010	28-Apr-2021	327.01	PROTECTING THE INFORMATION ENCODED IN A BLOOM FILTER USING ENCODED BITS OF DATA
82261124	F200904320	US	US8364909	Granted		25-Jan-2010	29-Jul-2020	3,606.00	DETERMINING A CONFLICT IN ACCESSING SHARED RESOURCES USING A REDUCED NUMBER OF CYCLES
82261316	F200904449	US	US8664940	Granted		12-Oct-2010	4-Sep-2021	3,766.00	GRAPHITE-BASED SENSOR
83214681	F201000277	CN	CN201080069548.1	Granted		11-Oct-2010	11-Oct-2020	648.83	SYSTEM AND METHOD FOR QUERYING A DATA STREAM
82263137	F201000463	US	US8539059	Granted		2-Jun-2010	17-Mar-2021	3,766.00	MANAGING COOLING DEVICES AND COMPUTING NODES IN AN INFRASTRUCTURE
83139124	F201000520	US	US8990165	Granted		13-Jul-2010	24-Sep-2022	3,766.00	METHODS, APPARATUS AND ARTICLES OF MANUFACTURE TO ARCHIVE DATA
82585683	F201000596	US	US8725904	Granted		18-Aug-2011	13-Nov-2021	3,766.00	MANAGEMENT PROCESSORS, METHODS AND ARTICLES OF MANUFACTURE

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Patent ID Tranche 8	Patent Family Id	CC	Patent Number	Patent Status	Application Number if not Granted	Filed Date	Annuity Due Date	Annuity Cost (Est. USD)	Application Title
83166392	F201000824	US	US9275542	Granted		30-Jul-2010	1-Sep-2023	3,766.00	LOCATION-INDEXED AUDIO CONTENT
83834197	F201001697	CN	CN201180074045.8	Granted		2-Sep-2011	2-Sep-2021	698.53	APPARATUS TO STORE DATA AND METHODS TO READ MEMORY CELLS
83834203	F201001697	US	US9311998	Granted		2-Sep-2011	12-Oct-2023	3,766.00	APPARATUS TO STORE DATA AND METHODS TO READ MEMORY CELLS
90175060	F201001697	US	US9431103	Granted		9-Mar-2016	29-Feb-2024	3,766.00	APPARATUS TO STORE DATA AND METHODS TO READ MEMORY CELLS
82267643	F201002333	US	US6937610	Expired		6-Oct-2000	N/A	N/A	METHOD AND PROTOCOL FOR A MEDIUM ACCESS CONTROL LAYER FOR LOCAL AREA NETWORKS WITH MULTIPLE-PRIORITY TRAFFIC
82268585	F201002556	US	US6959082	Expired		10-Jul-2001	N/A	N/A	METHOD AND SYSTEM FOR AUTOMATIC GAIN CONTROL WITH ADAPTIVE TABLE LOOKUP
82269776	F201002905	US	US7660408	Expired		28-Apr-2000	N/A	N/A	ATTENUATION AND TERMINATION CIRCUIT USING IMPEDANCE SYNTHESIS
82269779	F201002905	US	US8472614	Expired		22-Dec-2009	N/A	N/A	ATTENUATION AND TERMINATION CIRCUIT USING IMPEDANCE SYNTHESIS

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Patent ID Tranche 8	Patent Family Id	CC	Patent Number	Patent Status	Application Number if not Granted	Filed Date	Annuity Due Date	Annuity Cost (Est. USD)	Application Title
82269821	F201002924	US	US6859051	Expired		2-Jun-2003	N/A	N/A	SYSTEMS AND METHODS FOR IMPEDANCE SYNTHESIS
82270880	F201003297	US	US6507303	Expired		31-May-2000	N/A	N/A	DIRECT DIGITAL CONVERSION OF BASEBAND SIGNALS TO SUPER-NYQUIST FREQUENCIES
82272755	F201003297	US	US6703954	Expired		20-Dec-2002	N/A	N/A	DIRECT DIGITAL CONVERSION OF BASEBAND SIGNALS TO SUPER-NYQUIST FREQUENCIES
82271678	F201003514	US	US6601180	Expired		14-Apr-2000	N/A	N/A	METHOD AND SYSTEM FOR PROVIDING LINK DETECTION TO A PC CARD FOR POWER MANAGEMENT
82271741	F201003533	US	US7275093	Expired		26-Apr-2000	N/A	N/A	METHODS AND DEVICE FOR MANAGING MESSAGE SIZE TRANSMITTED OVER A NETWORK
82271903	F201003585	US	US6826279	Expired		25-May-2000	N/A	N/A	BASE BAND ECHO CANCELLATION USING LAGUERRE ECHO ESTIMATION
82272026	F201003635	US	US6982962	Expired		10-Apr-2000	N/A	N/A	SYSTEM AND METHOD FOR SELECTING A NETWORK ACCESS PROVIDER USING A PORTABLE INFORMATION DEVICE

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Patent ID Tranche 8	Patent Family Id	CC	Patent Number	Patent Status	Application Number if not Granted	Filed Date	Annuity Due Date	Annuity Cost (Est. USD)	Application Title
82272263	F201003731	US	US6545643	Expired		8-Sep-2000	N/A	N/A	EXTENDABLE PLANAR DIVERSITY ANTENNA
82272266	F201003731	US	US6933896	Expired		7-Apr-2003	N/A	N/A	EXTENDABLE PLANAR DIVERSITY ANTENNA
82272293	F201003749	US	US6766453	Expired		28-Apr-2000	N/A	N/A	AUTHENTICATED DIFFIE-HELLMAN KEY AGREEMENT PROTOCOL WHERE THE COMMUNICATING PARTIES SHARE A SECRET KEY WITH A THIRD PARTY
82272296	F201003753	US	US7024690	Expired		28-Apr-2000	N/A	N/A	PROTECTED MUTUAL AUTHENTICATION OVER AN UNSECURED WIRELESS COMMUNICATION CHANNEL
82272530	F201003835	US	US6772349	Expired		3-May-2000	N/A	N/A	DETECTION OF AN ATTACK SUCH AS A PRE-ATTACK ON A COMPUTER NETWORK
82272536	F201003836	US	US6862286	Expired		8-May-2000	N/A	N/A	TRACKING DYNAMIC ADDRESSES ON A NETWORK
82272572	F201003848	US	US6704016	Expired		8-May-2000	N/A	N/A	METHOD AND APPARATUS FOR THE GRAPHICAL PRESENTATION OF SELECTED DATA

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Patent ID Tranche 8	Patent Family Id	CC	Patent Number	Patent Status	Application Number if not Granted	Filed Date	Annuity Due Date	Annuity Cost (Est. USD)	Application Title
82272617	F201003860	US	US6701442	Expired		9-May-2000	N/A	N/A	A POWER MANAGEMENT CIRCUIT FOR SELECTIVELY APPLYING POWER TO NETWORK MONITORING CIRCUITRY WHICH MONITORS THE RECEIPT OF NETWORK WAKE-UP MESSAGES
82272695	F201003911	US	US6273735	Expired		25-Oct-2000	N/A	N/A	ROTATING TURRET SIDE-ENTRY RETRACTABLE JACK
82272893	F201004009	US	US6366261	Expired		8-Sep-2000	N/A	N/A	METHOD AND APPARATUS FOR OVERMOLDED ANTENNA
82272908	F201004015	US	US6509876	Expired		8-Sep-2000	N/A	N/A	ANTENNA FOR WIRELESS COMMUNICATIO N SYSTEM
82818908	F201005231	US	US9275041	Granted		24-Oct-2011	1-Sep-2023	3,766.00	PERFORMING SENTIMENT ANALYSIS ON MICROBLOGGIN G DATA, INCLUDING IDENTIFYING A NEW OPINION TERM THEREIN (AS AMENDED)
82576208	F201005331	US	US8390959	Granted		24-Mar-2011	5-Sep-2020	3,606.00	ACTUATOR WITH NON-MOVING MASS
83051101	F201005530	TW	TWI529988	Granted		19-Jul-2012	10-Apr-2021	237.00	MEMRISTOR STRUCTURE WITH A DOPANT SOURCE
83786501	F201005530	US	US9178153	Granted		20-Jul-2011	3-May-2023	3,766.00	MEMRISTOR STRUCTURE WITH A DOPANT SOURCE

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Patent ID Tranche 8	Patent Family Id	CC	Patent Number	Patent Status	Application Number if not Granted	Filed Date	Annuity Due Date	Annuity Cost (Est. USD)	Application Title
83057100	F201005561	TW	TWI520149	Granted		26-Jul-2012	31-Jan-2021	237.00	METHOD AND SYSTEM FOR REDUCING WRITE-BUFFER CAPACITIES WITHIN MEMRISTOR-BASED DATA-STORAGE DEVICES
83769079	F201005561	KR	KR10-1620761	Granted		27-Jul-2011	4-May-2021	383.94	METHOD AND SYSTEM FOR REDUCING WRITE-BUFFER CAPACITIES WITHIN MEMRISTOR-BASED DATA-STORAGE DEVICES
83769083	F201005561	US	US9405614	Granted		27-Jul-2011	2-Feb-2024	3,766.00	METHOD AND SYSTEM FOR REDUCING WRITE-BUFFER CAPACITIES WITHIN MEMRISTOR-BASED DATA-STORAGE DEVICES
82678579	F201005877	US	US8373584	Granted		16-May-2011	12-Aug-2020	3,606.00	COMPRESSING AND DECOMPRESSING DATA
83051185	F201006081	TW	TWI520393	Granted		26-Jul-2012	31-Jan-2021	237.00	NITRIDE-BASED MEMRISTORS
83807343	F201006081	KR	KR10-1528572	Granted		3-Aug-2011	8-Jun-2021	522.19	NITRIDE-BASED MEMRISTORS
83566663	F700205541	JP	JP5859654	Lapsed		25-Aug-2011	25-Dec-2020	206.51	MODEL-BASED STEREOSCOPIC AND MULTIVIEW CROSS-TALK REDUCTION
82835640	F700206343	US	US8854860	Granted		31-Jan-2012	7-Apr-2022	3,766.00	METAL-INSULATOR TRANSITION LATCH

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Patent ID Tranche 8	Patent Family Id	CC	Patent Number	Patent Status	Application Number if not Granted	Filed Date	Annuity Due Date	Annuity Cost (Est. USD)	Application Title
83862114	F700206343	KR	KR10-1634191	Granted		28-Oct-2011	22-Jun-2021	383.94	METAL-INSULATOR PHASE TRANSITION FLIP-FLOP
83862120	F700206343	US	US9331700	Granted		28-Oct-2011	3-Nov-2023	3,766.00	METAL-INSULATOR PHASE TRANSITION FLIP-FLOP
83863051	F700206384	KR	KR101620247	Granted		4-Nov-2011	3-May-2021	486.79	DECODER CIRCUITS HAVING METAL-INSULATOR-METAL THRESHOLD SWITCHES
83815245	F700206830	US	US9064568	Granted		26-Aug-2011	23-Dec-2022	3,766.00	CIRCUIT AND METHOD FOR READING A RESISTIVE SWITCHING DEVICE IN AN ARRAY
84020521	F700208907	US	US9224821	Granted		26-Apr-2012	29-Jun-2023	3,766.00	CUSTOMIZABLE NONLINEAR ELECTRICAL DEVICES
83013477	F700210371	US	US8793258	Granted		31-Jul-2012	29-Jan-2022	3,766.00	PREDICTING SHARING ON A SOCIAL NETWORK
83099558	F700211223	US	US9411657	Granted		9-Nov-2012	9-Feb-2024	3,766.00	LOAD-BALANCED SPARSE ARRAY PROCESSING
83138539	F700212517	US	US8810780	Granted		31-Jan-2013	19-Feb-2022	3,766.00	PLASMON RESONANCE BASED STRAIN GAUGE
83139311	F700212552	US	US9408050	Granted		31-Jan-2013	2-Feb-2024	3,766.00	REDUCING BANDWIDTH USAGE OF A MOBILE CLIENT

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Patent ID Tranche 8	Patent Family Id	CC	Patent Number	Patent Status	Application Number if not Granted	Filed Date	Annuity Due Date	Annuity Cost (Est. USD)	Application Title
83140845	F700212571	US	US9195727	Granted		30-Jan-2013	24-May-2023	3,766.00	DELTA PARTITIONS FOR BACKUP AND RESTORE
84191546	F700220555	EM	EM28789910001	Granted		27-Nov-2015	27-Nov-2020	135.11	RDX MICROSERVER MODULE
90405775	F700220555	EM	EM28789910002	Granted		27-Nov-2015	27-Nov-2020	135.11	SERVER MODULE

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Recordable Assignment - Escrow (PEA) Valtrus_v3

Final Audit Report 2021-01-21

Created:	2021-01-20
By:	Valerie Castro (valerie.castro@hpe.com)
Status:	Signed
Transaction ID:	CBJCHBCAABAAOFbUVbD3Ds5chRp3oMNevtMKdX88P_Q-

"Recordable Assignment - Escrow (PEA) Valtrus_v3" History

Document created by Valerie Castro (valerie.castro@hpe.com)
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Document emailed to Brett Alten (brett.alten@hpe.com) for signature
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HPE-OT_Valtrus_ Assignment and Lien

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APPLICATION NUMBER	PATENT NUMBER	GROUP ART UNIT	FILE WRAPPER LOCATION
09/703,427	6889244	2144	9200

OC000000073818790

Correspondence Address/Fee Address Change

The following fields have been set to Customer Number 56436 on 03/06/2015

- **Correspondence Address**
- **Maintenance Fee Address**

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56436
HP Company
Intellectual Property Administration
3404 E. Harmony Road
Mail Stop 35
Fort Collins, CO 80528

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09/703,427	6889244	2144	9200

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- **Correspondence Address**
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56436
HP Company
Intellectual Property Administration
3404 E. Harmony Road
Mail Stop 35
Fort Collins, CO 80528

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PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: Mail Mail Stop ISSUE FEE
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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.

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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 (703) 746-4000, on the date indicated below.

JOANNE BOURGUIGNON (Depositor's name)
(Signature)
03-21-05 (Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/703,427	10/31/2000	Blaine D. Gaither	10008316-1	2980

TITLE OF INVENTION: METHOD AND APPARATUS FOR PASSING MESSAGES USING A FAULT TOLERANT STORAGE SYSTEM

APPLN. TYPE	SMALL ENTITY	ISSUE FEE	PUBLICATION FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	$1400	$0	$1400	03/21/2005

EXAMINER	ART UNIT	CLASS-SUBCLASS
THOMPSON, MARC D	2144	709-202000

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 David A. Plettner
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: Hewlett-Packard Development Company, L.P.
(B) RESIDENCE: (CITY and STATE OR COUNTRY): Houston, Texas

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 enclosed:
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☐ Publication Fee (No small entity discount permitted)
☒ Advance Order - # of Copies 2

4b. Payment of Fee(s):
☐ A check in the amount of the fee(s) is enclosed.
☐ Payment by credit card. Form PTO-2038 is attached.
☒ The Director is hereby authorized by charge the required fee(s), or credit any overpayment, to Deposit Account Number 08-2025 (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).

The Director of the USPTO is requested to apply the Issue Fee and Publication Fee (if any) or to re-apply any previously paid issue fee to the application identified above.
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 Robert W. Bergstrom Date 03-21-05
Typed or printed name ROBERT W. BERGSTROM Registration No. 39,906

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.
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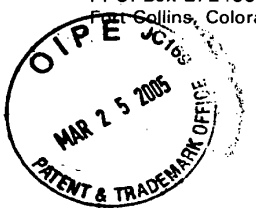
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02 FC:8001 6.00 DA

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SAP v. Valtrus et al. - IPR2025-00420
Page 269 of 704

HEWLETT-PACKARD COMPANY
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P. O. Box 272400
Fort Collins, Colorado 80527-2400

PATENT APPLICATION

ATTORNEY DOCKET NO. 10008316-1



IN THE
UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s):	Blaine D. Gaither et al.	***Confirmation No.:***	
Application No.:	09/703,427	***Examiner:***	Lambert L. Tran
Filing Date:	Oct. 31, 2000	***Group Art Unit:***	2142
Title:	Method and Apparatus for Passing Messages using a Fault Tolerant Storage System		

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Sir:

Enclosed herewith please find:

( ) _____ sheets of redlined drawing(s) which indicate proposed changes to the drawing(s). Upon approval of these proposed changes, formal drawing(s) will be submitted.

( ) _____ sheets of corrected formal drawing(s), as required by the Notice of Patent Drawings Objection (PTO-948) which accompanied the Office Action dated_____ .

( ) _____ sheets of corrected formal drawing(s), as required by the Notice of Patent Drawings Objection (PTO-948) and approved in the Notice of Allowability dated_____.

(X) 10 sheets of formal drawing(s). Please substitute these formal drawing(s) for the informal drawing(s) originally filed.

( ) _____

Examiner's approval of the entry of these drawings is respectfully requested. No new matter has been added.

Respectfully submitted,

Blaine D. Gaither et al.

By _____

Robert W. Bergstrom

Attorney/Agent for Applicant(s)
Reg. No. ***39,906***

Date: ***March 21, 2005***

Telephone No.: ***206.621.1933***

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to: Commissioner for Patents, Alexandria, VA 22313-1450.

Date of Deposit: ***March 21, 2005***

Typed Name: ***Joanne Bourguignon***

Signature: _____

Rev 12/04 (Dwgtrans)

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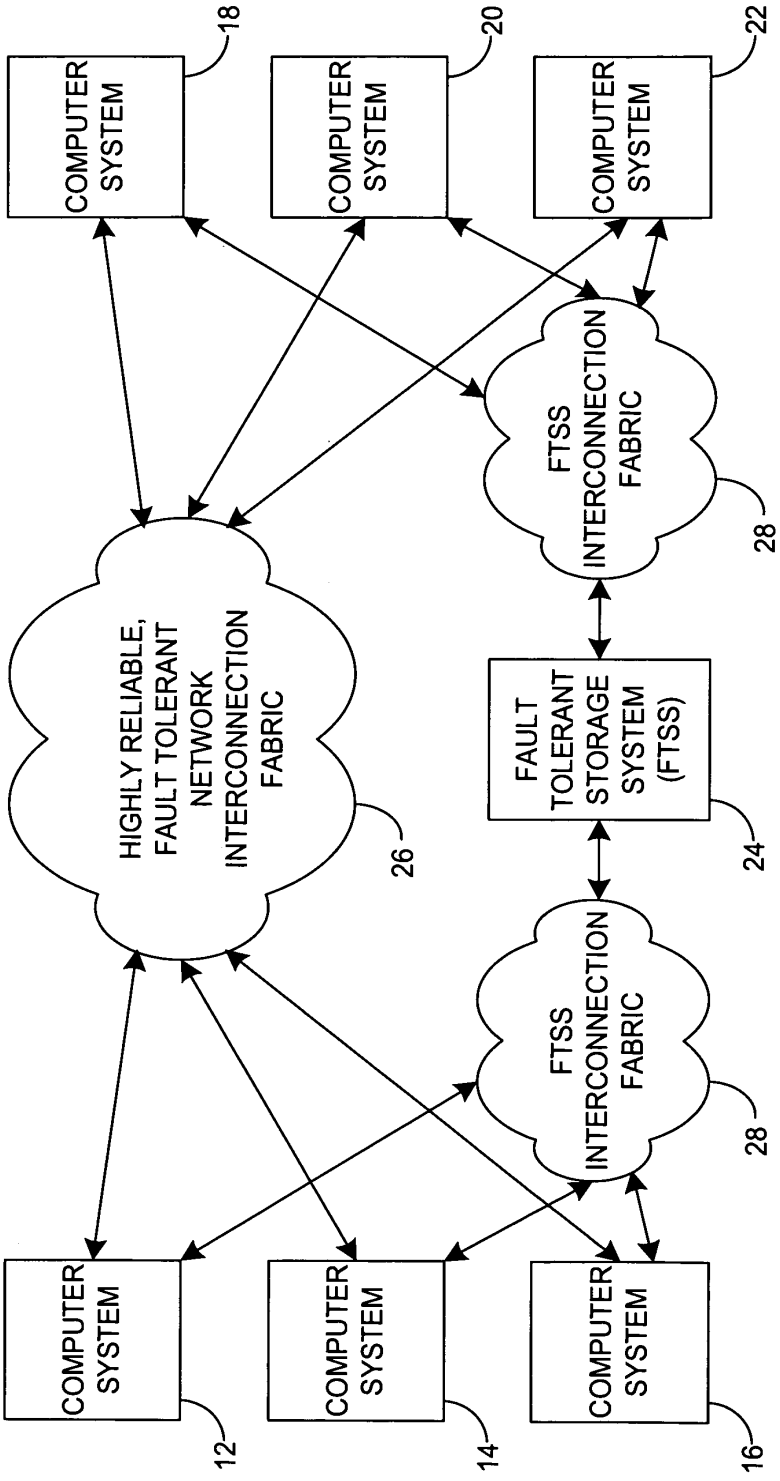


FIG. 1
(PRIOR ART)

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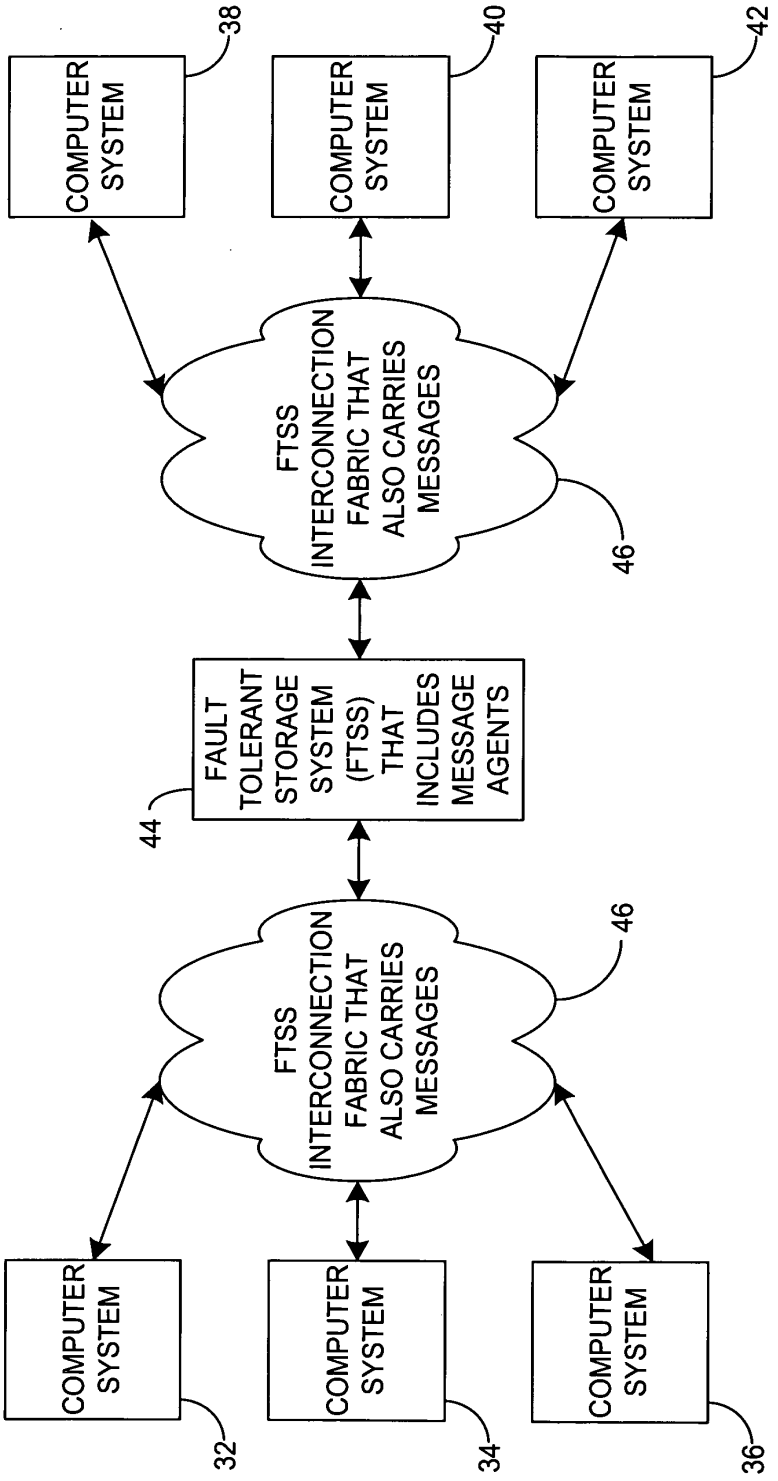


FIG. 2

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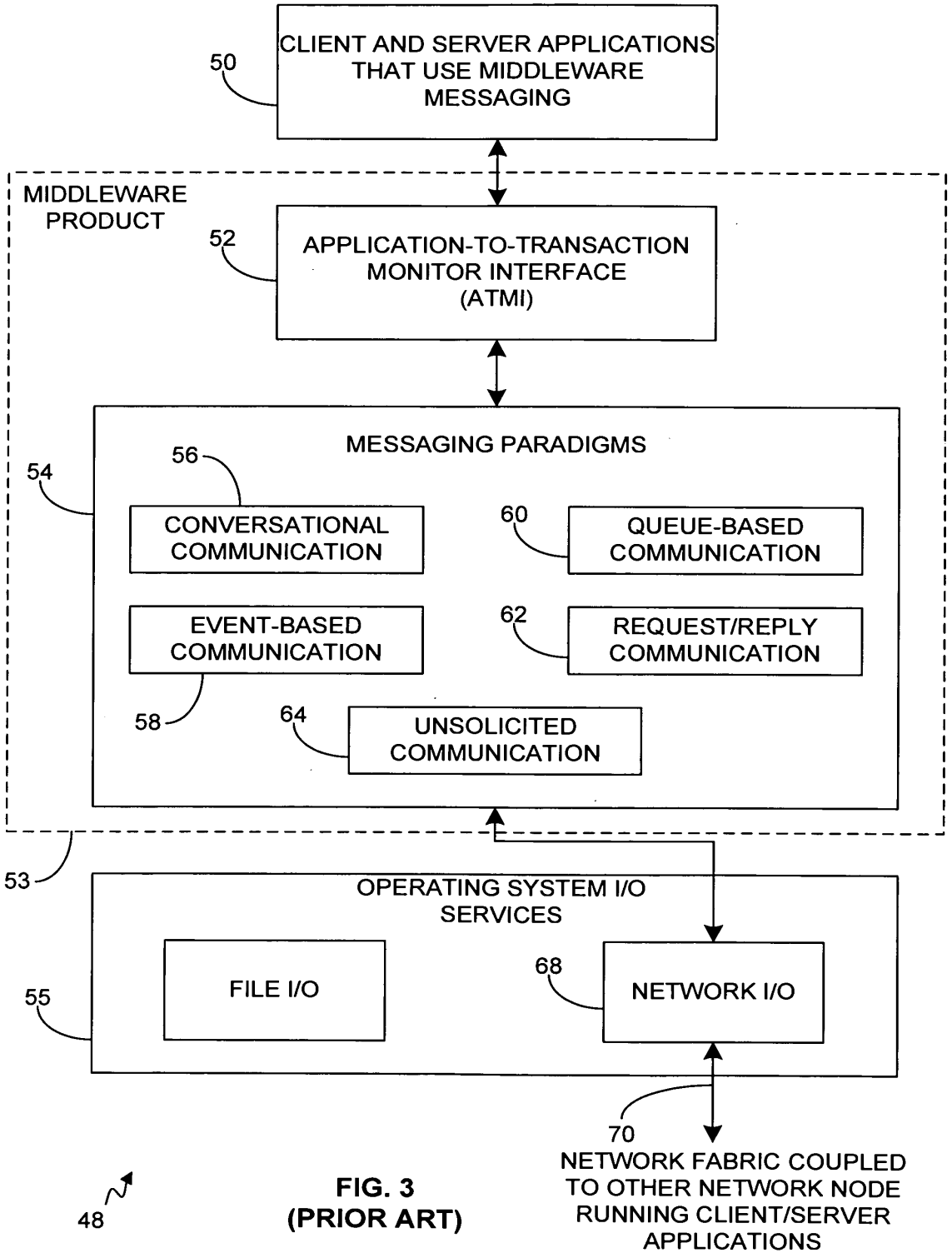


FIG. 3
(PRIOR ART)

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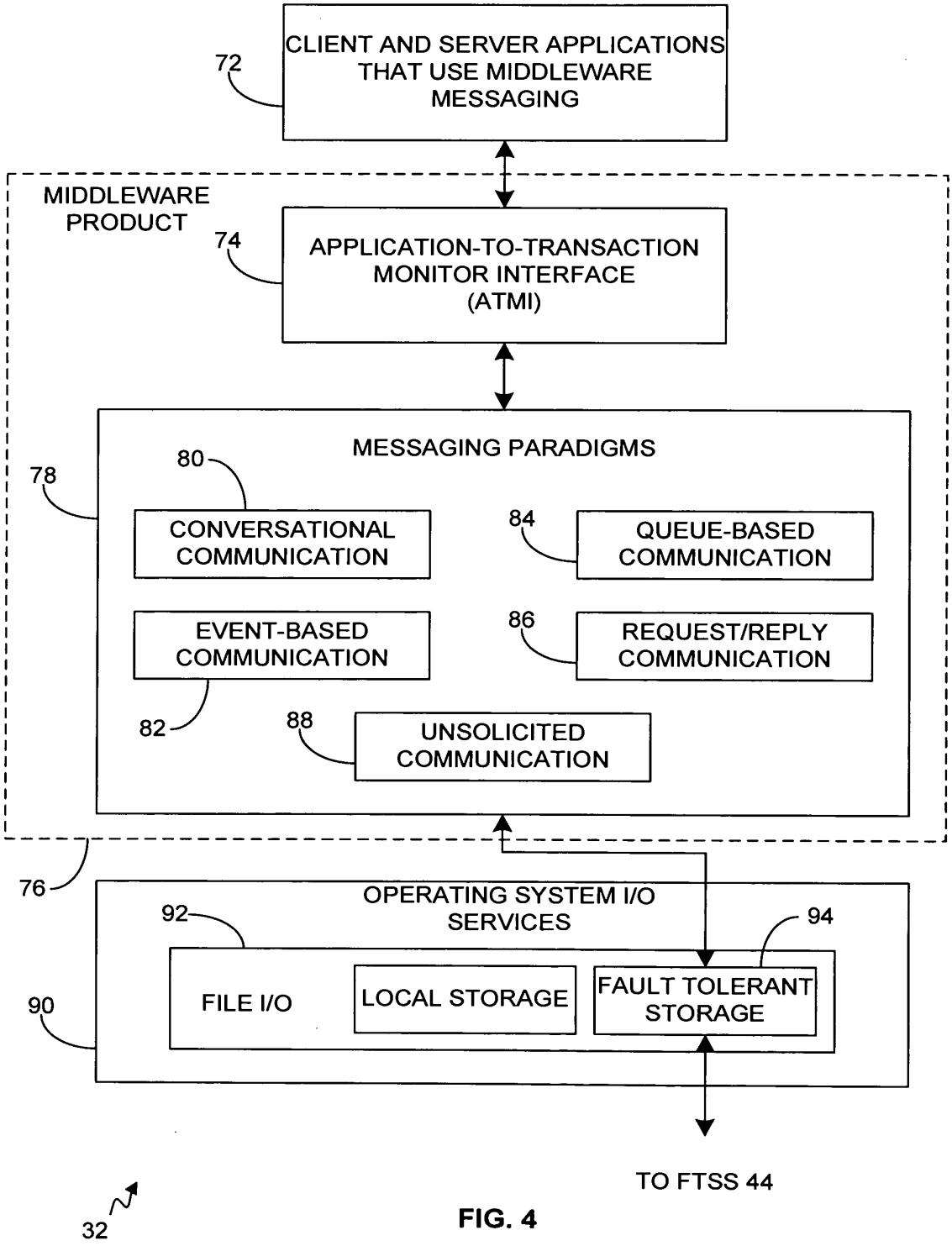


FIG. 4

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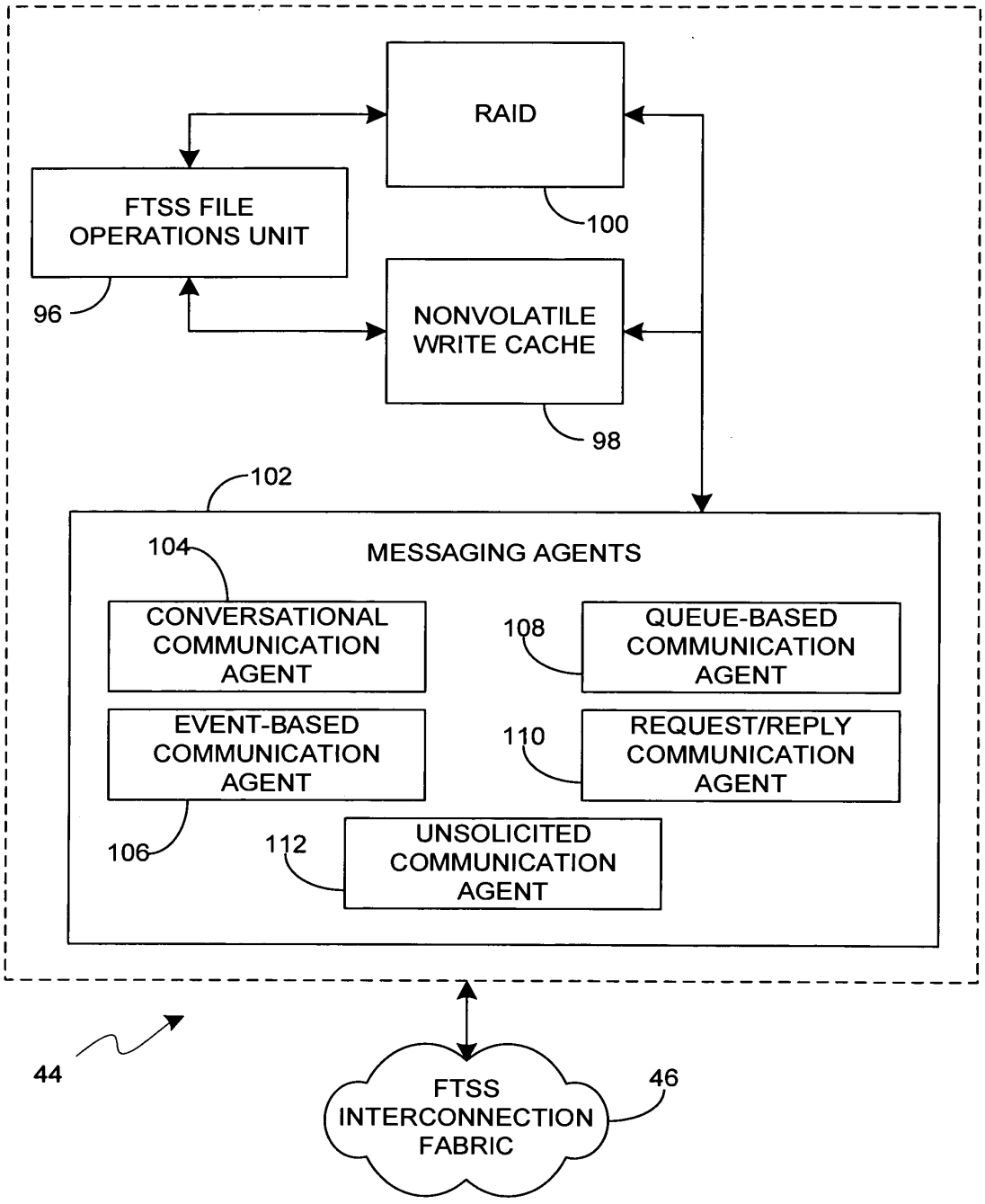


FIG. 5

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PATENT OFFICE
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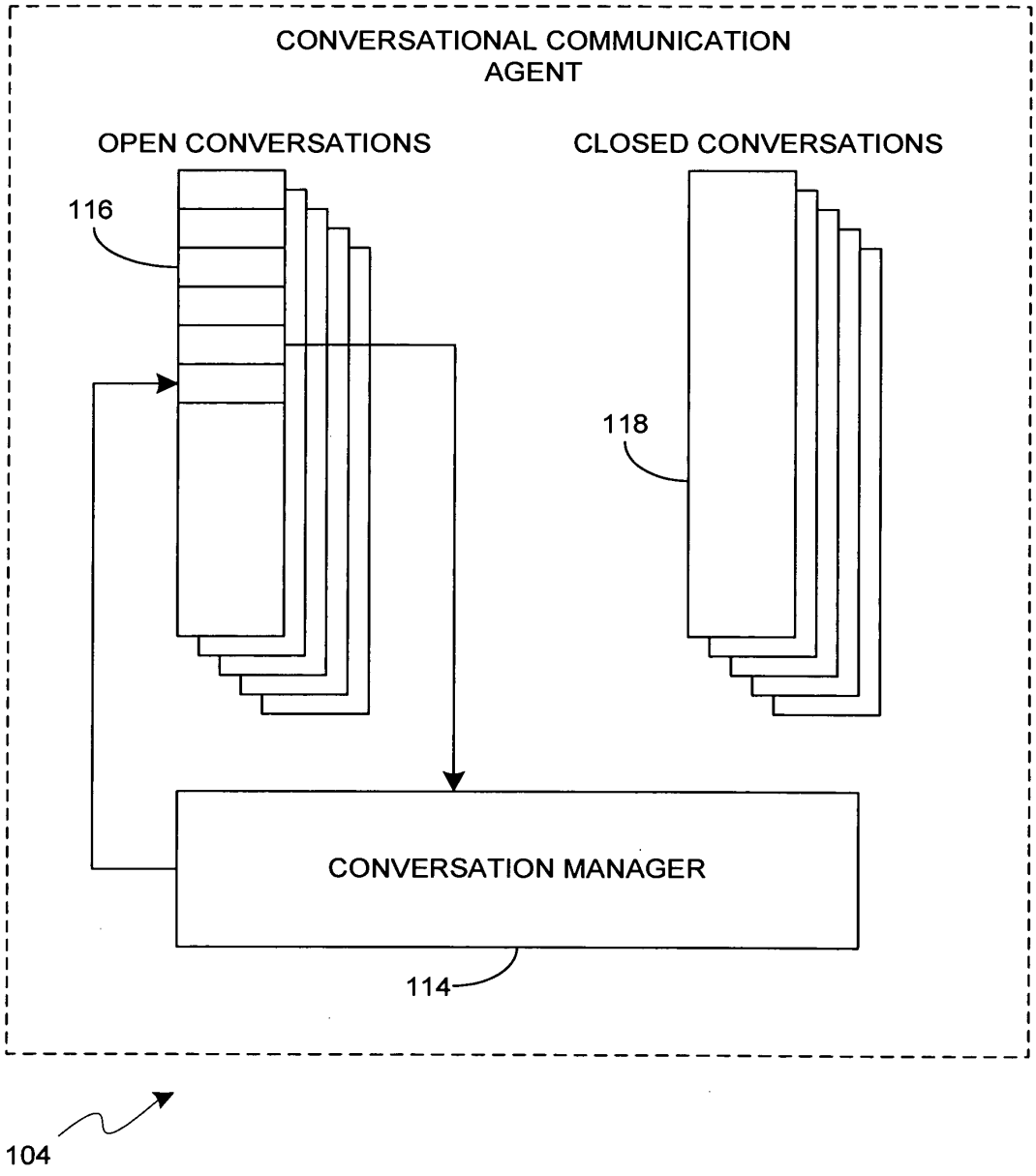


FIG. 6

O I P E JC169 MAR 2 5 2005 PATENT & TRADEMARK OFFICE

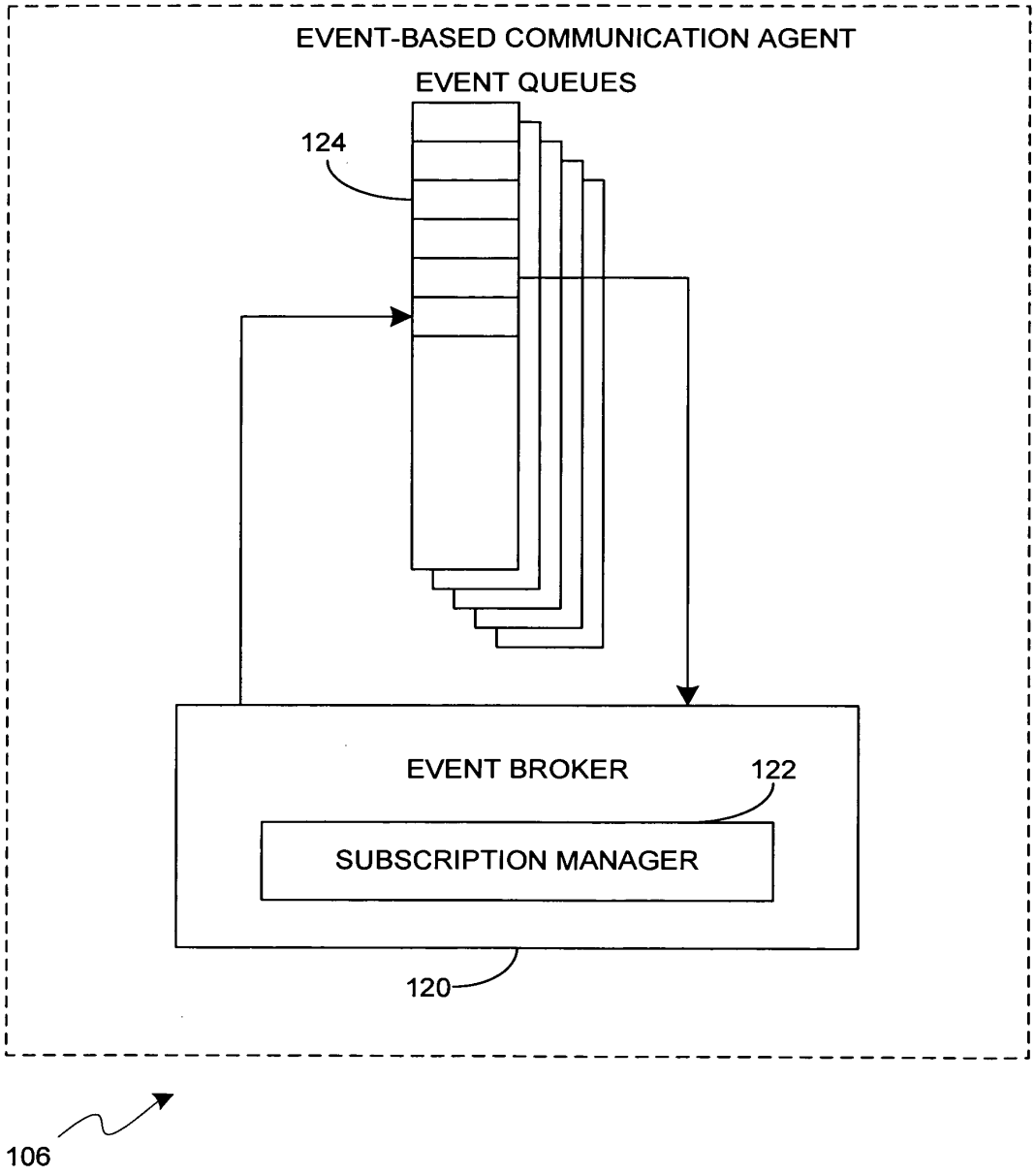


FIG. 7

U.S. PATENT & TRADEMARK OFFICE
MAR 25 2005
JC169

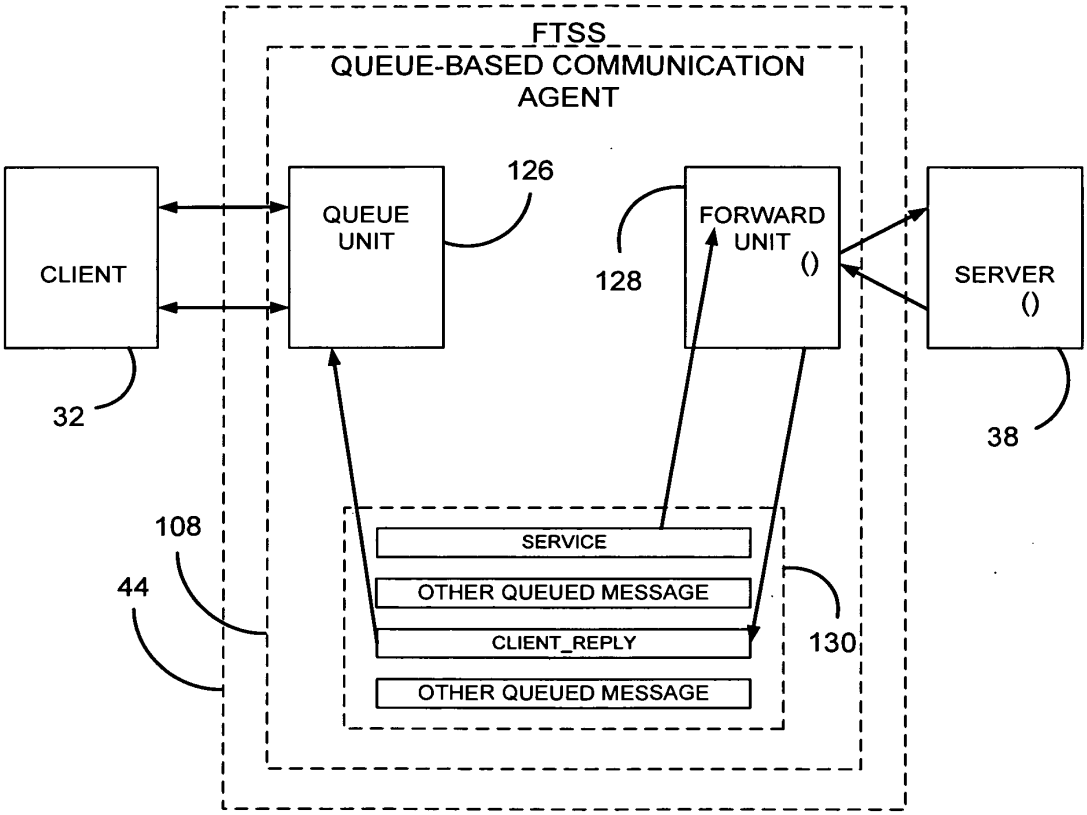


FIG. 8

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U.S.P.T.O. JC169 MAR 25 2005 PATENT & TRADEMARK OFFICE

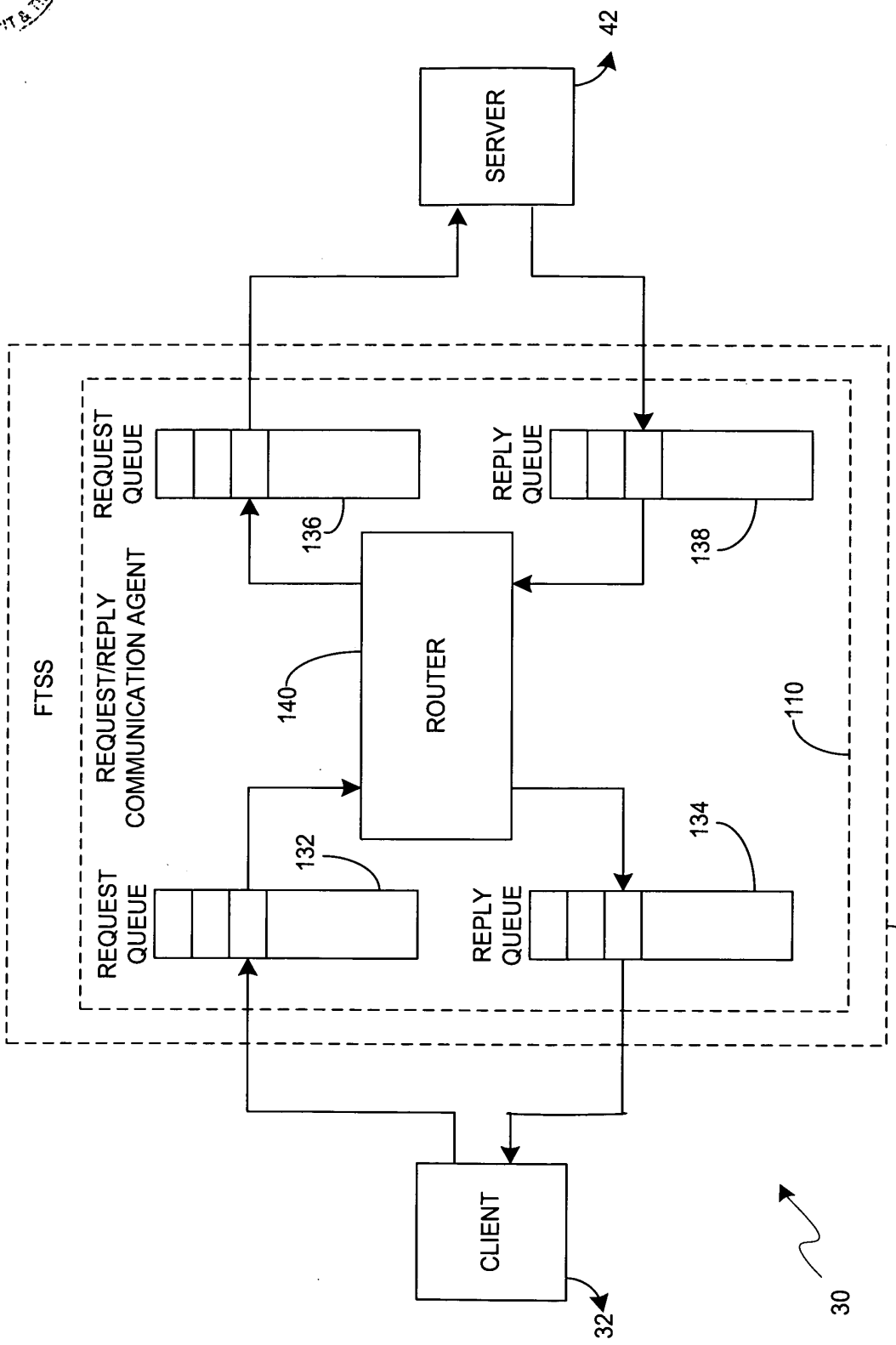


FIG. 9

C I P E
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MAR 2 5 2005
PATENT & TRADEMARK OFFICE

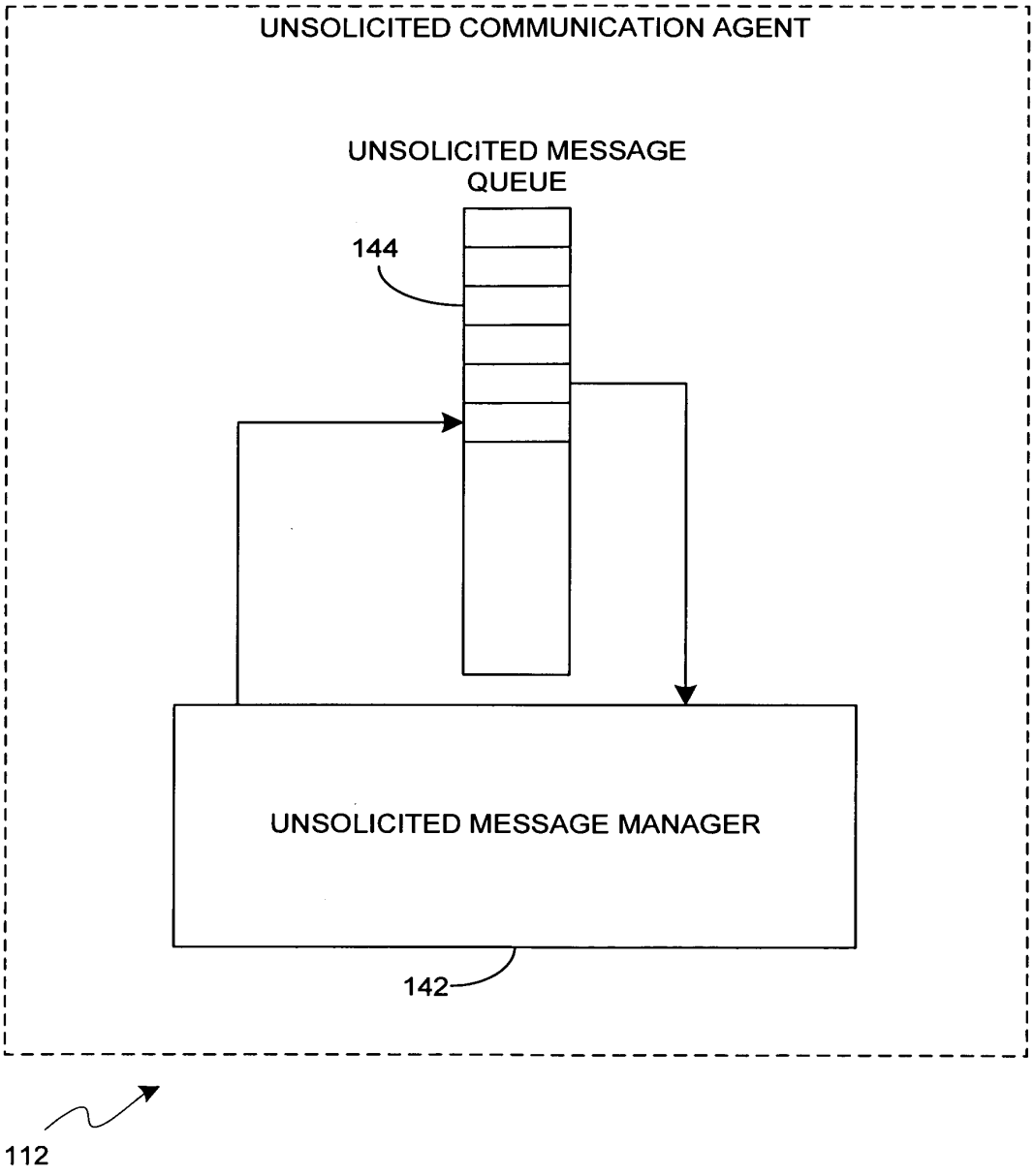


FIG. 10

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

022879 7590 12/21/2004

HEWLETT PACKARD COMPANY
P O BOX 272400, 3404 E. HARMONY ROAD
INTELLECTUAL PROPERTY ADMINISTRATION
FORT COLLINS, CO 80527-2400

EXAMINER	
THOMPSON, MARC D	
ART UNIT	PAPER NUMBER
2144	

DATE MAILED: 12/21/2004

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/703,427	10/31/2000	Blaine D. Gaither	10008316-1	2980

TITLE OF INVENTION: METHOD AND APPARATUS FOR PASSING MESSAGES USING A FAULT TOLERANT STORAGE SYSTEM

APPLN. TYPE	SMALL ENTITY	ISSUE FEE	PUBLICATION FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	$1400	$0	$1400	03/21/2005

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 REFLECTS A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE APPLIED IN THIS APPLICATION. THE PTOL-85B (OR AN EQUIVALENT) MUST BE RETURNED WITHIN THIS PERIOD EVEN IF NO FEE IS DUE OR THE APPLICATION WILL BE REGARDED AS ABANDONED.

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 should be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). Even if the fee(s) have already been paid, Part B - Fee(s) Transmittal should be completed and returned. 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.

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.

PTOL-85 (Rev. 11/04) Approved for use through 04/30/2007.

SAP - Exhibit 1102
SAP v. Valtrus et al. - IPR2025-00420
Page 281 of 704

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 (703) 746-4000

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)

022879 7590 12/21/2004

HEWLETT PACKARD COMPANY
P O BOX 272400, 3404 E. HARMONY ROAD
INTELLECTUAL PROPERTY ADMINISTRATION
FORT COLLINS, CO 80527-2400

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 (703) 746-4000, on the date indicated below.

(Depositor's name)

(Signature)

(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/703,427	10/31/2000	Blaine D. Gaither	10008316-1	2980

TITLE OF INVENTION: METHOD AND APPARATUS FOR PASSING MESSAGES USING A FAULT TOLERANT STORAGE SYSTEM

APPLN. TYPE	SMALL ENTITY	ISSUE FEE	PUBLICATION FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	$1400	$0	$1400	03/21/2005

EXAMINER	ART UNIT	CLASS-SUBCLASS
THOMPSON, MARC D	2144	709-202000

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 enclosed:

☐ Issue Fee

☐ Publication Fee (No small entity discount permitted)

☐ Advance Order - # of Copies _____

4b. Payment of Fee(s):

☐ A check in the amount of the fee(s) is enclosed.

☐ Payment by credit card. Form PTO-2038 is attached.

☐ The Director is hereby authorized by charge the required fee(s), 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).

The Director of the USPTO is requested to apply the Issue Fee and Publication Fee (if any) or to re-apply any previously paid issue fee to the application identified above.
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. _____

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.

SAP - Exhibit 1102
SAP v. Valtrus et al. - IPR2025-00420
Page 282 of 704

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.
09/703,427	10/31/2000	Blaine D. Gaither	10008316-1	2980

022879 7590 12/21/2004

HEWLETT PACKARD COMPANY
P O BOX 272400, 3404 E. HARMONY ROAD
INTELLECTUAL PROPERTY ADMINISTRATION
FORT COLLINS, CO 80527-2400

EXAMINER	
THOMPSON, MARC D	

ART UNIT	PAPER NUMBER
2144	

DATE MAILED: 12/21/2004

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 490 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 490 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 (703) 305-1383. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at (703) 305-8283.

PTOL-85 (Rev. 11/04) Approved for use through 04/30/2007.

SAP - Exhibit 1102
SAP v. Valtrus et al. - IPR2025-00420
Page 283 of 704

Notice of Allowability	Application No.	Applicant(s)	
	09/703,427	GAITHER ET AL.	
	Examiner	Art Unit	
	Marc D. Thompson	2144	

-- 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 *Appeal Brief, filed 8/30/2004*.
2. ☒ The allowed claim(s) is/are *1-10*.
3. ☒ The drawings filed on *31 October 2000 and 24 November 2003* are accepted by the Examiner.
4. ☐ 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: _____.
5. ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
   (a) ☐ The translation of the foreign language provisional application has been received.
6. ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

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.**

7. ☐ 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.

8. ☒ CORRECTED DRAWINGS 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. ____.
   (b) ☒ including changes required by the proposed drawing correction filed *24 November 2003*, which has been approved by the Examiner.
   (c) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No. _____.

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.

9. ☐ 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 Informal Patent Application (PTO-152)
3☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
4☐ Interview Summary (PTO-413), Paper No.____ .
5☐ Information Disclosure Statements (PTO-1449), Paper No. ____.
6☐ Examiner's Amendment/Comment
7☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
8☒ Examiner's Statement of Reasons for Allowance
9☐ Other

MARC D. THOMPSON
MARC THOMPSON
PRIMARY EXAMINER

SAP - Exhibit 1102
SAP v. Valtrus et al. - IPR2025-00420
Page 284 of 704

Reasons for Allowance

1. The following is an examiner's statement of reasons for allowance:

The entirety of the presented arguments in the Appeal Brief, filed 8/30/2004, are considered persuasive. The provision for the combination of message transmission to a destination node and importantly, message storage within a highly reliable fault-tolerant storage system (FTSS) prior to transmission of the message out of the FTSS (middleware messaging), the processing of the message within the FTSS according to an arbitrary messaging paradigm defined by agents within the FTSS, and subsequent access from FTSS storage and transmission of the message to the destination node over a network was not suitably taught or suggested by the prior art of record. This functionality is detailed and supported in the present specification, inter alia, at Page 10, Lines 9-20, Page 12, Lines 4-27, and Figures 2, 4, and 5, as expressly argued in the Appeal Brief at, inter alia, Pages 5-10.

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. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Marc D. Thompson whose telephone number is 571-272-3932. The examiner can normally be reached on Monday-Friday, 9am-4pm. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, William

Cuchlinski, Jr. can be reached at 571-272-3925. The fax phone number for the organization where this application or proceeding is assigned remains 703-872-9306.

3. 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).

MARC D. THOMPSON
MARC THOMPSON
PRIMARY EXAMINER

Marc D. Thompson
Primary Examiner
Art Unit 2144

Notice of References Cited	Application/Control No. 09/703,427	Applicant(s)/Patent Under Reexamination GAITHER ET AL.	
	Examiner Marc D. Thompson	Art Unit 2144	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
	A	US-5,694,541	12-1997	Service et al.	714/46
	B	US-			
	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.

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SAP v. Valtrus et al. - IPR2025-00420
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OIPE 3C42
APR 30 2004
PATENT & TRADEMARK OFFICE

#8
B. Board
5/10/04

PATENT

I hereby certify that on the date specified below, this correspondence is being deposited with the United States Postal Service as first-class mail in an envelope addressed to Mail Stop AF Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

April 26, 2004 — Date

J. Bourguignon — Joanne Bourguignon

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

RECEIVED
MAY 0 4 2004
Technology Center 2100

Applicants: Blaine D. Gaither et al.

Application No.: 09/703,427

Filed: October 31, 2000

Title: METHOD AND APPARATUS FOR PASSING MESSAGES USING A FAULT TOLERANT STORAGE SYSTEM

Examiner: Lambert L. Tran

Art Unit: 2142

Docket No.: 10008316-1

Date: April 26, 2004

OK TO ENTER
12/1/04
MDT

Mail Stop AF
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

RESPONSE

INTRODUCTORY COMMENTS

Sir:

In response to the Final Rejection date February 25, 2004, please consider the following response:

Issue Classification	Application No.	Applicant(s)	
	09/703,427	GAITHER ET AL.	
	Examiner	Art Unit	
	Marc D. Thompson	2144	

ISSUE CLASSIFICATION

ORIGINAL		CROSS REFERENCE(S)							
CLASS	SUBCLASS	CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)						
709	202	709	206	213					
INTERNATIONAL CLASSIFICATION									
G06F 15/16									
/									
/									
/									
/									

(Assistant Examiner) (Date)

Susan Boudreau 12/15/04
(Legal Instruments Examiner) (Date)

MARC D. THOMPSON
MARC THOMPSON
PRIMARY EXAMINER
(Primary Examiner) (Date)

Total Claims Allowed: 10

O.G. Print Claim(s)	O.G. Print Fig.
1	4

☒ 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
1	1		31		61		91		121		151		181
2	2		32		62		92		122		152		182
3	3		33		63		93		123		153		183
4	4		34		64		94		124		154		184
5	5		35		65		95		125		155		185
6	6		36		66		96		126		156		186
7	7		37		67		97		127		157		187
8	8		38		68		98		128		158		188
9	9		39		69		99		129		159		189
10	10		40		70		100		130		160		190
	11		41		71		101		131		161		191
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	29		59		89		119		149		179		209
	30		60		90		120		150		180		210

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Index of Claims

Application No.	Applicant(s)	
09/703,427	GAITHER ET AL.	
Examiner	**Art Unit**	
Marc D. Thompson	2144	

√	Rejected	–	(Through numeral) Cancelled	N	Non-Elected	A	Appeal
=	Allowed	+	Restricted	I	Interference	O	Objected

Claim		Date
Final	Original	12/1/04
1	1	=
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Claim		Date
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Claim		Date
Final	Original	
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SAP - Exhibit 1102
SAP v. Valtrus et al. - IPR2025-00420
Page 290 of 704

Search Notes	Application No.	Applicant(s)	
	09/703,427	GAITHER ET AL.	
	Examiner	Art Unit	
	Marc D. Thompson	2144	

SEARCHED			
Class	Subclass	Date	Examiner
709	213	12/1/2004	MDT

INTERFERENCE SEARCHED			
Class	Subclass	Date	Examiner
709	**202**	**12/1/2004**	**MDT**
709	206	12/1/2004	MDT
709	213	12/1/2004	MDT

SEARCH NOTES (INCLUDING SEARCH STRATEGY)		
	DATE	EXMR
updated class/subclass search	12/1/2004	MDT
updated full text EAST search: USPGPUB, USPAT, EPO, IBM-TDB, DERWENT	12/1/2004	MDT
updated NPL search	12/1/2004	MDT

SAP - Exhibit 1102
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OIPE JC1
AUG 30 2004
PATENT & TRADEMARK OFFICE

PATENT APPLICATION

ATTORNEY DOCKET NO. 10008316-1

IN THE
UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s): Blaine D. Gaither et al. ***Confirmation No.:***

Application No.: 09/703,427 ***Examiner:*** Lambert L. Tran

Filing Date: Oct. 31, 2000 ***Group Art Unit:*** 2142

Title: Method and Apparatus for Passing Messages using a Fault Tolerant Storage System

Mail Stop Appeal Brief-Patents
Commissioner For Patents
PO Box 1450
Alexandria, VA 22313-1450

TRANSMITTAL OF APPEAL BRIEF

Sir:

Transmitted herewith in ***triplicate*** is the Appeal Brief in this application with respect to the Notice of Appeal filed on ***June 25, 2004***.

The fee for filing this Appeal Brief is (37 CFR 1.17(c)) $330.00.

(complete (a) or (b) as applicable)

The proceedings herein are for a patent application and the provisions of 37 CFR 1.136(a) apply.

( ) (a) Applicant petitions for an extension of time under 37 CFR 1.136 (fees: 37 CFR 1.17(a)-(d) for the total number of months checked below:

( )	one month	$110.00
( )	two months	$420.00
( )	three months	$950.00
( )	four months	$1480.00

( ) The extension fee has already been filled in this application.

(X) (b) Applicant believes that no extension of time is required. However, this conditional petition is being made to provide for the possibility that applicant has inadvertently overlooked the need for a petition and fee for extension of time.

Please charge to Deposit Account ***08-2025*** the sum of ***$330.00***. At any time during the pendency of this application, please charge any fees required or credit any over payment to Deposit Account 08-2025 pursuant to 37 CFR 1.25. Additionally please charge any fees to Deposit Account 08-2025 under 37 CFR 1.16 through 1.21 inclusive, and any other sections in Title 37 of the Code of Federal Regulations that may regulate fees. A duplicate copy of this sheet is enclosed.

(X) I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to: Commissioner for Patents, Alexandria, VA 22313-1450. Date of Deposit: ***Aug. 25, 2004***

OR

( ) I hereby certify that this paper is being transmitted to the Patent and Trademark Office facsimile number_____ on _____

Number of pages:

Typed Name: ***Joanne Bourguignon***

Signature: Joanne Bourguignon

Rev 05/04 (Aplbrief)

Respectfully submitted,

Blaine D. Gaither et al.

By Robert W. Bergstrom

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OIPE JC16
AUG 30 2004
PATENT & TRADEMARK OFFICE

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re patent application of:

Inventors: Blaine D. Gaither et al.
Serial No. 09/703,427
Filed: October 31, 2000
For: Method and Apparatus for Passing Messages using a Fault Tolerant Storage System

Examiner: Lambert L. Tran
Group Art Unit: 2142
Docket No. 10008316-1
Date: August 25, 2004

BRIEF ON APPEAL

Commissioner of Patents and Trademarks
Washington, DC 20231

Sir:

This appeal is from the decision of the Examiner, in an Office Action mailed on February 25, 2004, finally rejecting claims 1-10.

REAL PARTY IN INTEREST

Hewlett-Packard Development Company, L.P. is the Assignee of the present patent application. Hewlett-Packard Development Company, L.P., is a Texas corporation with headquarters in Houston, Texas.

RELATED APPEALS AND INTERFERENCES

Applicants' representative has not identified, and does not know of, any other appeals of interferences which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

STATUS OF CLAIMS

08/30/2004 ZJUHAR1 00000048 082025 09703427
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Claims 1-10 are pending in the application. Claims 1-10 were finally rejected in the Office Action dated February 25, 2004. Applicants' appeal the final rejection of claims 1-10, which are copied in the attached Appendix.

STATUS OF AMENDMENTS

No Amendment After Final is enclosed with this brief. The last amendments to the claims were made in the Amendment filed April 26, 2004.

SUMMARY OF INVENTION

Embodiments of the present invention may be readily understood by comparison of Figure 1, showing a prior-art fault-tolerant computer system, and Figure 2, which shows a fault-tolerant computer system that employs a computer-to-computer-communications method that represents one embodiment of the present invention. The comparison is presented in the current application starting on line 25 of page 6. In the prior-art system shown in Figure 1, the computers 12, 14, 16, 18, 20, and 22 are interconnected with one another by a fault-tolerant interconnection fabric 26, and are each connected to a fault-tolerant storage system ("FTSS") 24, or fault-tolerant disk array, by a second, independent, FTSS interconnection fabric 28. The FTSS interconnection fabric 28 interconnects each computer with the FTSS, allowing computers to access data stored in the FTSS by transmitting I/O requests to the FTSS and receiving I/O-request responses from the FTSS, but does not interconnect the computers with one another. Conversely, the fault-tolerant interconnection fabric 26 interconnects the computers with one another, allowing the computers to exchange various types of messages, but does not interconnect the computers with the FTSS 24.

In one embodiment of the present invention, as shown in Figure 2, computers 32, 34, 36, 38, 40, and 42 are each directly interconnected via a single FTSS interconnection fabric 46 to an FTSS 44, and indirectly interconnected through the single FTSS interconnection fabric 46 and FTSS 44 to one another. In the embodiment shown in Figure 2, a computer transmits a message to another, target computer by transmitting the message to the FTSS. The FTSS stores the message in highly reliable, fault-tolerant storage media within the FTSS, and forwards the message to the target computer. Thus, rather than serving simply as a fault-tolerant data-storage device, to which computers direct I/O operations, the FTSS also stores and forwards messages directed from one computer to another computer. To facilitate

storing and forwarding computer-to-computer messages, the FTSS includes communications agents that implement one or more communications protocols. The described embodiment of the present invention provides for messages to be stored and forwarded according to conversational, event-based, and various queue-based messaging paradigms that are commonly employed in traditional computer networks, but not in FTSS interconnection fabrics and FTSSs.

Claim 1 clearly claims the above described embodiment. Claim 1 reads:

> 1. A method of transmitting messages between a first node and a second node, wherein the first and second nodes are each coupled to a fault tolerant storage system (FTSS), the method comprising:
>
> transmitting a message from the first node to a communication agent in the FTSS;
>
> storing the message in a data structure in highly reliable fault-tolerant storage media of the FTSS;
>
> processing the message at the FTSS in accordance with a messaging paradigm; and
>
> transmitting the message from the FTSS to the second node.

The term "node" is defined in the current application, in the paragraph beginning on line 19 of page 1, as being either a server computer intercommunicating with a client computer or a client computer intercommunicating with a server computer through a network. Messages are defined in the paragraph beginning on line 3 of page 3 of the current application as the units of information exchanged between a server application running on a server computer and a client application running on a client computer. Claim 1 thus specifically claims transmitting a message from a first computer to a second computer, with both the first and second computers coupled to a fault-tolerant storage system. The first computer transits the message to the fault-tolerant storage system (FTSS), the message is then stored in highly reliable fault-tolerant storage media of the FTSS, the message is later processed by the FTSS, and the message is finally transmitted from the FTSS to the second computer.

ISSUES

1. Whether claims 1-2 and 10 are anticipated, under 35 U.S.C § 102(b), by Utter et al., U.S. Patent No. 5,815,649 ("Utter").

2. Whether claims 3-5 are unpatentable under 35 U.S.C § 103(a) over Utter in view of

Northrup, U.S. Patent No. 6,546,413 ("Northrup").

3. Whether claims 6-9 are unpatentable under 35 U.S.C. 103(a) over Utter in view of Suarez, U.S. Patent No. 5,790,789 ("Suarez").

GROUPING OF CLAIMS

Claims 1-2 stand or fall together with respect to Issue 1. Claims 3-5 stand or fall together with respect to Issue 2. Claims 6-9 stand or fall together with respect to Issue 3. The default grouping of claims naturally by the claims included in each separate rejection is therefore accepted.

ARGUMENT

Claims 1-10 are currently pending in the application. In an Office Action dated February 25, 2004 ("Office Action"), the Examiner rejected claims 1-2 and 10 under 35 U.S.C § 102(b) as being anticipated by Utter et al., U.S. Patent No. 5,815,649 ("Utter"), rejected claims 3-5 under 35 U.S.C § 103(a) as being unpatentable over Utter in view of Northrup, U.S. Patent No. 6,546,413 ("Northrup"), and rejected claims 6-9 under 35 U.S.C. 103(a) as being unpatentable over Utter in view of Suarez, U.S. Patent No. 5,790,789 ("Suarez"). Applicants respectfully traverse the 35 U.S.C § 102(b) and 35 U.S.C. 103(a) rejections of claims 1-10.

ISSUE 1

1. Whether claims 1-2 and 10 are anticipated under 35 U.S.C § 102(b) by Utter.

Claim 1 is discussed above, in the Summary of the Invention section. For Utter to anticipate the invention clearly claimed in claim 1, Utter would need to disclose a fault-tolerant storage system ("FTSS") interconnected with at least two computers, or nodes, in which a first node transmits messages to a second node by: (1) transmitting a message from the first node to a communication agent in the FTSS; (2) storing the message in a data structure in highly reliable fault-tolerant storage media of the FTSS; (3) processing the message at the FTSS in accordance with a messaging paradigm; and (4) transmitting the message from the FTSS to the second node.

Figure 1 of Utter shows a fault-tolerant computer system (11 in Figure 1), the

components of which are surrounded by an outer, dashed, nearly rectangular boundary shaped somewhat like a mirror-image of Utah turned on its side. Four user terminals (12(A)-(D)) and a console terminal (14) are connected to the fault-tolerant computer system via two *conventional* Ethernet networks (13(A)-(B)) (Utter, column 3, lines 59-61).

As shown in Figure 1, and according to Utter's disclosure, one of the four user terminals may exchange messages with another of the four user terminals via the two *conventional* Ethernet networks, and the two user terminals are coupled through the two *conventional* Ethernet networks to a fault-tolerant computer system (Utter, column 3, lines 49-67). In Utter's system, communications between user terminals is conducted in an entirely conventional manner, via entirely conventional Ethernet links. There is no teaching, disclosure, or even suggestion in Utter for two user terminals to exchange messages with one another by a mechanism in which the messages are stored in fault-tolerant storage media in one or more of the storage nodes 30(A)-30(S) within the fault-tolerant computer system.

Within Utter's fault-tolerant computer system, there are a large number of processing nodes 16(A)-16(M), storage nodes 31(A)-31(S), and switches 18(A) and 18(B) that are interconnected with one another through networks 20(A) and 20(B). These networks are also conventional Ethernet networks "which transfer information in the form of messages, with each generated by a device connected to a network 20(k) (that is, by a processing node 16(m) or switch 18(h)) containing information to be transferred, as well as an *address which identifies the intended recipient or recipients of the information*" (Utter, column 4, lines 4-23) (emphasis added). There is no teaching, disclosure, or even suggestion in Utter for two internal processing nodes or storage nodes to exchange messages with one another by a mechanism in which the messages are sent through a storage node and stored in fault-tolerant storage media in one of the storage nodes 30(A)-30(S). Note that messages are addressed to recipients, and not to FTSSs, for forwarding to recipients.

Within Utter's fault-tolerant computer system, the processing nodes 16(A)-16(M) are interconnected through a management network 15 with a console terminal 14 that the console terminal can use in connection with initialization of the fault-tolerant computer system 11 (Utter, column 6, lines 8-10). The management network is not even connected to the storage nodes within the fault-tolerant computer system. There is no teaching, disclosure, or even suggestion in Utter for two internal processing nodes or storage nodes to exchange messages with one another by a mechanism in which the messages are sent through a storage node and stored in fault-tolerant storage media in one or more of the storage nodes 30(A)-30(S). The

storage nodes are not even connected to the management network.

To summarize the above, three paragraphs, none of the networks that appear in Utter's disclosed system transmit messages by a store-and-forward method through an FTSS. The user terminals directly communicate with one another through one pair of Ethernets. The internal processing nodes and storage nodes directly communicate with one another (*see*, e.g., Utter, column 4, lines 33-41) through another pair of Ethernets. The console terminal can alternatively communicate with processing nodes through a management network. In none of these communications networks does Utter teach or suggest any kind of store-and-forward messaging system involving a storage-node intermediary.

Utter's fault tolerant computer system (11 in Figure 1) is disclosed as containing fault-tolerant storage media only in storage nodes 30(A)-30(S). Thus, only were a first computer or node able to transmit a message through a storage node to a second computer or node would Utter's disclosed system meet the "storing the message in a data structure in highly reliable fault-tolerant storage media of the FTSS" element of claim 1. But, as discussed above, there is no such disclosure. Nor can such a mechanism be inferred from Utter's disclosure. Ethernet networks do not operate in a store-and-forward fashion. Instead, as clearly stated in Utter in several places (column 3, lines 62-67; column 4, lines 17-23), each device connected to an Ethernet sends a message to another, target device connected to the Ethernet by including the address of the target device in the message. Ethernet networks have a bus-like topology, where the controllers of all devices on the network generally see all messages, but accept only those messages addressed to them. Ethernet networks are not store-and-forward networks. With all of the nodes in Utter's system interconnected by Ethernet networks, there is absolutely no reason for Utter to arrange for storage nodes 30(A)-30(S) to somehow be placed into a promiscuous receiving mode, receive all messages, store the messages, determine to whom the messages are addressed, and then forward them to their intended recipients, when, in fact, the processing nodes and storage nodes can all directly intercommunicate with one another. Moreover, modifying Utter's system to transform the storage nodes into storage-node/store-and-forward-communications-node hybrids is not taught or suggested by Utter. There is no teaching or suggestion in Utter for any kind of store-and-forward communication. There is no teaching or suggestion in Utter for storage nodes doing anything other than executing I/O requests – either storing or retrieving data from fault-tolerant storage media within the storage nodes. Utter is unrelated to the invention claimed in claim 1.

In the Office Action, the Examiner states that Utter discloses "transmitting a message from the first node to a communication agent (processing node) in the FTSS, referring to Figure 1, col. 2, lines 61-67 and column 3, lines 1-15. Applicants' representative reproduces the cited passage, below, with added emphasis:

> FIG. 1 is a functional block diagram of a digital computer system 10 including a storage subsystem that is constructed in accordance with the invention. With reference to FIG. 1, the digital computer system 10 includes a fault-tolerant computer system 11 which connects to a plurality of user terminals 12(A) through 12(D) (generally identified by reference numeral 12(*d*)) over respective user networks 13(A) and 13(B) (generally identified by reference numeral 13(*n*)) which connect the user terminals 12(*d*) to the fault-tolerant computer system 11. The fault-tolerant computer system 11 performs conventional digital data processing and data retrieval and storage services that are generally typical of those performed by digital computer systems, in connection with processing, data retrieval and data storage requests provided thereto by the user terminals 12(*d*). As will be described below in greater detail, the fault-tolerant computer system 11 includes a number of subsystems which allow the data processing, storage and retrieval services to be provided in a manner which is tolerant of faults, failures, and malfunctions therein. The digital computer system 10 further includes a console terminal 14, which connects to the fault-tolerant computer system 11 over a maintenance network 15 as well as over a user network 13(*n*).

The word "message" does not even once appear in the above cited passage. Instead, the above cited passage is directed to a fault-tolerant computer system that performs "conventional digital data processing and data retrieval and storage services." Such services involve client computers requesting services from the fault-tolerant computer system, the fault-tolerant computer system performing the requested services, and the fault-tolerant computer system returning status, data, or both status and data to the requesting client computer. A *conventional* fault-tolerant computer system provides these services independently to requesting client computers. The above passage makes no mention or indication that the fault-tolerant computer system undertakes any kind of service involving transfer of data or other information from one user terminal to another. As indicated above, the word "message" is defined in the current application, and is used in claim 1 consistently with that definition, to mean units of information exchanged between a first computer and a second computer, both distinct from the FTSS. Moreover, the Examiner states that Utter's processing node carries out the operations of Applicants' claimed communication agent, but the above-cited makes no mention of Utter's processing node or of a communications agent. Thus, the above cited passage does not teach that to which the Examiner ascribes to it.

Next, the Examiner states that Utter discloses "storing the message in a data structure in highly reliable fault-tolerant storage media of the FTSS," referring to lines 25-30 of

column 2. That portion of column is provided below:

> The storage nodes store data in at least one replicated partition group comprising a plurality of replicated partitions distributed across the storage nodes. A storage node, on receiving a retrieval request from a processing node provide the requested data to the processing node.

This passage does not teach, mention, or even remotely suggest storing messages in the highly reliable fault-tolerant storage media of the FTSS for later forwarding to another computer. The passage instead is directed to an entirely conventional FTSS operation of storing data in replicated partitions, as is done in disk arrays by RAID controllers, and retrieving the stored data. The term "message" does not once occur in above passage, nor does the term "data structure.". As noted above, the term "message" has a well defined meaning in the current application and in claim 1, and is not synonymous with the term "data." Moreover, all of the nodes and components mentioned in the above cited passage from Utter involve internal components of Utter's FTSS. In claim 1, a message is received by the FTSS from a remote computer, and stored in highly reliable fault-tolerant storage media of the FTSS, for later forwarding to another computer.

Next, the Examiner states that Utter discloses "transmitting the message from the FTSS to the second node," referring to Figure 1, column 2, lines 61-67, and column 3, lines 1-15. The cited lines are the same as those previously quoted, above. Again, there is not one occurrence of the term "message" in the cited passage. More importantly, there is nothing in the cited passage even remotely related to a message transmitted between two user terminals in Figure 1 of Utter, and temporarily stored in the FTSS.

In the Response to Arguments section of the Office Action, section 29, the Examiner responds to Applicants' representative's previous argument that, to show anticipation of claim 1, the cited reference needs to show messages passed between two computers through the FTSS by calling Applicants' attention to column 3, lines 49-67 of Utter. That paragraph is provided below:

> In addition to transferring requests from the user terminals 12(*d*) to the fault-tolerant computer system 11, the networks 13(*n*) may also download data from the fault-tolerant computer system 11 to the user terminals 12(*d*) for the local processing by the user terminals 12(*d*) or for display to a user on a display terminal which may be provided with respective ones of the user terminal 12(*d*). *In addition*, the networks 13(*n*) may transfer data from the user terminals 12(*d*) to the fault-tolerant computer system 11 for processing or storage, and *in addition* may transfer data among the user terminals 12(*d*). In one embodiment, the networks 13(A) and 13(B) are each in the form of *conventional* high-speed (100 Mb/second) Ethernet networks, which transfer information in the form of messages. As is conventional in Ethernet networks, messages generated by one device connected to a network 13(A), 13(B) (that is, by

> a user terminal 12(*d*) or by a fault-tolerant computer system 11) contain information to be transferred, as well as an address which identifies the intended recipient or recipients of the information. (emphasis added)

The above passage, like the other cited passages from Utter, describes very conventional FTSS and Ethernet components. In this paragraph, Utter discloses the fact that the conventional Ethernet networks 13(A) and 13(B) of Utter's system can transfer messages between entities of the system in a conventional manner. Utter states that: (1) the networks can transfer data from the FTSS to a user terminal; (2) the networks can transfer data from user terminals to the FTSS; and (3) the networks can transfer data from one user terminal to another. As in all conventional Ethernet networks, a computer may send a message to another, target computer using the target computer's address. A user terminal in Utter's system can thus directly send a message through the Ethernet networks to another user terminal, as is the case in all conventional Ethernet networks. However, there is no mention in the cited passage that the Ethernet networks would behave in a decidedly unconventional fashion by arranging for a message sent by a first user terminal to a second user terminal using the address of the second user terminal to not be directly sent from the first user terminal to the second user terminal, but to be instead to be shunted onto an internal Ethernet, intercepted by the FTSS, to which the message is not addressed, stored in highly reliable FTSS data storage, retrieved from the FTSS data storage, and then forwarded to the second computer.

It is not surprising that the Examiner's proposed interpretation of Utter is not disclosed or suggested in Utter, because it would make no sense for Utter to do so. It would be extremely inefficient and slow to send a message through the FTSS Ethernet controller and have the message stored and forwarded by the FTSS when the message can be directly sent via the Ethernet network from one user terminal to another user terminal, and the conventional Ethernet would need to be greatly modified to produce an unconventional Ethernet in order to provide this capability, both at the Ethernet-controller level as well as the operating system level. By contrast, in Applicants' system, an alternative, high-bandwidth data storage communication, referred to as the "FTSS interconnection fabric," which directly interconnects computer systems to the FTSS, shown in Figure 1 of the current application as clouds labeled 28, and which does not directly interconnect computers with each other, is modified to allow computers directly connected to the FTSS through the FTSS interconnection fabric, but not directly to one another through the FTSS interconnection

fabric, *to address and send messages to one another through the FTSS interconnection fabric and the FTSS*, either obviating the need for the direct network interconnection between the computers (26 in Figure 1), or providing a second, entirely separate, high-throughput communications medium through which the computers can send messages to one another.

In section 30, the Examiner apparently attempts to refute Applicants' representative's previous arguments to the effect that data transferred among user terminals in Utter's system is transferred by the network, and not the network in combination with the FTSS or the FTSS. The Examiner then quotes the sentence: "In addition, the networks 13(n) may transfer data from the user terminals 12(d) to the fault-tolerant computer system 11 for processing or storage, and in addition may transfer data among the user terminals 12(d)." There is only one subject in this sentence, namely "the networks." This sentence states that the networks may transfer data from the user terminals 12(d) to the fault-tolerant computer system, and that the networks may also transfer data among the user terminals. However, the sentence does not teach or suggest a system in which the networks, in combination with the FTSS, intercept a message from one computer to a second computer, store the message in data storage within the FTSS, retrieve the message from the FTSS data store, and then forward the message to the second computer. Ethernets do not employ the FTSS-based store and forward technique clearly claimed in claim 1, but nowhere taught or suggested in Utter.

ISSUE 2

2. Whether claims 3-5 are unpatentable under 35 U.S.C § 103(a) over Utter in view of Northrup.

Claims 3-5 depend from claim 1. As discussed above, with respect to Issue 1, Utter is unrelated to the claimed invention. Northrup discloses a "virtual network, sitting 'above' the physical connectivity and thereby providing the administrative controls necessary to link various communication devices via an Access-Method-Independent Exchange" (Northrup, column 3, lines 11-15). Northrup does not appear to once mention fault-tolerant storage systems or fault-tolerant storage media. In Section 10 of the Office Action, the Examiner provides a lengthy list of statements, many explicitly including the term FTSS, that the Examiner claims Northrup to disclose. Applicants' representative cannot find any basis for a conclusion that Northrup has any relation to the claimed communications method involving

message storage and forwarding by an FTSS. Similarly, Applicants' representative cannot find any basis for combining Utter and Northrup, nor can Applicants' representative understand the motivation, recited in Section 11 of the Office Action, of providing virtually continuous, error-free operation as an apparent suggestion for the combination. Error-free operation is discussed in Utter on lines 24-25 of column 1 as a general introduction to fault-tolerant computing. In the next paragraph, Utter explains that error-free operation can be achieved by building fault-tolerant computer systems containing redundant components. Indeed, Utter proceeds to disclose a fault-tolerant computer system architecture with various redundant components, including redundant Ethernet networks. Applicants' representative cannot understand how an introductory statement related to fault-tolerant computing has any relation to combining the "virtual network" disclosure of Northrup, which fails to mention fault-tolerant computing, with Utter. However, even if a basis for combining the two references can somehow be found, the combination does not teach, mention, or suggest a communications systems involving storing and forwarding messages by an FTSS.

ISSUE 3

3. Whether claims 6-9 are unpatentable under 35 U.S.C. 103(a) over Utter in view of Suarez.

Claims 6-9 depend from claim 1. As discussed above, with respect to Issue 1, Utter is unrelated to the claimed invention. Suarez discloses a "distributed computing system comprising a plurality of computer hosts, a communication network for exchanging information and data between the computer hosts, and a plurality of services, including software based services, distributed throughout the computer system" (Suarez, Abstract). Suarez does not appear to once mention fault-tolerant storage systems or fault-tolerant storage media. In Section 19 of the Office Action, the Examiner provides a lengthy list of statements, many explicitly including the term FTSS, that the Examiner claims Suarez to disclose. Applicants' representative cannot find any basis for a conclusion that Suarez has any relation to the claimed communications method involving message storage and forwarding by an FTSS. Similarly, Applicants' representative cannot find any basis for combining Utter and Suarez, nor can Applicants' representative understand the motivation, recited in Section 20 of the Office Action, of providing virtually continuous, error-free operation as an apparent suggestion for the combination. Error-free operation is discussed in Utter on lines 24-25 of column 1 as a general introduction to fault-tolerant computing. In the

next paragraph, Utter explains that error-free operation can be achieved by building fault-tolerant computer systems containing redundant components. Indeed, Utter proceeds to disclose a fault-tolerant computer system architecture with various redundant components, including redundant Ethernet networks. Applicants' representative cannot understand how an introductory statement related to fault-tolerant computing has any relation to combining the "distributed computing system" disclosure of Suarez, which fails to mention fault-tolerant computing, with Utter. However, even if a basis for combining the two references can somehow be found, the combination does not teach, mention, or suggest a communications systems involving storing and forwarding messages by an FTSS.

CONCLUSION

Utter is unrelated to the claimed invention. There is no basis for an anticipation rejection based solely on Utter, or obviousness rejections largely based on Utter. Applicants' respectfully submit that all statutory requirements are met and that the present application is allowable over all the references of record. Therefore, Applicants' respectfully requests that the present application be passed to issue.

Respectfully submitted,

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APPENDIX

1. A method of transmitting messages between a first node and a second node, wherein the first and second nodes are each coupled to a fault tolerant storage system (FTSS), the method comprising:

transmitting a message from the first node to a communication agent in the FTSS;

storing the message in a data structure in highly reliable fault-tolerant storage media of the FTSS;

processing the message at the FTSS in accordance with a messaging paradigm; and

transmitting the message from the FTSS to the second node.

2. The method of claim 1 wherein the messaging paradigm is a request/reply communication paradigm, and:

transmitting a message from the first node to a communication agent in the FTSS comprises:

transmitting a request message from the first node to a request/reply communication agent in the FTSS;

storing the message in a data structure in highly reliable fault-tolerant storage media of the FTSS comprises:

storing the request message in a request queue in highly reliable fault-tolerant storage media of the FTSS;

processing the message at the FTSS in accordance with a messaging paradigm comprises:

retrieving the request message from the request queue; and

transmitting the message from the FTSS to the second node comprises:

transmitting the request message from the FTSS to a service on the second node;

and the method further comprises:

executing the service on the second node using the request message as an input

and providing a reply message as an output;

transmitting the reply message from the second node to the

request/reply
communication agent in the FTSS;
storing the reply message in a reply queue in highly reliable fault-tolerant storage
media of the FTSS;
retrieving the reply message from the reply queue; and
transmitting the reply message from the FTSS to the first node.

3. The method of claim 1 wherein the messaging paradigm is a conversational communication paradigm, and:
transmitting a message from the first node to a communication agent in the FTSS comprises:
transmitting a connect message from the first node to a conversational communication agent in the FTSS;
processing the message at the FTSS in accordance with a messaging paradigm comprises:
opening a conversation queue in highly reliable fault-tolerant storage media of the FTSS;
storing the message in a data structure in highly reliable fault-tolerant storage media of the FTSS comprises:
storing the connect message in the conversation queue; and
transmitting the message from the FTSS to the second node comprises:
transmitting the connect message from the FTSS to the second node.

4. The method of claim 3 and further comprising:
transmitting a send message from the first node to the conversational communication agent in the FTSS;
storing the send message in the conversation queue;
transmitting the send message to from the FTSS to a service on the second node;
executing the service in the second node using the send message as an input and providing a receive message as an output;
transmitting the receive message from the second node to the conversational communication agent in the FTSS;

storing the receive message in the conversation queue; and
transmitting the receive message to the first node.

5. The method of claim 3 and further comprising:
transmitting a disconnect message from the first node to the conversational communication agent in the FTSS;
closing the conversation queue; and
transmitting the disconnect message to the second node.

6. The method of claim 1 wherein the messaging paradigm is an event-based communication paradigm, and:
transmitting a message from the first node to a communication agent in the FTSS comprises:
transmitting a post message from the first node to an event-based communication agent in the FTSS;
processing the message at the FTSS in accordance with a messaging paradigm comprises:
accessing a subscription manager to determine whether any nodes have subscribed to receive the event represented by the post message;
storing the message in a data structure in highly reliable fault-tolerant storage media of the FTSS comprises:
storing the post message in an event queue in highly reliable fault-tolerant storage media of the FTSS; and
transmitting the message from the FTSS to the second node comprises:
transmitting the post message from the FTSS to the second node if the
second node has subscribed to receive the event represented by
the post message.

7. The method of claim 6 and further comprising:
transmitting a subscribe message from the second node to the event-based communication manager in the FTSS, wherein the subscribe message

includes an event; and

accessing the subscription manager to record that the second node has subscribed to receive post messages associated with the event.

8. The method of claim 6 and further comprising:

transmitting an unsubscribe message from the second node to the event-based communication manager in the FTSS, wherein the unsubscribe message includes an event; and

accessing the subscription manager to record that the second node should no longer receive post messages associated with the event.

9. The method of claim 1 wherein the messaging paradigm is a queue-based communication paradigm, and:

transmitting a message from the first node to a communication agent in the FTSS comprises:

transmitting an enqueue message from the first node to a queue-based communication agent in the FTSS;

storing the message in a data structure in highly reliable fault-tolerant storage media of the FTSS comprises:

storing the enqueue message in a queue space in highly reliable fault tolerant storage media of the FTSS;

processing the message at the FTSS in accordance with a messaging paradigm

comprises:

retrieving the enqueue message from the queue space only if the second

node is available; and

transmitting the message from the FTSS to the second node comprises:

transmitting the enqueue message from the FTSS to a service on the second

node only if the second node is available;

and the method further comprises:

executing the service on the second node using the enqueue message as

an input

and providing a dequeue message as an output;

transmitting the dequeue message from the second node to the queue-based

communication agent in the FTSS;

storing the dequeue message in the queue space;

retrieving the dequeue message from the queue space; and

transmitting the dequeue message from the FTSS to the first node.

10. The method of claim 1 wherein the messaging paradigm is an unsolicited communication paradigm, and:

transmitting a message from the first node to a communication agent in the

FTSS comprises:

transmitting a broadcast message from the first node to an unsolicited

communication agent in the FTSS;

processing the message at the FTSS in accordance with a messaging paradigm

comprises:

accessing determining which nodes should receive the broadcast message

based on the broadcast message;

storing the message in a data structure in highly reliable fault-tolerant storage

media of the FTSS comprises:

storing the broadcast message in an unsolicited message queue in highly

reliable fault-tolerant storage media of the FTSS; and

transmitting the message from the FTSS to the second node comprises:

transmitting the post message from the FTSS to all nodes that should

receive the broadcast message.

AF/2142

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Fort Collins, Colorado 80527-2400

PATENT APPLICATION

ATTORNEY DOCKET NO. 10008316-1

83

OIPE JC48 JUL 01 2004 PATENT & TRADEMARK OFFICE

IN THE
UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s): Blaine D. Gaither et al. *Confirmation No.:*

Application No.: 09/703,427 *Examiner:* Lambert L. Tran

Filing Date: 10/31/2000 *Group Art Unit:* 2142

Title: Method and Apparatus for Passing Messages using a Fault Tolerant Storage System

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JUL 06 2004
Technology Center 2100

Commissioner for Patents
PO Box 1450
Alexandria, VA 22313-1450

NOTICE OF APPEAL FROM THE EXAMINER TO THE BOARD OF PATENT APPEALS AND INTERFERENCES

Sir:

Applicant hereby appeals to the Board of Patent Appeals and Interferences from the decision of the examiner dated, May 26, 2004, rejecting the following claims 1-10.
The fee for this Notice of Appeal is (37 CFR 1.17(b)) $330.00.

(complete (a) or (b) as applicable)

The proceedings herein are for a patent application and the provisions of 37 CFR 1.136(a) apply.

( ) (a) Applicant petitions for an extension of time under 37 CFR 1.136 (fees: 37 CFR 1.17(a)-(d) for the total number of months checked below:

( )	one month	$110.00
( )	two months	$420.00
( )	three months	$950.00
( )	four months	$1480.00

( ) The extension fee has already been filed in this application.

(X) (b) Applicant believes that no extension of time is required. However, this conditional petition is being made to provide for the possibility that applicant has inadvertently overlooked the need for a petition and fee for extension of time.

Please charge to Deposit Account ***08-2025*** the sum of ***$330.00***. At any time during the pendency of this application, please charge any fees required or credit any over payment to Deposit Account 08-2025 pursuant to 37 CFR 1.25. Additionally please charge any fees to Deposit Account 08-2025 under 37 CFR 1.16 through 1.21 inclusive, and any other sections in Title 37 of the Code of Federal Regulations that may regulate fees. A duplicate copy of this sheet is enclosed.

07/06/2004 AWONDAF1 00000025 082025 09703427
01 FC:1401 330.00 DA

(X) I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to: Commissioner for Patents, Alexandria, VA 22313-1450. Date of Deposit: *June 25, 2004*

OR

( ) I hereby certify that this paper is being transmitted to the Patent and Trademark Office facsimile number_____ on _____

Number of pages:

Typed Name: *Joanne Bourguignon*

Signature: *Joanne Bourguignon*

Rev 05/04 (NoteApeal)

Respectfully submitted,

Blaine D. Gaither et al.

By *Robert W. Bergstrom*

Robert W. Bergstrom
Attorney/Agent for Applicant(s)
Reg. No. ***39,906***

Date: ***June 25, 2004***

Telephone No.: ***206.621.1933***

HEWLETT-PACKARD COMPANY
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Fort Collins, Colorado 80527-2400

RP/2140

PATENT APPLICATION

ATTORNEY DOCKET NO. 10008318-1

83

OIPE
JUL 01 2004
PATENT & TRADEMARK OFFICE

IN THE
UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s): Blaine D. Gaither et al. Confirmation No.:

Application No.: 09/703,427 Examiner: Lambert L. Tran

Filing Date: 10/31/2000 Group Art Unit: 2142

Title: Method and Apparatus for Passing Messages using a Fault Tolerant Storage System

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NOTICE OF APPEAL FROM THE EXAMINER TO THE BOARD OF PATENT APPEALS AND INTERFERENCES

Sir:

Applicant hereby appeals to the Board of Patent Appeals and Interferences from the decision of the examiner dated, May 26, 2004, rejecting the following claims 1-10.
The fee for this Notice of Appeal is (37 CFR 1.17(b)) $330.00.

(complete (a) or (b) as applicable)

The proceedings herein are for a patent application and the provisions of 37 CFR 1.136(a) apply.

( ) (a) Applicant petitions for an extension of time under 37 CFR 1.136 (fees: 37 CFR 1.17(a)-(d) for the total number of months checked below:

( ) one month	$110.00
( ) two months	$420.00
( ) three months	$950.00
( ) four months	$1480.00

( ) The extension fee has already been filed in this application.

(X) (b) Applicant believes that no extension of time is required. However, this conditional petition is being made to provide for the possibility that applicant has inadvertently overlooked the need for a petition and fee for extension of time.

Please charge to Deposit Account *08-2025* the sum of *$330.00*. At any time during the pendency of this application, please charge any fees required or credit any over payment to Deposit Account 08-2025 pursuant to 37 CFR 1.25. Additionally please charge any fees to Deposit Account 08-2025 under 37 CFR 1.16 through 1.21 inclusive, and any other sections in Title 37 of the Code of Federal Regulations that may regulate fees. A duplicate copy of this sheet is enclosed.

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Typed Name: *Joanne Bourguignon*

Signature:

Rev 05/04 (NoteAppeal)

07/28/2004 SFORD1 00000025 09703427
01 FC:1252 330.00 DA

Respectfully submitted,

Blaine D. Gaither et al.

By

Robert W. Bergstrom

Attorney/Agent for Applicant(s)
Reg. No. *39,906*

Date: *June 25, 2004*

Telephone No.: *206.621.1933*

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/703,427	10/31/2000	Blaine D. Gaither	10008316-1	2980

22879 7590 05/26/2004

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FORT COLLINS, CO 80527-2400

EXAMINER	
TRAN, LAMBERT L	
ART UNIT	**PAPER NUMBER**
2144	9

DATE MAILED: 05/26/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 10/03)

Advisory Action	Application No.	Applicant(s)	
	09/703,427	GAITHER ET AL.	
	Examiner	Art Unit	
	Lambert L. Tran	2144	

--The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

THE REPLY FILED 04 May 2004 FAILS TO PLACE THIS APPLICATION IN CONDITION FOR ALLOWANCE. Therefore, further action by the applicant is required to avoid abandonment of this application. A proper reply to a final rejection under 37 CFR 1.113 may only be either: (1) a timely filed amendment which places the application in condition for allowance; (2) a timely filed Notice of Appeal (with appeal fee); or (3) a timely filed Request for Continued Examination (RCE) in compliance with 37 CFR 1.114.

PERIOD FOR REPLY [check either a) or b)]

a) ☐ The period for reply expires _____months from the mailing date of the final rejection.

b) ☒ The period for reply expires on: (1) the mailing date of this Advisory Action, or (2) the date set forth in the final rejection, whichever is later. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of the final rejection.
ONLY CHECK THIS BOX WHEN THE FIRST REPLY WAS FILED WITHIN TWO MONTHS OF THE FINAL REJECTION. See MPEP 706.07(f).

Extensions of time may be obtained under 37 CFR 1.136(a). The date on which the petition under 37 CFR 1.136(a) and the appropriate extension fee have been filed is the date for purposes of determining the period of extension and the corresponding amount of the fee. The appropriate extension fee under 37 CFR 1.17(a) is calculated from: (1) the expiration date of the shortened statutory period for reply originally set in the final Office action; or (2) as set forth in (b) above, if checked. Any reply received by the Office later than three months after the mailing date of the final rejection, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

1. ☐ A Notice of Appeal was filed on _____. Appellant's Brief must be filed within the period set forth in 37 CFR 1.192(a), or any extension thereof (37 CFR 1.191(d)), to avoid dismissal of the appeal.

2. ☐ The proposed amendment(s) will not be entered because:

   (a) ☐ they raise new issues that would require further consideration and/or search (see NOTE below);

   (b) ☐ they raise the issue of new matter (see Note below);

   (c) ☐ they are not deemed to place the application in better form for appeal by materially reducing or simplifying the issues for appeal; and/or

   (d) ☐ they present additional claims without canceling a corresponding number of finally rejected claims.

   NOTE: _____.

3. ☐ Applicant's reply has overcome the following rejection(s): _____.

4. ☐ Newly proposed or amended claim(s) _____ would be allowable if submitted in a separate, timely filed amendment canceling the non-allowable claim(s).

5. ☒ The a)☐ affidavit, b)☐ exhibit, or c)☒ request for reconsideration has been considered but does NOT place the application in condition for allowance because: *See Continuation Sheet*.

6. ☐ The affidavit or exhibit will NOT be considered because it is not directed SOLELY to issues which were newly raised by the Examiner in the final rejection.

7. ☒ For purposes of Appeal, the proposed amendment(s) a)☐ will not be entered or b)☒ will be entered and an explanation of how the new or amended claims would be rejected is provided below or appended.

   The status of the claim(s) is (or will be) as follows:

   Claim(s) allowed: *None*.

   Claim(s) objected to: _____.

   Claim(s) rejected: *1-10*.

   Claim(s) withdrawn from consideration: _____.

8. ☐ The drawing correction filed on _____ is a)☐ approved or b)☐ disapproved by the Examiner.

9. ☐ Note the attached Information Disclosure Statement(s)(PTO-1449) Paper No(s). _____.

10. ☐ Other: _____

MARC D. THOMPSON
MARC THOMPSON
PRIMARY EXAMINER

SAP - Exhibit 1102
SAP v. Valtrus et al. - IPR2025-00420
Page 313 of 704

Continuation of 5. does NOT place the application in condition for allowance because: Applicant argues the same subject matters (meaning of message, node) which had been addressed in the Final Office Action .

SAP - Exhibit 1102
SAP v. Valtrus et al. - IPR2025-00420
Page 314 of 704

HEWLETT-PACKARD COMPA[redacted]
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61

PATENT APPLICATION

AF 2142

ATTORNEY DOCKET NO. 10008316-1

OIPE JC42
APR 30 2004
PATENT & TRADEMARK OFFICE

IN THE
UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s): Blaine D. Gaither et al.

Confirmation No.:

Application No.: 09/703,427

Examiner: Lambert L. Tran

Filing Date: 10/31/2000

Group Art Unit: 2142

Title: METHOD AND APPARATUS FOR PASSING MESSAGES USING A FAULT TOLERANT STORAGE SYSTEM

Commissioner for Patents
PO Box 1450
Alexandria, VA 22313-1450

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MAY 04 2004
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TRANSMITTAL LETTER FOR RESPONSE/AMENDMENT

Sir:

Transmitted herewith is/are the following in the above-identified application:

(X) Response/Amendment
( ) New fee as calculated below
(X) No additional fee (Address envelope to "Mail Stop Non-Fee Amendment")
( ) Other: _____ (fee $_____)
( ) Petition to extend time to respond
( ) Supplemental Declaration

CLAIMS AS AMENDED BY OTHER THAN A SMALL ENTITY						
(1) FOR	(2) CLAIMS REMAINING AFTER AMENDMENT	(3) NUMBER EXTRA	(4) HIGHEST NUMBER PREVIOUSLY PAID FOR	(5) PRESENT EXTRA	(6) RATE	(7) ADDITIONAL FEES
TOTAL CLAIMS	10	MINUS	20	= 0	x $18	$ 0
INDEP. CLAIMS	1	MINUS	3	= 0	x $84	$ 0
[ ] FIRST PRESENTATION OF A MULTIPLE DEPENDENT CLAIM					+ $280	$ 0
EXTENSION FEE	1ST MONTH $110.00 [ ]	2ND MONTH $410.00 [ ]	3RD MONTH $930.00 [ ]	4TH MONTH $1450.00 [ ]		$ 0
					OTHER FEES	$
					TOTAL ADDITIONAL FEE FOR THIS AMENDMENT	$ 0

Charge $ 0 to Deposit Account 08-2025. At any time during the pendency of this application, please charge any fees required or credit any overpayment to Deposit Account 08-2025 pursuant to 37 CFR 1.25. Additionally please charge any fees to Deposit Account 08-2025 under 37 CFR 1.16 through 1.21 inclusive, and any other sections in Title 37 of the Code of Federal Regulations that may regulate fees. A duplicate copy of this sheet is enclosed.

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to: Commissioner for Patents, Alexandria, VA 22313-1450.

Date of Deposit: April 26, 2004

Typed Name: Joanne Bourguignon

Signature: [signature]

Respectfully submitted,

Blaine D. Gaither et al.

By [signature]
Robert W. Bergstrom

Attorney/Agent for Applicant(s)
Reg. No. 39,906

Date: April 26, 2004

Telephone No.: (206) 621-1933

Rev 05/03 (TransAmd)

- Attach as First Page to Transmitted Papers -

OIPE 3C42
APR 30 2004
PATENT & TRADEMARK OFFICE

#8
B. Bond
5/10/04

PATENT

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April 26, 2004 — Date

J. Bourguignon — Joanne Bourguignon

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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MAY 04 2004
Technology Center 2100

Applicants:	Blaine D. Gaither et al.
Application No.:	09/703,427
Filed:	October 31, 2000
Title:	METHOD AND APPARATUS FOR PASSING MESSAGES USING A FAULT TOLERANT STORAGE SYSTEM
Examiner:	Lambert L. Tran
Art Unit:	2142
Docket No.:	10008316-1
Date:	April 26, 2004

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Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

RESPONSE

INTRODUCTORY COMMENTS

Sir:

In response to the Final Rejection date February 25, 2004, please consider the following response:

REMARKS

Claims 1-10 are currently pending in the application. In an Office Action dated February 25, 2004 ("Office Action"), the Examiner rejected claims 1-2 and 10 under 35 U.S.C § 102(b) as being anticipated by Utter et al., U.S. Patent No. 5,815,649 ("Utter"), rejected claims 3-5 under 35 U.S.C § 103(a) as being unpatentable over Utter in view of Northrup, U.S. Patent No. 6,546,413 ("Northrup"), and rejected claims 6-9 under 35 U.S.C. 103(a) as being unpatentable over Utter in view of Suarez, U.S. Patent No. 5,790,789 ("Suarez"). Applicants' representative again respectfully traverses the 35 U.S.C § 102(b) and 35 U.S.C. 103(a) rejections of claims 1-10.

In a previous Response, Applicants' representative carefully provided a summary of the invention disclosed in the current application. Applicants' representative refers the Examiner to that summary, rather than repeat the summary in the current Response. Please again consider claim 1, provided for the Examiner's convenience, below:

> 1. A method of transmitting messages between a first node and a second node, wherein the first and second nodes are each coupled to a fault tolerant storage system (FTSS), the method comprising:
>
> transmitting a message from the first node to a communication agent in the FTSS;
>
> storing the message in a data structure in highly reliable fault-tolerant storage media of the FTSS;
>
> processing the message at the FTSS in accordance with a messaging paradigm; and
>
> transmitting the message from the FTSS to the second node.

The term "node" is defined in the current application, in the paragraph beginning on line 19 of page 1, as being either a server computer intercommunicating with a client computer or a client computer intercommunicating with a server computer through a network. Messages are defined in the paragraph beginning on line 3 of page 3 of the current application as the units of information exchanged between a server application running on a server computer and a client application running on a client computer. Claim 1 thus specifically claims transmitting a message from a first computer to a second computer, both the first and second computers coupled to a fault-tolerant storage system. The first computer transits the message to the fault-tolerant storage

system (FTSS), the message is then stored in highly reliable fault-tolerant storage media of the FTSS, the message is later processed by the FTSS, and the message is finally transmitted from the FTSS to the second computer.

In section 4 of the Office Action, the Examiner states that "Utter discloses a method of transmitting messages between a first node and a second node, wherein the first and second nodes are each coupled to a fault tolerant storage system (FTSS)," referring to Figure 1 of Utter. Figure 1 of Utter shows a fault-tolerant computer system, the components of which are surrounded by an outer, dashed, nearly rectangular boundary shaped somewhat like a mirror-image of Utah turned on its side. Four user terminals (12(A)-(D)) and a console terminal (14) are connected to the fault-tolerant computer system via two *conventional* Ethernet networks (13(A)-(B)) (column 3, lines 59-61). Indeed, Applicants' representative agrees that, as shown in Figure 1, and according to Utter's disclosure, one of the four user terminals may exchange messages with another of the four user terminals via the two *conventional* Ethernet networks, and that the two user terminals are coupled through the two *conventional* Ethernet networks to a fault-tolerant computer system. However, in Utter's system, communications between user terminals is conducted in an entirely conventional manner, via entirely conventional Ethernet links, and not through the FTSS, as clearly claimed in the elements of claim 1 directed to Applicants' invention, and as discussed below.

Next, the Examiner states that Utter discloses "transmitting a message from the first node to a communication agent (processing node) in the FTSS, referring to Figure 1, col. 2, lines 61-67 and column 3, lines 1-15. Applicants' representative reproduces the cited passage, below:

> FIG. 1 is a functional block diagram of a digital computer system 10 including a storage subsystem that is constructed in accordance with the invention. With reference to FIG. 1, the digital computer system 10 includes a fault-tolerant computer system 11 which connects to a plurality of user terminals 12(A) through 12(D) (generally identified by reference numeral 12(*d*)) over respective user networks 13(A) and 13(B) (generally identified by reference numeral 13(*n*)) which connect the user terminals 12(*d*) to the fault-tolerant computer system 11. The fault-tolerant computer system 11 performs conventional digital data processing and data retrieval and storage services that are generally typical of those performed by digital computer systems, in connection with processing, data retrieval and data storage requests provided thereto by the user terminals 12(*d*). As will be described below in greater detail, the fault-tolerant computer system 11 includes a number of subsystems which allow the data processing, storage and retrieval services to be provided in a manner

> which is tolerant of faults, failures, and malfunctions therein. The digital computer system 10 further includes a console terminal 14, which connects to the fault-tolerant computer system 11 over a maintenance network 15 as well as over a user network 13(*n*).

Applicants' representative has underlined interesting passages in the above text cited by the Examiner. First, the word "message" does not even once appear in the above cited passage. Instead, the above cited passage is directed to a fault-tolerant computer system that performs "conventional digital data processing and data retrieval and storage services." Such services involve client computers requesting services from the fault-tolerant computer system, the fault-tolerant computer system performing the requested services, and the fault-tolerant computer system returning status, data, or both status and data to the requesting client computer. A *conventional* fault-tolerant computer system provides these services independently to requesting client computers. The above passage makes no mention or indication that the fault-tolerant computer system undertakes any kind of service involving transfer of data or other information from one user terminal to another. As indicated above, the word "message" is defined in the current application, and is used in claim 1 consistent with that definition, to mean units of information exchanged between a first computer and a second computer, both distinct from the FTSS. Moreover, the Examiner states that Utter's processing node carries out the operations of Applicants' claimed communication agent, but the above-cited makes no mention of Utter's processing node or of a communications agent. Thus, the above cited passage does not teach that to which the Examiner ascribes to it.

Next, the Examiner states that Utter discloses "storing the message in a data structure in highly reliable fault-tolerant storage media of the FTSS," referring to lines 25-30 of column 2. That portion of column is provided below:

> The storage nodes store data in at least one replicated partition group comprising a plurality of replicated partitions distributed across the storage nodes. A storage node, on receiving a retrieval request from a processing node provide the requested data to the processing node.

This passage does not teach, mention, or even remotely suggest storing messages in the highly reliable fault-tolerant storage media of the FTSS for later forwarding to another computer. The passage instead is directed to an entirely conventional FTSS

operation of storing data in replicated partitions, as is done in disk arrays by RAID controllers, and retrieving the stored data. The term "message" does not once occur in above passage. As noted above, the term "message" has a well defined meaning in the current application and in claim 1, and is not synonymous with the term "data." Moreover, all of the nodes and components mentioned in the above cited passage from Utter involve internal components of Utter's FTSS. In claim 1, a message is received by the FTSS from a remote computer, and stored in highly reliable fault-tolerant storage media of the FTSS, for later forwarding to another computer.

Next, the Examiner states that Utter discloses "transmitting the message from the FTSS to the second node," referring to Figure 1, column 2, lines 61-67, and column 3, lines 1-15. The cited lines are the same as those previously quoted, above. Again, there is not one occurrence of the term "message" in the cited passage. More importantly, there is nothing in the cited passage even remotely related to a message transmitted between two user terminals in Figure 1 of Utter, and temporarily stored in the FTSS. If the Examiner is referring to the fact that *data* is processed, retrieved, and stored by Utter's FTSS, then the Examiner has failed to properly read claim 1. Claim 1 claims a message sent from a first computer ***through*** an FTSS to a second computer. The quoted passage discusses nothing other than conventional data storage and retrieval by an FTSS on behalf of one or more client computers. There is no indication whatsoever in the passage that a user terminal can send a message *through the FTSS* to another user terminal. Furthermore, if the Examiner is referring to the internal components of the FTSS as the second node, then, again, the Examiner has not properly read claim 1. Claim 1 refers to two separate and distinct computers as well as an FTSS. Nothing in the quoted passages involves messages, or even data, transmitted between two computers separate and distinct from Utter's FTSS.

In Applicants' representative's opinion, the Examiner's stated rationale falls far short of that required for an anticipation rejection of the claim 1 based on Utter. An anticipation rejection requires that every element in the claim be disclosed in the cited reference. In the current case, none of the elements of claim 1 are disclosed in the cited reference.

In the Response to Arguments section of the Office Action, section 29, the Examiner responds to Applicants' representative's previous argument that, to show

anticipation of claim 1, the cited reference needs to show messages passed between two computers through the FTSS by calling Applicants' attention to column 3, lines 49-67 of Utter. That paragraph is provided below:

> In addition to transferring requests from the user terminals 12(*d*) to the fault-tolerant computer system 11, the networks 13(*n*) may also download data from the fault-tolerant computer system 11 to the user terminals 12(*d*) for the local processing by the user terminals 12(*d*) or for display to a user on a display terminal which may be provided with respective ones of the user terminal 12(*d*). *In addition*, the networks 13(*n*) may transfer data from the user terminals 12(*d*) to the fault-tolerant computer system 11 for processing or storage, and *in addition* may transfer data among the user terminals 12(*d*). In one embodiment, the networks 13(A) and 13(B) are each in the form of *conventional* high-speed (100 Mb/second) Ethernet networks, which transfer information in the form of messages. As is conventional in Ethernet networks, messages generated by one device connected to a network 13(A), 13(B) (that is, by a user terminal 12(*d*) or by a fault-tolerant computer system 11) contain information to be transferred, as well as an address which identifies the intended recipient or recipients of the information. (emphasis added)

The above passage, like the other cited passages from Utter, describes very conventional FTSS and Ethernet components. In this paragraph, Utter discloses the fact that the conventional Ethernet networks 13(A) and 13(B) of Utter's system can transfer messages between entities of the system in a conventional manner. Utter states that: (1) the networks can transfer data from the FTSS to a user terminal; (2) the networks can transfer data from user terminals to the FTSS; and (3) the networks can transfer data from one user terminal to another. As in all conventional Ethernet networks, a computer may send a message to another computer using that computer's address. A user terminal in Utter's system can thus directly send a message through the Ethernet networks to another user terminal, as is the case in all conventional Ethernet networks.

However, there is no mention in the cited passage that the Ethernet networks would behave in a decidedly unconventional fashion by arranging for a message sent by a first user terminal to a second user terminal using the address of the second user terminal to not be directly sent from the first user terminal to the second user terminal, but to be instead intercepted by the FTSS, to which the message is not addressed, stored in highly reliable FTSS data storage, retrieved from the FTSS data storage, and then forwarded to the second computer. **It is not surprising that the Examiner's proposed interpretation of Utter is not disclosed or suggested in Utter, because it would make no sense to do so.** *It would be*

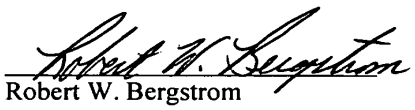
extremely inefficient and slow to send a message through the FTSS Ethernet controller and have the message stored and forwarded by the FTSS when the message can be directly sent via the Ethernet network from one user terminal to another user terminal, and the conventional Ethernet would need to be greatly modified to an unconventional Ethernet to provide this capability, both at the Ethernet controller level as well as the operating system level. By contrast, in Applicants' system, an alternative, high-bandwidth data storage communication, referred to as the "FTSS interconnection fabric," which directly interconnects computer systems to the FTSS, shown in Figure 1 of the current application as clouds labeled 28, and which does not directly interconnect computers with each other, is modified to allow computers directly connected to the FTSS through the FTSS interconnection fabric, but not directly to one another through the FTSS interconnection fabric, *to address and send messages to one another through the FTSS interconnection fabric and the FTSS,* either obviating the need for the direct network interconnection between the computers (26 in Figure 1), or providing a second, entirely separate, high-throughput communications medium through which the computers can send messages to one another.

In section 30, the Examiner apparently attempts to refute Applicants' representative's previous arguments to the effect that data transferred among user terminals in Utter's system is transferred by the network, and not the network in combination with the FTSS or the FTSS. The Examiner then quotes the sentence: "In addition, the networks 13(n) may transfer data from the user terminals 12(d) to the fault-tolerant computer system 11 for processing or storage, and in addition may transfer data among the user terminals 12(d)." There is only one subject in this sentence, namely "the networks." This sentence states that the networks may transfer data from the user terminals 12(d) to the fault-tolerant computer system, and that the networks may also transfer data among the user terminals. However, the sentence does not teach or suggest a system in which the networks, in combination with the FTSS, intercept a message from one computer to a second computer, store the message in data storage within the FTSS, retrieve the message from the FTSS data store, and then forward the message to the second computer. Ethernets do not employ the FTSS-based store and forward technique clearly claimed in claim 1, but nowhere

taught or suggested in Utter.

Applicants' representative respectfully submits that the Examiner has failed to meet the burden of an anticipation rejection of claim 1. Applicant's representative believes that, since claim 1 is allowable, all of the remaining claims, which depend directly or indirectly from claim 1, are also allowable. Favorable consideration and a Notice of Allowance are earnestly solicited.

Respectfully submitted,
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Enclosures:
Postcards (2)
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER	
TRAN, LAMBERT L	
ART UNIT	**PAPER NUMBER**
2144	7

DATE MAILED: 02/25/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 10/03)

Office Action Summary	Application No.	Applicant(s)	
	09/703,427	GAITHER ET AL.	
	Examiner	Art Unit	
	Lambert L. Tran	2144	

-- 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) 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 the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- 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 *24 November 2003*.

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) *1-10* 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) *1-10* 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 *24 November 2003* 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-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

1. Applicant's response received on 24 November 2003 has been entered as Paper #6.

Drawings

2. The proposed drawing corrections to Figure 8 and 9 are acceptable for examination purpose.

Claim Rejections - 35 USC § 102

3. 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.

4. Claims 1-2 and 10 are rejected under 35 U.S.C. 102(b) as being anticipated by Utter et al., (Utter) U.S. Patent No 5815649.

In regard to claim 1, Utter discloses *a method of transmitting messages between a first node and a second node, wherein the first and second nodes are each coupled to a fault tolerant storage system (FTSS),* [see Figure 1, note the Fault Tolerant Computer System 11] *the method comprising*:

transmitting a message from the first node to a communication agent (processing node) in the FTSS [see Figure 1, col. 2, lines 61-67 and col. 3, lines 1-15];

storing the message in a data structure in highly reliable fault-tolerant storage

media of the FTSS [see col. 2, lines 25-30];

processing the message at the FTSS in accordance with a messaging paradigm [see col. 2, lines 19-25 and col. 3, lines 3-15] ; and

transmitting the message from the FTSS to the second node [see Figure 1, col. 2, lines 61-67 and col. 3, lines 1-15].

5. In regard to claim 2, Utter discloses the *messaging paradigm is a request/reply communication paradigm* [see col. 4, lines 48-67, and col. 5 lines 1-14], *and:*

transmitting a message from the first node to a communication agent (processing node) in the FTSS [see Figure 1, col. 2, lines 61-67 and col. 3, lines 1-15] *comprises:*

transmitting a request message from the first node to a request/reply communication agent in the FTSS [see col. 3, lines 49-62];

storing the message in a data structure in highly reliable fault-tolerant storage media of the FTSS [see col. 4 lines 48-67, and col. 5 lines 1-14] *comprises:*

storing the request message in a request queue in highly reliable fault tolerant storage media of the FTSS [see col. 19, lines 13-43];

processing the message at the FTSS in accordance with a messaging paradigm comprises:

retrieving the request message from the request queue [see col. 9, lines 1-12, and

col. 19, lines 13-43]; *and*

transmitting the message from the FTSS to the second node comprises:

transmitting the request message from the FTSS to a service on the second node [see col. 4, lines 48-67 and col. 5, lines 1-14]; *and the method further comprises: executing the service on the second node using the request message as an input and providing a reply message as an output* [see col. 4, lines 48-67 and col. 5, lines 1-14];

transmitting the reply message from the second node to the request/reply communication agent in the FTSS [see col. 4, lines 48-67 and col. 5, lines 1-14];

storing the reply message in a reply queue in highly reliable fault-tolerant storage media of the FTSS [col. 19, lines 13-43];

retrieving the reply message from the reply queue [see col. 9, lines 1-12, and col. 19, lines 13-43]; *and*

transmitting the reply message from the FTSS to the first node [see col. 4, lines 48-67 and col. 5, lines 1-14].

6. In regard to claim 10, Utter discloses *transmitting a message from the first node to a communication agent in the FTSS comprises:*

transmitting a broadcast message from the first node to an unsolicited communication agent in the FTSS [see Figure 7, col. 18, lines 35-44];

processing the message at the FTSS in accordance with a messaging paradigm comprises:

accessing determining which nodes should receive the broadcast message based

on the broadcast message [see col. 18, lines 53-57]*;*

storing the message in a data structure in highly reliable fault-tolerant storage media of the FTSS comprises:

storing the broadcast message in an unsolicited message queue in highly reliable fault-tolerant storage media of the FTSS [see col. 16, lines 41-65]*; and*

transmitting the message from the FTSS to the second node comprises:

transmitting the post message from the FTSS to all nodes that should receive the broadcast message [see col. 16, lines 41-65, and col. 19, lines 4-25].

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

8. Claims 3-5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Utter, in view of Northrup, U.S. Patent No. 6546413.

9. In regard to claim 3, Utter discloses the invention substantially as claimed. However, Utter does not explicitly disclose *wherein the messaging paradigm is a conversational communication paradigm.*

10. In the same field of endeavor, Northrup discloses an Access-Method-Independent Exchange Using A Communication Primitive. Northrup discloses *wherein the messaging paradigm is a conversational communication paradigm* [see Northrup, Abstract and col. 1, lines 51-61], *and:*

transmitting a message from the first node to a communication agent in the FTSS comprises:

transmitting a connect message from the first node to a conversational communication agent in the FTSS [see Northrup, col. 6, lines 10-17, col. 28, lines 15-23, col. 30, lines 12-21 and col. 30, lines 43-54];

processing the message at the FTSS in accordance with a messaging paradigm comprises:

opening (creating) a conversation queue in highly reliable fault-tolerant storage media of the FTSS [see Northrup, col. 28, lines 60-62, and col. 29, lines 7-11];

storing the message in a data structure in highly reliable fault-tolerant storage media of the FTSS comprises:

storing the connect message in the conversation queue [see Northrup, col. 6, lines 10-17, col. 28, lines 15-23, col. 29, lines 22-35]; *and*

transmitting the message from the FTSS to the second node comprises:

transmitting the connect message from the FTSS to the second node [see Northrup, col. 6, lines 10-17, col. 28, lines 15-23, col. 30, lines 12-21 and col. 30, lines 43-54].

11. An ordinary artisan in the art at the same time the invention was made, would have been motivated to look to a way to provide virtually continuous, error-free operation [see Utter, col. 1, lines 24-25].

12. Accordingly, it would have been obvious to one of ordinary skill in the networking and software programming art at the time the invention was made to have incorporated Northrup's teachings of conversational communication primitives [see Northrup, col. 4, lines 9-44] with the teachings of Utter's, for the purpose of providing the administrative controls necessary to link various communication devices, as well as providing software which can be commoditized and upgraded while in operation [see Northrup, Abstract]. By this rationale claim 3 is rejected.

13. In regard to claim 4, Utter-Northrup discloses *transmitting a send message from the first node to the conversational communication agent in the FTSS* [see Northrup, col. 6, lines 27-34, col. 28, lines 38-39, col. 30, lines 12-21 and col. 30, lines 43-54];
storing the send message in the conversation queue [see Northrup, col. 28, lines 65-68, col. 29, lines 22-35];
transmitting the send message to from the FTSS to a service on the second node [see Northrup, col. 28, lines 38-39, col. 30, lines 12-21 and col. 30, lines 43-54];
executing the service in the second node using the send message as an input and providing a receive message as an output [see Northrup, col. 30, lines 12-21, col. 28, lines 40-41, and col. 31, lines 23-27];
transmitting the receive message from the second node to the conversational

communication agent in the FTSS [see Northrup, col.28, lines 40-41, col. 30, lines 12-21 and col. 30, lines 43-54];

storing the receive message in the conversation queue [see Northrup, col. 28, lines 40-41, col. 29, lines 22-35]; *and*

transmitting the receive message to the first node [see Northrup, col. 28, lines 40-41, col. 30, lines 12-21 and col. 30, lines 43-54].

14. By this rationale, claim 4 is rejected.

15. In regard to claim 5, Utter-Northrup discloses *transmitting a disconnect message from the first node to the conversational communication agent in the FTSS* [see Northrup, col. 28, lines 45-46, col. 33, lines 44-47];

closing the conversation queue [see Northrup, col. 33, lines 50-54]; *and*

transmitting the disconnect message to the second node [see Northrup, col. 33, lines 55-64].

16. By this rationale, claim 5 is rejected.

17. Claims 6-9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Utter, in view of Suarez, U.S. Patent No. 5790789.

18. In regard to claim 6, Utter discloses the invention substantially as claimed. However, Utter does not explicitly disclose *wherein the messaging paradigm is an event-based communication paradigm.*

19. In the same field of endeavor, Suarez discloses a method and architecture for creation, control and deployment of services within a distributed computer environment that teaches the use of intelligent queue-based agent in network environments [see Abstract and col. 9, lines 14-39]. Suarez discloses *wherein the messaging paradigm is an event-based communication paradigm; and:*

transmitting a message from the first node to a communication agent in the FTSS comprises:

transmitting a post message from the first node to an event-based communication agent in the FTSS [see Suarez, col. 21, lines 35-51, col. 25, lines 33-42 and col. 26, lines 50-62];

processing the message at the FTSS in accordance with a messaging paradigm comprises:

accessing a subscription manager to determine whether any nodes have subscribed to receive the event represented by the post message; [see Suarez col. 21, lines 35-51, col. 25, lines 33-42, col. 26, lines 50-62];

storing the message in a data structure in highly reliable fault-tolerant storage media of the FTSS comprises:

storing the post message in an event queue in highly reliable fault-tolerant storage media of the FTSS [see Suarez col. 21, lines 35-51, col. 25, lines 33-42, col. 26, lines 50-62]; *and*

transmitting the message from the FTSS to the second node comprises:

transmitting the post message from the FTSS to the second node if the second node has subscribed to receive the event represented by the post message. [see Suarez col. 21, lines 35-51, col. 25, lines 33-42, col. 26, lines 50-62].

20. An ordinary artisan in the art at the same time the invention was made, would have been motivated to look to a way to provide virtually continuous, error-free operation [see Utter, col. 1, lines 24-25].

21. Accordingly, it would have been obvious to one of ordinary skill in the networking and software programming art at the time the invention was made to have incorporated Suarez's teachings of intelligent queue-based communication agents [see Suarez, col. 21, lines 16-33] with the teachings of Utter's, for the purpose of providing a system that is smaller [see Suarez, col. 2, lines 63-61], modulized, compacted and maintainability. By this rationale claim 6 is rejected.

22. In regard to claim 7, Utter-Suarez discloses *transmitting a subscribe message from the second node to the event-based communication manager in the FTSS, wherein the subscribe message includes an event* [see Suarez col. 21, lines 35-51, col. 25, lines 33-42, col. 26, lines 50-62]; *and*

accessing the subscription manager to record that the second node has subscribed to receive post messages associated with the event [see Suarez col. 21, lines 35-51, col. 6, lines 18-29, col. 9, lines 14-39, col. 25, lines 33-42, col. 26, lines 50-62].

23. By this rationale, claim 7 is rejected.

24. In regard to claim 8, Utter-Suarez discloses *transmitting an unsubscribe message from the second node to the event-based communication manager in the FTSS, wherein the*

unsubscribe message includes an event [see Suarez col. 21, lines 35-51, col. 6, lines 18-29, col. 9, lines 14-39, col. 25, lines 33-42, col. 26, lines 50-62]; *and*

accessing the subscription manager to record that the second node should no longer receive post messages associated with the event [see Suarez col. 21, lines 35-51, col. 6, lines 18-29, col. 9, lines 14-39, col. 25, lines 33-42, col. 26, lines 50-62].

25. By this rationale, claim 8 is rejected.

26. In regard to claim 9, Utter-Suarez discloses *where in the messaging paradigm is a queue-based communication paradigm* [see Suarez col. 21, lines 16-33]; *and:*

transmitting a message from the first node to a communication agent in the fault tolerant storage system comprises:

transmitting an enqueue message from the first node to a queue-based communication agent in the fault tolerant storage system [see Suarez, col. 13, lines 20-38, see Utter, Figure 1, col. 4 lines 48-67, and col. 5 lines 1-14];

storing the message in a data structure in highly reliable fault-tolerant storage media of the FTSS comprises:

storing the enqueue message in a queue space in highly reliable fault tolerant storage media of the FTSS [see Suarez, col. 13, lines 20-38, see Utter, col. 19, lines 13-43];

processing the message at the FTSS in accordance with a messaging paradigm comprises:

retrieving the enqueue message from the queue space only if the second node is available [see Suarez, col. 21, lines 16-33, see Utter, col. 9, lines 1-12]; *and*

transmitting the message from the FTSS to the second node comprises:

transmitting the enqueue message from the FTSS to a service on the second node only if the second node is available [see Suarez, col. 21, lines 16-33, see Utter, col.9, lines 13-31]; *and the method further comprises:*

executing the service on the second node using the enqueue message as an input and providing a dequeue message as an output [see Utter, col. 8, lines 25-43];

transmitting the dequeue message from the second node to the queue-based communication agent in the FTSS [see Utter, Figure 1, col. 4 lines 48-67, and col. 5 lines 1-14];

storing the dequeue message in the queue space [see Utter, col. 6, lines 18-25, see Suarez, col. 21, lines 16-33];

retrieving the dequeue message from the queue space [see Utter, col. 19, lines 13-43]; *and transmitting the dequeue message from the FTSS to the first node* [see Utter col. 3, lines 49-62, col. 5, lines 50-58].

27. By this rationale, claim 9 is rejected.

Response to Arguments

28. Applicant's arguments filed on 24 November 2003, Paper #6, have been fully considered but they are not persuasive.

29. On Page 2 of the Remarks, second paragraph, Applicant asserts: "*In order for a cited reference to anticipate claim 1, the cited reference would need to show messages passed between a server computer and a client computer through an FTSS.*" Examiner would like to direct

Applicant attention to the prior art of record, col. 3, lines 49-67, where Utter expressly stated: "the networks 13(A) and 13(B) [Figure 1] are each in the form of conventional high-speed (100 Mb/second) Ethernet networks, which transfer information in the form of messages. As is conventional in Ethernet networks, messages generated by one device connected to a network 13(A), 13(B) (that is, by a user terminal 12(d) or by the fault-tolerant computer system 11) contain information to be transferred, as well as an address which identifies the intended recipient or recipients of the information." Further, in the said column and lines, Utter disclosed the server/client model by stated: "In addition to transferring requests from the user terminals 12(d) to the fault-tolerant computer system 11, the networks 13(n) may also download data from the fault-tolerant computer system 11 to the user terminals 12(d) for local processing by the user terminals 12(d)..."

30. On Page 3 of the Remarks, second paragraph, Applicant states: "*In the case that data is transferred among users terminals, **rather** than to the fault tolerant computer system, the data is transferred by the network (13(n) in Figure 1), as clearly stated in the sentence beginning on line 55 of column 3.*" Examiner would like to assert that instead of ***rather***, Utter disclosed "In addition." Below is the exact quote from Utter's disclosure beginning on line 55 of column 3: "In addition, the networks 13(n) may transfer data from the user terminals 12(d) to the fault-tolerant computer system 11 for processing or storage, and in addition may transfer data among the user terminals 12(d)."

31. On Page 4 of the Remarks, first paragraph, Applicant argues that the combination of Utter with either or both of Northrup and Suarez is improper because Utter did not disclose messaging through a fault-tolerant storage system. Examiner has successfully proved otherwise

as set forth above. Further, in response to Applicant's argument that there is no suggestion to combine the references, Examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, the motivation, the suggestion for combining and the expectation for success have clearly set forth in Paragraph 11, 12, 20 and 21 of the Office Action.

Conclusion

32. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

33. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lambert L. Tran whose telephone number is (703) 305-4663. The examiner can normally be reached on M-F at 9AM - 5PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jack B Harvey can be reached on (703) 305-9705. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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).

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GAU 2144

JACK B. HARVEY
SUPERVISORY PATENT EXAMINER

L Number	Hits	Search Text	DB	Time stamp
1	5289	(709/202 709/206 709/227 714/4).ccls.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/02/23 01:24
2	341	((709/202 709/206 709/227 714/4).ccls.) and (message node) and tolerant	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/02/23 01:25
-	1919	709/202,204-207.ccls. and @ad<20001031	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/30 11:13
-	1570	(broadcast$3 transmitt$3) same agent$3 same ("on$line transaction$ process$4" messag$4 request$reply event$base$)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/25 16:24
-	203742	("on$line transaction$ process$4" messag$4 request$reply event$base$) and @ad<20001031	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/20 14:44
-	120	(broadcast$3 transmitt$3) same agent$3 same ("fault tolerant storage system"$1 raid mirror)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/30 11:11

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-	1570	(US-4884266-$ or US-4866664-$ or US-4837798-$ or US-4825354-$ or US-4807109-$ or US-4788643-$ or US-4785396-$ or US-4766746-$ or US-4763353-$ or US-4718002-$ or US-4694483-$ or US-4689786-$ or US-4661902-$ or US-4656623-$ or US-4628504-$ or US-4617398-$ or US-4582959-$ or US-4570220-$ or US-4544501-$ or US-4509543-$ or US-4352956-$ or US-4325120-$ or US-4278199-$ or US-4270042-$ or US-4203160-$ or US-4117405-$).did. or (US-3943046-$ or US-3875067-$ or US-3679874-$ or US-3610159-$ or US-5297195-$ or US-5283905-$ or US-5283904-$ or US-5278955-$ or US-5274700-$ or US-5272382-$ or US-5271058-$ or US-5268903-$ or US-5257384-$ or US-5245652-$ or US-5235642-$ or US-5231634-$ or US-5231591-$ or US-5218539-$ or US-5181239-$ or US-5181236-$ or US-5168515-$ or US-5159551-$ or US-5153909-$ or US-5142683-$ or US-5136585-$ or US-5107470-$ or US-5073890-$).did. or (US-5062103-$ or US-5046084-$ or US-5046018-$ or US-5040208-$ or US-5039528-$ or US-5036535-$ or US-5027345-$ or US-5023868-$ or US-5008930-$ or US-5006983-$ or US-4988987-$ or US-4988209-$ or US-4947163-$ or US-4943929-$ or US-4929880-$ or US-4916443-$ or US-4914732-$ or US-4896246-$ or US-4887292-$ or US-4886790-$ or US-5504837-$ or US-5499364-$ or US-5495615-$ or US-5493564-$ or US-5490097-$ or US-5485634-$ or US-5481613-$).did. or (US-5479482-$ or US-5477038-$ or US-5473692-$ or US-5463670-$ or US-5461366-$ or US-5459717-$ or US-5444849-$ or US-5440633-$ or US-5440563-$ or US-5436966-$ or US-5426637-$ or US-5424724-$ or US-5414833-$ or US-5410710-$ or US-5410681-$ or US-5408619-$ or US-5402474-$ or US-5402431-$ or US-5398012-$ or US-5392345-$ or US-5390326-$ or US-5388147-$ or US-5386412-$ or US-5367670-$ or US-5359593-$ or US-5354069-$ or US-5347633-$).did. or (US-5341412-$ or US-5329626-$ or US-5321813-$ or US-5317135-$ or US-5309563-$ or US-5309504-$ or US-5305461-$ or US-5305374-$ or US-5664126-$ or US-5659701-$ or US-5659543-$ or US-5655081-$ or US-5650604-$ or US-5640537-$ or US-5636345-$ or US-5633924-$ or US-5632020-$ or US-5623495-$ or US-5621539-$ or US-5619648-$ or US-5613128-$ or US-5608720-$ or US-5602850-$ or US-5602536-$ or US-5598539-$ or US-5596994-$ or US-5588059-$).did. or (US-5586179-$ or US-5581594-$ or US-5577202-$ or US-5574782-$ or US-5568552-$ or US-5566225-$ or US-5559967-$ or US-5559878-$ or US-5557668-$ or US-5557658-$ or US-5557320-$ or US-5555553-$ or US-5555420-$ or US-5553073-$ or US-5551035-$ or US-5546456-$ or US-5546452-$ or US-5541911-$ or US-5539877-$ or US-5533115-$ or US-5524052-$ or US-5522070-$ or US-5519778-$ or US-5515421-$ or US-5781732-$ or US-5781703-$ or US-5781536-$).did. or (US-5778183-$ or US-5774656-$ or US-5774552-$ or US-5771387-$ or US-5764756-$ or US-5764750-$ or US-5761285-$ or US-5761284-$ or US-5758169-$ or US-5757783-$ or US-5757669-$ or US-5754627-$ or US-5754111-$ or US-5751795-$ or US-5742905-$ or US-5742845-$ or US-5742668-$ or US-5737688-$ or US-5727950-$ or US-5727058-$ or US-5724418-$ or US-5720034-$ or US-5717859-$ or US-5717689-$ or US-5710883-$ or US-5704041-$ or US-5703943-$).did. or (US-5701496-$ or US-5696976-$ or US-5691494-$ or US-5690582-$ or US-5687320-$ or US-5684988-$ or US-5682482-$ or US-5680551-$ or US-5677910-$ or US-5675735-$ or US-5671436-$ or US-5669000-$ or US-6351773-$ or US-6351771-$ or US-6353734-$ or US-6424717-$ or US-6423319-$ or US-6421714-$ or US-6421605-$ or US-6415285-$ or US-6415028-$ or US-6411810-$ or US-6411698-$ or US-6408334-$ or US-6437803-$ or US-6434607-$ or US-6438585-$).did. or (US-6442158-$ or US-6442269-$ or US-6442592-$ or US-6445922-$ or US-6408328-$ or US-6404883-$ or US-6401131-$ or US-6401113-$ or US-6400999-$ or US-6397116-$ or US-6397040-$ or US-6396395-$ or US-6393475-$ or US-6393461-$ or US-6393386-$ or US-6393379-$ or US-6393296-$ or US-6389457-$ or US-6389055-$ or US-6385646-$ or US-6378001-$ or US-6377582-$ or US-6374305-$ or US-6374295-$ or US-6370590-$ or US-6370577-$ or US-6370548-$).did. or (US-6370147-$ or US-6366967-$ or US-6366949-$ or US-6366663-$ or US-6363411-$ or US-6361145-$ or US-6360251-$ or US-6359894-$ or US-6359622-$ or US-6356633-$ or US-6356626-$ or US-6356196-$ or US-6449267-$ or US-6442438-$ or US-6434150-$ or US-6434121-$ or US-6432476-$ or US-6430698-$ or US-6430597-$ or US-6438374-$ or US-6430282-$ or	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/23 11:52

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-	80690	(message$1 request$1 transaction$1 order$1) same (prox$2 mediator$1 interceptor$1 redirector$1 server$1)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/23 14:22
-	930	379/265.$$.ccls. or 379/266.$$.ccls.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/23 14:24
-	358	((message$1 request$1 transaction$1 order$1) same (prox$2 mediator$1 interceptor$1 redirector$1 server$1)) and (379/265.$$.ccls. or 379/266.$$.ccls.)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/23 14:24
-	316	(((message$1 request$1 transaction$1 order$1) same (prox$2 mediator$1 interceptor$1 redirector$1 server$1)) and (379/265.$$.ccls. or 379/266.$$.ccls.)) and (IPC queu$3 enqueu$3 dequeu$3 buffer$3 (inter adj process adj communication$1) storage fifo)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/23 14:32
-	245	((((message$1 request$1 transaction$1 order$1) same (prox$2 mediator$1 interceptor$1 redirector$1 server$1)) and (379/265.$$.ccls. or 379/266.$$.ccls.)) and (IPC queu$3 enqueu$3 dequeu$3 buffer$3 (inter adj process adj communication$1) storage fifo)) and @ad<20001031	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/24 12:21
-	22	(((((message$1 request$1 transaction$1 order$1) same (prox$2 mediator$1 interceptor$1 redirector$1 server$1)) and (379/265.$$.ccls. or 379/266.$$.ccls.)) and (IPC queu$3 enqueu$3 dequeu$3 buffer$3 (inter adj process adj communication$1) storage fifo)) and @ad<20001031) and ((fault adj toleran$2) or mirror$3 raid$1)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/23 14:38
-	21	(379/265.$$.ccls. or 379/266.$$.ccls.) and (fault adj toleran$2)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/25 17:29
-	6591	((((message$1 request$1 transaction$1 order$1) same (prox$2 mediator$1 interceptor$1 redirector$1 server$1)) and (709/$.ccls. or 379/265.$$.ccls. or 379/266.$$.ccls.)) and (IPC queu$3 enqueu$3 dequeu$3 buffer$3 (inter adj process adj communication$1) storage fifo)) and @ad<20001031	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/24 13:03
-	5832	(((((message$1 request$1 transaction$1 order$1) same (prox$2 mediator$1 interceptor$1 redirector$1 server$1)) and (709/$.ccls. or 379/265.$$.ccls. or 379/266.$$.ccls.)) and (IPC queu$3 enqueu$3 dequeu$3 buffer$3 (inter adj process adj communication$1) storage fifo)) and @ad<20001031) and storage$3	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/24 12:42
-	327	(((((message$1 request$1 transaction$1 order$1) same (prox$2 mediator$1 interceptor$1 redirector$1 server$1)) and (709/$.ccls. or 379/265.$$.ccls. or 379/266.$$.ccls.)) and (IPC queu$3 enqueu$3 dequeu$3 buffer$3 (inter adj process adj communication$1) storage fifo)) and @ad<20001031) and "fault tolerant"	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/24 13:36
-	4	(((((message$1 request$1 transaction$1 order$1) same (prox$2 mediator$1 interceptor$1 redirector$1 server$1)) and (709/$.ccls. or 379/265.$$.ccls. or 379/266.$$.ccls.)) and (IPC queu$3 enqueu$3 dequeu$3 buffer$3 (inter adj process adj communication$1) storage fifo)) and @ad<20001031) and "fault tolerant storage"	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/24 12:51
-	26421	event$base$2 and reply$request and queu$4 conversation$3	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/24 13:45

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-	53137	(event$base$2 and reply$request and queu$4 conversation$3) and @ad "20001031"	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/24 13:09
-	11	((event$base$2 and reply$request and queu$4 conversation$3) and @ad "20001031") and "fault tolerant storage"	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/24 13:11
-	327	((((((message$1 request$1 transaction$1 order$1) same (prox$2 mediator$1 interceptor$1 redirector$1 server$1)) and (709/$.ccls. or 379/265.$$.ccls. or 379/266.$$.ccls.)) and (IPC queu$3 enqueu$3 dequeu$3 buffer$3 (inter adj process adj communication$1) storage fifo)) and @ad<20001031) and "fault tolerant") and @ad<20001031	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/24 13:41
-	306	(event$base$2 and reply$request and queu$4 conversation$3) and unsolicit$3	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/24 13:42
-	278	(event$base$2 and reply$request and queu$4 conversation$3) and unsolicit$3 and @ad<20011031	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/24 13:43
-	57336	event$base$2 reply$request queu$4	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/24 13:48
-	46	(event$base$2 reply$request queu$4) and messag$3 and "fault tolerant storage"	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/24 13:51
-	20	((event$base$2 reply$request queu$4) and messag$3 and "fault tolerant storage") and @ad<20001031	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/24 13:52
-	19741	("fault " and (node$2 message$2)) and @ad<20001031	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/25 09:43
-	1545	(("fault " and (node$2 message$2)) and @ad<20001031) and reply	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/25 09:46
-	458	(("fault " and (node$2 message$2)) and @ad<20001031) and reply same stor$4	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/25 10:02
-	1214	(("fault " and (node$2 message$2)) and @ad<20001031) and toleran$2 same stor$4	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/25 10:17

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-	2	("5426688").PN.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/25 14:24
-	2	("5297193").PN.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/25 14:31
-	10	("6493685" "6556997" "6230197" "6446076" "5710887").pn.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/25 16:58
-	389325	("fault tolerant storage system"$1 raid mirror) and @ad<20001031	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/25 17:04
-	32	(("fault tolerant storage system"$1 raid mirror) and @ad<20001031) and ((broadcast$3 transmitt$3) same agent$3 same ("on$line transaction$ process$4" messag$4 request$reply event$base$))	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/25 17:05
-	449	event$based and @ad<20001031	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/25 17:47
-	11	(event$based and @ad<20001031) and conversation	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/25 17:47
-	128	(event$based and @ad<20001031) and queu$3	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/25 17:48
-	47	(event$based and @ad<20001031) and reply	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/25 17:48
-	2	(event$based and @ad<20001031) and reply and conversation and queu$3	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/25 17:49
-	411	(messag$3 same paradigm$1) and @ad<20001031	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/26 10:26
-	34	((messag$3 same paradigm$1) and @ad<20001031) and conversation	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/07/01 17:06

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-	44243	((US-6581104-$ or US-5790789-$ or US-5440719-$ or US-5555346-$ or US-6570853-$ or US-6526521-$ or US-6571354-$ or US-6571274-$ or US-6442269-$ or US-6477665-$ or US-5896523-$ or US-5815649-$ or US-6112223-$ or US-5113522-$).did. or (US-20020138704-$ or US-20010052084-$).did.) and request queue	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/27 17:21
-	1	((US-6581104-$ or US-5790789-$ or US-5440719-$ or US-5555346-$ or US-6570853-$ or US-6526521-$ or US-6571354-$ or US-6571274-$ or US-6442269-$ or US-6477665-$ or US-5896523-$ or US-5815649-$ or US-6112223-$ or US-5113522-$).did. or (US-20020138704-$ or US-20010052084-$).did.) and "request queue"	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/27 17:23
-	5	((US-6581104-$ or US-5790789-$ or US-5440719-$ or US-5555346-$ or US-6570853-$ or US-6526521-$ or US-6571354-$ or US-6571274-$ or US-6442269-$ or US-6477665-$ or US-5896523-$ or US-5815649-$ or US-6112223-$ or US-5113522-$).did. or (US-20020138704-$ or US-20010052084-$).did.) and agent	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/27 17:46
-	5	((US-6581104-$ or US-5790789-$ or US-5440719-$ or US-5555346-$ or US-6570853-$ or US-6526521-$ or US-6571354-$ or US-6571274-$ or US-6442269-$ or US-6477665-$ or US-5896523-$ or US-5815649-$ or US-6112223-$ or US-5113522-$).did. or (US-20020138704-$ or US-20010052084-$).did.) and post$3	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/27 17:46
-	16	(US-5113522-$ or US-6571354-$ or US-6442269-$ or US-6112223-$ or US-5440719-$ or US-5790789-$ or US-6477665-$ or US-5555346-$ or US-5815649-$ or US-5896523-$ or US-6571274-$ or US-6581104-$ or US-6526521-$ or US-6570853-$).did. or (US-20010052084-$ or US-20020138704-$).did.	USPAT; US-PGPUB	2003/06/30 11:09
-	120	(US-6467915-$ or US-6560002-$ or US-6499822-$ or US-6516337-$ or US-6519901-$ or US-6525814-$ or US-6537673-$ or US-6181413-$ or US-6331878-$ or US-6219113-$ or US-6185034-$ or US-6238487-$ or US-6226933-$ or US-6460055-$ or US-6174291-$ or US-6062746-$ or US-5922606-$ or US-5841494-$ or US-5875013-$ or US-5858798-$ or US-5736977-$ or US-5692226-$ or US-5835166-$ or US-5793486-$ or US-5642189-$ or US-5435969-$).did. or (US-5642192-$ or US-5663710-$ or US-5656939-$ or US-5416323-$ or US-5428441-$ or US-5419926-$ or US-5113476-$ or US-5128175-$ or US-5304800-$ or US-5266493-$ or US-5247318-$ or US-5389548-$ or US-5411889-$ or US-5223976-$ or US-5192834-$ or US-4810614-$ or US-4668077-$ or US-4830483-$ or US-4857746-$ or US-4858081-$ or US-4920374-$ or US-4925514-$ or US-4940900-$ or US-5041386-$ or US-3692388-$ or US-4190859-$ or US-4208671-$).did. or (US-4228406-$ or US-4278199-$ or US-4286543-$ or US-4315283-$ or US-4327430-$ or US-4354509-$ or US-4360824-$ or US-RE31160-$ or US-4402018-$ or US-4404599-$ or US-4412961-$ or US-4420827-$ or US-4486791-$ or US-4541434-$ or US-4630921-$ or US-4642124-$).did. or (US-20030030850-$ or US-20030030686-$ or US-20010008469-$ or US-20020138616-$ or US-20020071463-$ or US-20020057484-$ or US-20020042767-$ or US-20020041968-$ or US-20020036975-$ or US-20020196452-$ or US-20020178251-$ or US-20020150081-$ or US-20030068639-$ or US-20030063327-$ or US-20030058384-$ or US-20030048518-$).did. or (JP-2001194095-$ or JP-2002121511-$ or JP-03142939-$ or JP-03156332-$ or JP-03162825-$ or JP-04106519-$ or JP-04116504-$ or JP-04175265-$ or JP-05163046-$ or JP-05275067-$ or JP-05322749-$ or JP-06123739-$ or JP-06233739-$ or JP-06281413-$ or JP-06281802-$ or JP-07168039-$ or JP-11003688-$ or JP-02292142-$ or JP-02157705-$ or JP-01017043-$ or JP-63289527-$ or JP-63261143-$ or JP-63172204-$ or JP-63160489-$ or JP-63029737-$ or JP-62123489-$).did. or (JP-61214139-$).did. or (US-6460055-$ or KR-2001108640-$ or JP-11183693-$ or US-5610932-$ or SU-1521112-$ or SU-1770819-$ or EP-167721-$ or JP-72013317-$).did.	USPAT; US-PGPUB; JPO; DERWENT	2003/06/30 11:11

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-	3	((US-6467915-$ or US-6560002-$ or US-6499822-$ or US-6516337-$ or US-6519901-$ or US-6525814-$ or US-6537673-$ or US-6181413-$ or US-6331878-$ or US-6219113-$ or US-6185034-$ or US-6238487-$ or US-6226933-$ or US-6460055-$ or US-6174291-$ or US-6062746-$ or US-5922606-$ or US-5841494-$ or US-5875013-$ or US-5858798-$ or US-5736977-$ or US-5692226-$ or US-5835166-$ or US-5793486-$ or US-5642189-$ or US-5435969-$).did. or (US-5642192-$ or US-5663710-$ or US-5656939-$ or US-5416323-$ or US-5428441-$ or US-5419926-$ or US-5113476-$ or US-5128175-$ or US-5304800-$ or US-5266493-$ or US-5247318-$ or US-5389548-$ or US-5411889-$ or US-5223976-$ or US-5192834-$ or US-4810614-$ or US-4668077-$ or US-4830483-$ or US-4857746-$ or US-4858081-$ or US-4920374-$ or US-4925514-$ or US-4940900-$ or US-5041386-$ or US-3692388-$ or US-4190859-$ or US-4208671-$).did. or (US-4228406-$ or US-4278199-$ or US-4286543-$ or US-4315283-$ or US-4327430-$ or US-4354509-$ or US-4360824-$ or US-RE31160-$ or US-4402018-$ or US-4404599-$ or US-4412961-$ or US-4420827-$ or US-4486791-$ or US-4541434-$ or US-4630921-$ or US-4642124-$).did. or (US-20030030850-$ or US-20030030686-$ or US-20010008469-$ or US-20020138616-$ or US-20020071463-$ or US-20020057484-$ or US-20020042767-$ or US-20020041968-$ or US-20020036975-$ or US-20020196452-$ or US-20020178251-$ or US-20020150081-$ or US-20030068639-$ or US-20030063327-$ or US-20030058384-$ or US-20030048518-$).did. or (JP-2001194095-$ or JP-2002121511-$ or JP-03142939-$ or JP-03156332-$ or JP-03162825-$ or JP-04106519-$ or JP-04116504-$ or JP-04175265-$ or JP-05163046-$ or JP-05275067-$ or JP-05322749-$ or JP-06123739-$ or JP-06233739-$ or JP-06281413-$ or JP-06281802-$ or JP-07168039-$ or JP-11003688-$ or JP-02292142-$ or JP-02157705-$ or JP-01017043-$ or JP-63289527-$ or JP-63261143-$ or JP-63172204-$ or JP-63160489-$ or JP-63029737-$ or JP-62123489-$).did. or (JP-61214139-$).did. or (US-6460055-$ or KR-2001108640-$ or JP-11183693-$ or US-5610932-$ or SU-1521112-$ or SU-1770819-$ or EP-167721-$ or JP-72013317-$).did.) and broadcast	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/30 11:11

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-	910	(US-6564216-$ or US-6564244-$ or US-6567848-$ or US-6564248-$ or US-6564258-$ or US-6564264-$ or US-6567818-$ or US-6567844-$ or US-6567845-$ or US-6564245-$ or US-6564246-$ or US-6564247-$ or US-6571292-$ or US-6567854-$ or US-6560637-$ or US-6560638-$ or US-6560655-$ or US-6563913-$ or US-6571278-$ or US-6571275-$ or US-6571257-$ or US-6571234-$ or US-6570606-$ or US-6574674-$ or US-6574231-$ or US-6574660-$).did. or (US-6574672-$ or US-6574655-$ or US-6574658-$ or US-6573926-$ or US-6577328-$ or US-6578025-$ or US-6578067-$ or US-6581095-$ or US-6578070-$ or US-6581092-$ or US-6466966-$ or US-6466964-$ or US-6466963-$ or US-6466932-$ or US-6463504-$ or US-6463491-$ or US-6463471-$ or US-6463464-$ or US-6463463-$ or US-6463462-$ or US-6463461-$ or US-6463460-$ or US-6463459-$ or US-6460096-$ or US-6460074-$ or US-6460073-$ or US-6460070-$).did. or (US-6460050-$ or US-6460037-$ or US-6457879-$ or US-6457076-$ or US-6457063-$ or US-6457062-$ or US-6457060-$ or US-6457055-$ or US-6457045-$ or US-6457044-$ or US-6457043-$ or US-6457039-$ or US-6453349-$ or US-6453348-$ or US-6453341-$ or US-6453340-$ or US-6453339-$ or US-6453338-$ or US-6453336-$ or US-6453335-$ or US-6453333-$ or US-6453327-$ or US-6449644-$ or US-6449640-$ or US-6449637-$ or US-6449636-$ or US-6449635-$).did. or (US-6449634-$ or US-6449633-$ or US-6449632-$ or US-6449622-$ or US-6448978-$ or US-6446118-$ or US-6446116-$ or US-6446114-$ or US-6446113-$ or US-6446112-$ or US-6480884-$ or US-6480882-$ or US-6480881-$ or US-6480861-$ or US-6480582-$ or US-6480480-$ or US-6480294-$ or US-6477575-$ or US-6477566-$ or US-6477564-$ or US-6477563-$ or US-6477551-$ or US-6477532-$ or US-6473786-$ or US-6473785-$ or US-6473784-$ or US-6473761-$).did. or (US-6473760-$ or US-6470406-$ or US-6470398-$ or US-6470379-$ or US-6466969-$ or US-6466968-$ or US-6557035-$ or US-6557029-$ or US-6557028-$ or US-6557027-$ or US-6557026-$ or US-6535912-$ or US-6535911-$ or US-6535910-$ or US-6535909-$ or US-6535907-$ or US-6532489-$ or US-6532488-$ or US-6532218-$ or US-6529976-$ or US-6493745-$ or US-6493703-$ or US-6493324-$ or US-6490624-$ or US-6490614-$ or US-6490613-$ or US-6490610-$).did. or (US-6490585-$ or US-6489935-$ or US-6487600-$ or US-6487585-$ or US-6487584-$ or US-6487583-$ or US-6487582-$ or US-6487548-$ or US-6487195-$ or US-6484211-$ or US-6484197-$ or US-6484196-$ or US-6484155-$ or US-6480895-$ or US-6480885-$ or US-6523063-$ or US-6523061-$ or US-6523060-$ or US-6519653-$ or US-6519650-$ or US-6519649-$ or US-6519642-$ or US-6519641-$ or US-6519639-$ or US-6519630-$ or US-6519628-$ or US-6519625-$).did. or (US-6519243-$ or US-6516340-$ or US-6516337-$ or US-6515576-$ or US-6513065-$ or US-6513059-$ or US-6553403-$ or US-6553401-$ or US-6553355-$ or US-6553341-$ or US-6553208-$ or US-6529947-$ or US-6529943-$ or US-6529942-$ or US-6529940-$ or US-6529936-$ or US-6529934-$ or US-6526507-$ or US-6526436-$ or US-6526424-$ or US-6557025-$ or US-6553425-$ or US-6553418-$ or US-6553416-$ or US-6546415-$ or US-6542992-$ or US-6542936-$).did. or (US-6542923-$ or US-6542922-$ or US-6542920-$ or US-6542868-$ or US-6539433-$ or US-6549938-$ or US-6549937-$ or US-6549936-$ or US-6549935-$ or US-6549932-$ or US-6557054-$ or US-6557045-$ or US-6557041-$ or US-6557036-$ or US-6539430-$ or US-6539422-$ or US-6539421-$ or US-6539420-$ or US-6539416-$ or US-6539404-$ or US-6539385-$ or US-6535916-$ or US-6496864-$ or US-6496861-$ or US-6496855-$ or US-6496853-$ or US-6496852-$).did. or (US-6496851-$ or US-6496836-$ or US-6496501-$ or US-6496201-$ or US-6493752-$ or US-6549916-$ or US-6549178-$ or US-6546488-$ or US-6546419-$ or US-6546417-$ or US-6546416-$ or US-6560633-$ or US-6560632-$ or US-6559863-$ or US-6510455-$ or US-6510454-$ or US-6510453-$ or US-6510452-$ or US-6510438-$ or US-6510229-$ or US-6509828-$ or US-6507914-$ or US-6507866-$ or US-6507865-$ or US-6549957-$ or US-6549956-$ or US-6549950-$).did. or (US-6549943-$ or US-6549939-$ or US-6507643-$ or US-6505240-$ or US-6505236-$ or US-6505235-$ or US-6505233-$ or US-6505231-$ or US-6505230-$ or US-6504915-$ or US-6502134-$ or US-6502127-$ or US-6502126-$ or US-6502106-$ or US-6501852-$ or US-6499061-$ or US-6499059-$ or US-6499055-$ or US-6499054-$ or US-6499053-$ or US-6499051-$ or	USPAT; US-PGPUB	2003/06/30 11:14

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-	189	((US-6564216-$ or US-6564244-$ or US-6567848-$ or US-6564248-$ or US-6564258-$ or US-6564264-$ or US-6567818-$ or US-6567844-$ or US-6567845-$ or US-6564245-$ or US-6564246-$ or US-6564247-$ or US-6571292-$ or US-6567854-$ or US-6560637-$ or US-6560638-$ or US-6560655-$ or US-6563913-$ or US-6571278-$ or US-6571275-$ or US-6571257-$ or US-6571234-$ or US-6570606-$ or US-6574674-$ or US-6574231-$ or US-6574660-$).did. or (US-6574672-$ or US-6574655-$ or US-6574658-$ or US-6573926-$ or US-6577328-$ or US-6578025-$ or US-6578067-$ or US-6581095-$ or US-6578070-$ or US-6581092-$ or US-6466966-$ or US-6466964-$ or US-6466963-$ or US-6466932-$ or US-6463504-$ or US-6463491-$ or US-6463471-$ or US-6463464-$ or US-6463463-$ or US-6463462-$ or US-6463461-$ or US-6463460-$ or US-6463459-$ or US-6460096-$ or US-6460074-$ or US-6460073-$ or US-6460070-$).did. or (US-6460050-$ or US-6460037-$ or US-6457879-$ or US-6457076-$ or US-6457063-$ or US-6457062-$ or US-6457060-$ or US-6457055-$ or US-6457045-$ or US-6457044-$ or US-6457043-$ or US-6457039-$ or US-6453349-$ or US-6453348-$ or US-6453341-$ or US-6453340-$ or US-6453339-$ or US-6453338-$ or US-6453336-$ or US-6453335-$ or US-6453333-$ or US-6453327-$ or US-6449644-$ or US-6449640-$ or US-6449637-$ or US-6449636-$ or US-6449635-$).did. or (US-6449634-$ or US-6449633-$ or US-6449632-$ or US-6449622-$ or US-6448978-$ or US-6446118-$ or US-6446116-$ or US-6446114-$ or US-6446113-$ or US-6446112-$ or US-6480884-$ or US-6480882-$ or US-6480881-$ or US-6480861-$ or US-6480582-$ or US-6480480-$ or US-6480294-$ or US-6477575-$ or US-6477566-$ or US-6477564-$ or US-6477563-$ or US-6477551-$ or US-6477532-$ or US-6473786-$ or US-6473785-$ or US-6473784-$ or US-6473761-$).did. or (US-6473760-$ or US-6470406-$ or US-6470398-$ or US-6470379-$ or US-6466969-$ or US-6466968-$ or US-6557035-$ or US-6557029-$ or US-6557028-$ or US-6557027-$ or US-6557026-$ or US-6535912-$ or US-6535911-$ or US-6535910-$ or US-6535909-$ or US-6535907-$ or US-6532489-$ or US-6532488-$ or US-6532218-$ or US-6529976-$ or US-6493745-$ or US-6493703-$ or US-6493324-$ or US-6490624-$ or US-6490614-$ or US-6490613-$ or US-6490610-$).did. or (US-6490585-$ or US-6489935-$ or US-6487600-$ or US-6487585-$ or US-6487584-$ or US-6487583-$ or US-6487582-$ or US-6487548-$ or US-6487195-$ or US-6484211-$ or US-6484197-$ or US-6484196-$ or US-6484155-$ or US-6480895-$ or US-6480885-$ or US-6523063-$ or US-6523061-$ or US-6523060-$ or US-6519653-$ or US-6519650-$ or US-6519649-$ or US-6519642-$ or US-6519641-$ or US-6519639-$ or US-6519630-$ or US-6519628-$ or US-6519625-$).did. or (US-6519243-$ or US-6516340-$ or US-6516337-$ or US-6515576-$ or US-6513065-$ or US-6513059-$ or US-6553403-$ or US-6553401-$ or US-6553355-$ or US-6553341-$ or US-6553208-$ or US-6529947-$ or US-6529943-$ or US-6529942-$ or US-6529940-$ or US-6529936-$ or US-6529934-$ or US-6526507-$ or US-6526436-$ or US-6526424-$ or US-6557025-$ or US-6553425-$ or US-6553418-$ or US-6553416-$ or US-6546415-$ or US-6542992-$ or US-6542936-$).did. or (US-6542923-$ or US-6542922-$ or US-6542920-$ or US-6542868-$ or US-6539433-$ or US-6549938-$ or US-6549937-$ or US-6549936-$ or US-6549935-$ or US-6549932-$ or US-6557054-$ or US-6557045-$ or US-6557041-$ or US-6557036-$ or US-6539430-$ or US-6539422-$ or US-6539421-$ or US-6539420-$ or US-6539416-$ or US-6539404-$ or US-6539385-$ or US-6535916-$ or US-6496864-$ or US-6496861-$ or US-6496855-$ or US-6496853-$ or US-6496852-$).did. or (US-6496851-$ or US-6496836-$ or US-6496501-$ or US-6496201-$ or US-6493752-$ or US-6549916-$ or US-6549178-$ or US-6546488-$ or US-6546419-$ or US-6546417-$ or US-6546416-$ or US-6560633-$ or US-6560632-$ or US-6559863-$ or US-6510455-$ or US-6510454-$ or US-6510453-$ or US-6510452-$ or US-6510438-$ or US-6510229-$ or US-6509828-$ or US-6507914-$ or US-6507866-$ or US-6507865-$ or US-6549957-$ or US-6549956-$ or US-6549950-$).did. or (US-6549943-$ or US-6549939-$ or US-6507643-$ or US-6505240-$ or US-6505236-$ or US-6505235-$ or US-6505233-$ or US-6505231-$ or US-6505230-$ or US-6504915-$ or US-6502134-$ or US-6502127-$ or US-6502126-$ or US-6502106-$ or US-6501852-$ or US-6499061-$ or US-6499059-$ or US-6499055-$ or US-6499054-$ or US-6499053-$ or US-6499051-$ or	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/07/01 17:40

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-	5	((US-6564216-$ or US-6564244-$ or US-6567848-$ or US-6564248-$ or US-6564258-$ or US-6564264-$ or US-6567818-$ or US-6567844-$ or US-6567845-$ or US-6564245-$ or US-6564246-$ or US-6564247-$ or US-6571292-$ or US-6567854-$ or US-6560637-$ or US-6560638-$ or US-6560655-$ or US-6563913-$ or US-6571278-$ or US-6571275-$ or US-6571257-$ or US-6571234-$ or US-6570606-$ or US-6574674-$ or US-6574231-$ or US-6574660-$).did. or (US-6574672-$ or US-6574655-$ or US-6574658-$ or US-6573926-$ or US-6577328-$ or US-6578025-$ or US-6578067-$ or US-6581095-$ or US-6578070-$ or US-6581092-$ or US-6466966-$ or US-6466964-$ or US-6466963-$ or US-6466932-$ or US-6463504-$ or US-6463491-$ or US-6463471-$ or US-6463464-$ or US-6463463-$ or US-6463462-$ or US-6463461-$ or US-6463460-$ or US-6463459-$ or US-6460096-$ or US-6460074-$ or US-6460073-$ or US-6460070-$).did. or (US-6460050-$ or US-6460037-$ or US-6457879-$ or US-6457076-$ or US-6457063-$ or US-6457062-$ or US-6457060-$ or US-6457055-$ or US-6457045-$ or US-6457044-$ or US-6457043-$ or US-6457039-$ or US-6453349-$ or US-6453348-$ or US-6453341-$ or US-6453340-$ or US-6453339-$ or US-6453338-$ or US-6453336-$ or US-6453335-$ or US-6453333-$ or US-6453327-$ or US-6449644-$ or US-6449640-$ or US-6449637-$ or US-6449636-$ or US-6449635-$).did. or (US-6449634-$ or US-6449633-$ or US-6449632-$ or US-6449622-$ or US-6448978-$ or US-6446118-$ or US-6446116-$ or US-6446114-$ or US-6446113-$ or US-6446112-$ or US-6480884-$ or US-6480882-$ or US-6480881-$ or US-6480861-$ or US-6480582-$ or US-6480480-$ or US-6480294-$ or US-6477575-$ or US-6477566-$ or US-6477564-$ or US-6477563-$ or US-6477551-$ or US-6477532-$ or US-6473786-$ or US-6473785-$ or US-6473784-$ or US-6473761-$).did. or (US-6473760-$ or US-6470406-$ or US-6470398-$ or US-6470379-$ or US-6466969-$ or US-6466968-$ or US-6557035-$ or US-6557029-$ or US-6557028-$ or US-6557027-$ or US-6557026-$ or US-6535912-$ or US-6535911-$ or US-6535910-$ or US-6535909-$ or US-6535907-$ or US-6532489-$ or US-6532488-$ or US-6532218-$ or US-6529976-$ or US-6493745-$ or US-6493703-$ or US-6493324-$ or US-6490624-$ or US-6490614-$ or US-6490613-$ or US-6490610-$).did. or (US-6490585-$ or US-6489935-$ or US-6487600-$ or US-6487585-$ or US-6487584-$ or US-6487583-$ or US-6487582-$ or US-6487548-$ or US-6487195-$ or US-6484211-$ or US-6484197-$ or US-6484196-$ or US-6484155-$ or US-6480895-$ or US-6480885-$ or US-6523063-$ or US-6523061-$ or US-6523060-$ or US-6519653-$ or US-6519650-$ or US-6519649-$ or US-6519642-$ or US-6519641-$ or US-6519639-$ or US-6519630-$ or US-6519628-$ or US-6519625-$).did. or (US-6519243-$ or US-6516340-$ or US-6516337-$ or US-6515576-$ or US-6513065-$ or US-6513059-$ or US-6553403-$ or US-6553401-$ or US-6553355-$ or US-6553341-$ or US-6553208-$ or US-6529947-$ or US-6529943-$ or US-6529942-$ or US-6529940-$ or US-6529936-$ or US-6529934-$ or US-6526507-$ or US-6526436-$ or US-6526424-$ or US-6557025-$ or US-6553425-$ or US-6553418-$ or US-6553416-$ or US-6546415-$ or US-6542992-$ or US-6542936-$).did. or (US-6542923-$ or US-6542922-$ or US-6542920-$ or US-6542868-$ or US-6539433-$ or US-6549938-$ or US-6549937-$ or US-6549936-$ or US-6549935-$ or US-6549932-$ or US-6557054-$ or US-6557045-$ or US-6557041-$ or US-6557036-$ or US-6539430-$ or US-6539422-$ or US-6539421-$ or US-6539420-$ or US-6539416-$ or US-6539404-$ or US-6539385-$ or US-6535916-$ or US-6496864-$ or US-6496861-$ or US-6496855-$ or US-6496853-$ or US-6496852-$).did. or (US-6496851-$ or US-6496836-$ or US-6496501-$ or US-6496201-$ or US-6493752-$ or US-6549916-$ or US-6549178-$ or US-6546488-$ or US-6546419-$ or US-6546417-$ or US-6546416-$ or US-6560633-$ or US-6560632-$ or US-6559863-$ or US-6510455-$ or US-6510454-$ or US-6510453-$ or US-6510452-$ or US-6510438-$ or US-6510229-$ or US-6509828-$ or US-6507914-$ or US-6507866-$ or US-6507865-$ or US-6549957-$ or US-6549956-$ or US-6549950-$).did. or (US-6549943-$ or US-6549939-$ or US-6507643-$ or US-6505240-$ or US-6505236-$ or US-6505235-$ or US-6505233-$ or US-6505231-$ or US-6505230-$ or US-6504915-$ or US-6502134-$ or US-6502127-$ or US-6502126-$ or US-6502106-$ or US-6501852-$ or US-6499061-$ or US-6499059-$ or US-6499055-$ or US-6499054-$ or US-6499053-$ or US-6499051-$ or	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/30 11:16

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-	17	(US-5440719-$ or US-6112223-$ or US-5896523-$ or US-5815649-$ or US-5555346-$ or US-6571354-$ or US-5113522-$ or US-6570853-$ or US-6526521-$ or US-6581104-$ or US-6571274-$ or US-5790789-$ or US-6477665-$ or US-6442269-$).did. or (US-20030041094-$ or US-20010052084-$ or US-20020138704-$).did.	USPAT; US-PGPUB	2003/07/01 09:49
-	12	((US-5440719-$ or US-6112223-$ or US-5896523-$ or US-5815649-$ or US-5555346-$ or US-6571354-$ or US-5113522-$ or US-6570853-$ or US-6526521-$ or US-6581104-$ or US-6571274-$ or US-5790789-$ or US-6477665-$ or US-6442269-$).did. or (US-20030041094-$ or US-20010052084-$ or US-20020138704-$).did.) and queue	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/07/01 09:49
-	19	(((connect! near message) and @ad<20001031) and post) and 709/$$.ccls.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/07/01 17:11
-	10	((US-6335927-$ or US-5734871-$ or US-6526026-$ or US-6421705-$ or US-5818836-$ or US-6442269-$ or US-6477665-$ or US-5790789-$ or US-5896523-$ or US-5815649-$ or US-6112223-$ or US-5555346-$ or US-6571354-$ or US-5113522-$ or US-6570853-$ or US-6526521-$ or US-6581104-$ or US-6571274-$ or US-6430177-$ or US-6546413-$ or US-5440719-$ or US-4387278-$).did. or (US-20020138704-$ or US-20010052084-$ or US-20030041094-$).did.) and broadcast	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/07/03 09:30
-	1	("6574655").PN.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/07/08 14:24
-	0	("(faultnear2tolerantfault$1tolerant)andtransmit$4and@ad<20001031").PN	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/10/20 11:22
-	0	("(faultnear2tolerantfault$1tolerant)andtransmit$4and@ad<20001031").PN	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/10/20 11:24
-	0	("(faultnear2tolerantfault$1tolerant)@ad<20001031").PN.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/10/20 11:24
-	0	("(faultnear2tolerant)and@ad<20001031").PN.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/10/20 11:24
-	0	("(faultnear2tolerantfault$1tolerant)andtransmit$4and@ad<20001031").PN	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/10/20 11:25
-	3115	(fault near2 tolerant) and transmit$4 and @ad<20001031	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/10/23 12:17
-	649	((fault near2 tolerant) and transmit$4 and @ad<20001031) and ((node1 source) same (node2 destination))	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/10/20 11:29

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-	499	(((fault near2 tolerant) and transmit$4 and @ad<20001031) and ((node1 source) same (node2 destination))) and storage	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/10/21 16:24
-	138	(((fault near2 tolerant) and transmit$4 and @ad<20001031) and ((node1 source) same (node2 destination))) and storage and tcp/ip	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/10/21 09:39
-	578	(((fault near2 tolerant) and transmit$4 and @ad<20001031) and ((node1 source) same (node2 destination))) and memory	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/10/21 17:10
-	2	("5,574,849").PN.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/10/21 16:31
-	347	(((fault near2 tolerant) and transmit$4 and @ad<20001031) and ((node1 source) same (node2 destination))) and memory and " i/o"	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/10/21 18:01
-	2	("5872904").PN.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/10/21 18:01
-	166	(fault near2 tolerant) and transmit$4 and @ad<20001031 and (Storage near2 network)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/10/23 12:19
-	73	((fault near2 tolerant) and transmit$4 and @ad<20001031 and (Storage near2 network)) and i/o and protocol	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/10/23 12:39
-	19	(((fault near2 tolerant) and transmit$4 and @ad<20001031 and (Storage near2 network)) and i/o and protocol) and encapsulat$3	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/10/23 12:40

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P. O. Box 272400
Fort Collins, Colorado 80527-2400

OIPE
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PATENT & TRADEMARK OFFICE

PATENT APPLICATION

ATTORNEY DOCKET NO. 10008316-1

IN THE
UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s): Blaine D. Gaither et al.

Confirmation No.:

Application No.: 09/703,427

Examiner: Lambert L. Tran

Filing Date: 10/31/2000

Group Art Unit: 2142

Title: METHOD AND APPARATUS FOR PASSING MESSAGES USING A FAULT TOLERANT STORAGE SYSTEM

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Technology Center 2100

Commissioner for Patents
PO Box 1450
Alexandria, VA 22313-1450

TRANSMITTAL LETTER FOR RESPONSE/AMENDMENT

Sir:

Transmitted herewith is/are the following in the above-identified application:

(X) Response/Amendment
(X) New fee as calculated below
( ) No additional fee (Address envelope to "Mail Stop Non-Fee Amendment")
( ) Other: _____ (fee $_____)
(X) Petition to extend time to respond
( ) Supplemental Declaration

CLAIMS AS AMENDED BY OTHER THAN A SMALL ENTITY

(1) FOR	(2) CLAIMS REMAINING AFTER AMENDMENT	(3) NUMBER EXTRA	(4) HIGHEST NUMBER PREVIOUSLY PAID FOR	(5) PRESENT EXTRA	(6) RATE	(7) ADDITIONAL FEES
TOTAL CLAIMS	*10*	MINUS	*20*	= *0*	X *$18*	$ *0*
INDEP. CLAIMS	*1*	MINUS	*3*	= *0*	X *$84*	$ *0*
[ ] FIRST PRESENTATION OF A MULTIPLE DEPENDENT CLAIM					+ *$280*	$ *0*
EXTENSION FEE	1ST MONTH $110.00 [X]	2ND MONTH $410.00 [ ]	3RD MONTH $930.00 [ ]	4TH MONTH $1450.00 [ ]		$ *110*
					OTHER FEES	$
					TOTAL ADDITIONAL FEE FOR THIS AMENDMENT	$ *110*

Charge $ *110* to Deposit Account 08-2025. At any time during the pendency of this application, please charge any fees required or credit any overpayment to Deposit Account 08-2025 pursuant to 37 CFR 1.25. Additionally please charge any fees to Deposit Account 08-2025 under 37 CFR 1.16 through 1.21 inclusive, and any other sections in Title 37 of the Code of Federal Regulations that may regulate fees. A duplicate copy of this sheet is enclosed.

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to: Commissioner for Patents, Alexandria, VA 22313-1450.

Date of Deposit: ***Nov. 18, 2003***

Typed Name: ***Joanne Bourguignon***

Signature: Joanne Bourguignon

Respectfully submitted,

Blaine D. Gaither et al.

By Robert W. Bergstrom

Robert W. Bergstrom

Attorney/Agent for Applicant(s)
Reg. No. ***39,906***

Date: ***Nov. 18, 2003***

Telephone No.: ***(206) 621-1933***

Rev 09/03 (TransAmd)

- Attach as First Page to Transmitted Papers -

OIPE JC99
NOV 24 2003
PATENT & TRADEMARK OFFICE

#6
LDJ
12-8-03

PATENT

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Nov. 18, 2003 — Joanne Bourguignon

Date — Joanne Bourguignon

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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DEC 03 2003
Technology Center 2100

12/9/03

Applicant:	Blaine D. Gaither et al.
Application No.:	09/703,427
Filed:	October 31, 2000
Title:	METHOD AND APPARATUS FOR PASSING MESSAGES USING A FAULT TOLERANT STORAGE SYSTEM
Examiner:	Lambert L. Tran
Docket No.:	10008316-1
Date:	November 18, 2003

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

RESPONSE

INTRODUCTORY COMMENTS

Sir:

In response to the Office Action date July 18, 2003, please extend the time to respond one–month, from October 18, 2003 to November 18, 2003. The Petition for Extension of Time and requisite fee is enclosed.

REMARKS

Claims 1-10 are currently pending in the application. In an Office Action dated July 18, 2003 ("Office Action"), the Examiner objected to Figures 8 and 9, rejected claims 1-2 and 10 under 35 U.S.C § 102(b) as being anticipated by Utter et al., U.S. Patent No. 5,815,649 ("Utter"), rejected claims 3-5 under 35 U.S.C § 103(a) as being unpatentable over Utter in view of Northrup, U.S. Patent No. 6,546,413 ("Northrup"), and rejected claims 6-9 under 35 U.S.C. 103(a) as being unpatentable over Utter in view of Suarez, U.S. Patent No. 5,790,789 ("Suarez"). Applicants' representative has provided proposed drawing corrections in order to address the Examiner's objections to Figures 8 and 9. Applicants' representative respectfully traverses the 35 U.S.C § 102(b) and 35 U.S.C. 103(a) rejections of claims 1-10.

As stated in the Summary of the Invention section of the current application:

> The present invention is a method and apparatus for passing messages between server and client applications using a fault tolerant storage system (FTSS). The interconnection fabric that couples the FTSS to the computer systems that host the client and server applications may also be used to carry messages. ... The FTSS not only processes file-related I/O transactions, but also carries message traffic. (current application, page 7, lines 15-21)

Thus, for example, the present invention involves messages passed between computer systems, such as computer systems 12, 14, 16, 18, 20, and 22 in Figure 1, through the FTSS interconnection fabrics 28 and the FTSS 24. In the Description of the Related Art section of the current application, conventional, network-based message systems are discussed, including discussion of conversational, queue-based messaging paradigms including event-based, request/reply, and unsolicited messaging paradigms. As discussed in the Description of the Related Art section, it was well-known for FTSS interconnection fabrics to carry I/O transaction traffic – that is the original goal for developing FTSS interconnection fabrics. Conversational, queue-based messaging paradigms implemented in traditional computer networks are also well-known. The present invention allows not only I/O transaction traffic to be carried through the FTSS interconnection fabrics, but provides for messages employed by conversational, event-based, and various queue-based messaging paradigms that are commonly exchanged through traditional networks

to be, instead, exchanged through FTSS interconnection fabrics and an FTSS.

Please consider claim 1, provided below:

> 1. A method of transmitting messages between a first node and a second node, wherein the first and second nodes are each coupled to a fault tolerant storage system (FTSS), the method comprising:
>
> transmitting a message from the first node to a communication agent in the FTSS;
>
> storing the message in a data structure in highly reliable fault-tolerant storage media of the FTSS;
>
> processing the message at the FTSS in accordance with a messaging paradigm; and
>
> transmitting the message from the FTSS to the second node.

The term "node" is defined in the current application, in the paragraph beginning on line 19 of page 1, as being either a server computer intercommunicating with a client computer or a client computer intercommunicating with a server computer through a network. Messages are defined in the paragraph beginning on line 3 of page 3 of the current application as the units of information exchanged between a server application running on a server computer and a client application running on a client computer. Claim 1 is consistent with the above-quoted portions of the summary of the present invention, and with the above references to Figure 1. In order for a cited reference to anticipate claim 1, the cited reference would need to show messages passed between a server computer and a client computer through an FTSS.

In the Office Action, the Examiner repeatedly references Utter as disclosing a method for transmitting messages between a first node and a second node, wherein the first and second nodes are each coupled to a fault tolerant storage system, and to other elements of claim 1, citing Figure 1, Figure 7, and numerous portions of Utter's specification. However, as explicitly stated in Utter, beginning on line 61 of column 2, and as clearly shown in Figure 1 of Utter, Figure 1

> is a functional block diagram of a digital computer system 10 including a storage subsystem that is constructed in accordance with the invention. With reference to FIG. 1, the digital computer system 10 includes a fault-tolerant computer system 11 which connects to a plurality of user terminals ... over respective user networks ... which connect the user terminals to the fault-tolerant computer system 11.

Note that the outer dashed line in Figure 1 of Utter surrounds all but the user terminals and user-terminal network, and the contents of the outer dashed line is labeled with the numerical label "11," referring to a fault-tolerant computer system. Moreover, as stated beginning on line 31 of column 17, "Figure 7 depicts a detailed functional block of the controller 31(s)." In other words, FIgures 1 and 7 of Utter, and Utter's entire disclosure, illustrate and discusses a single computer system that includes a fault-tolerant computer system - roughly a distributed FTSS. As clearly shown in Figure 1 of Utter, the distributed computer system includes a number of user terminals and a console terminal.

As explicitly stated beginning on line 3 of column 3 of Utter, the fault-tolerant computer system disclosed in Utter "performs conventional digital data processing and data retrieval and storage services that are generally typical of those performed by digital computer systems, in connection with processing, data retrieval and data storage requests provided thereto by the user terminals." In the paragraph beginning on line 16 of column 3, Utter discloses that the user terminals are video display terminals or personal computers for which the fault-tolerant computer system performs data storage and processing operations. The user terminals essentially make requests of the fault-tolerant computer system, which responds to the user terminals. In the case that data is transferred among user terminals, rather than to the fault-tolerant computer system, the data is transferred by the network (13(n) in Figure 1), as clearly stated in the sentence beginning on line 55 of column 3. Applicants' representative cannot find a single teaching or suggestion in Utter of a message being passed form a first user terminal through the fault-tolerant computer system to a second user terminal. In short, Utter describes a distributed FTSS that executes I/O requests and data-processing requests, returning responses to the requestors. For Utter to anticipate, or even be relevant to, the invention claimed in claim 1 of the current application, Utter would need to disclose or suggest a message passed from one user terminal through the fault-tolerant computer system to another user terminal – but Utter does not. Utter is completely unrelated to the invention claimed in claim 1, and in all dependent claims 2-10 that depend from claim 1.

Northrup and Suarez both disclose networking systems. Neither Northrup nor Suarez disclose, teach, or suggest anything related to fault-tolerant storage systems.

There can thus be no teaching or suggestion in any of the cited references for implementing messaging through a fault-tolerant storage system. The combination of Utter with either or both of Northrup and Suarez is thus improper. More importantly, no combination of two or more of the cited references can possibly suggest implementing messaging through a fault-tolerant storage system, because Utter does not do so, and Utter is the only cited reference among the three cited references that relates to, or mentions, a fault-tolerant computer system.

Applicant's representative believes that all of the claims remaining in the application remain clearly allowable. Favorable consideration and a Notice of Allowance are earnestly solicited.

Respectfully submitted,
Blaine D. Gaither et al.
Olympic Patent Works PLLC

Robert W. Bergstrom
Registration No. 39,906

Enclosures:
Postcard
Extension of Time in duplicate
Transmittal in duplicate
Redline Drawings (Figs. 8-9)

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NOV 24 2003
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ANNOTATED MARKED-UP DRAWINGS

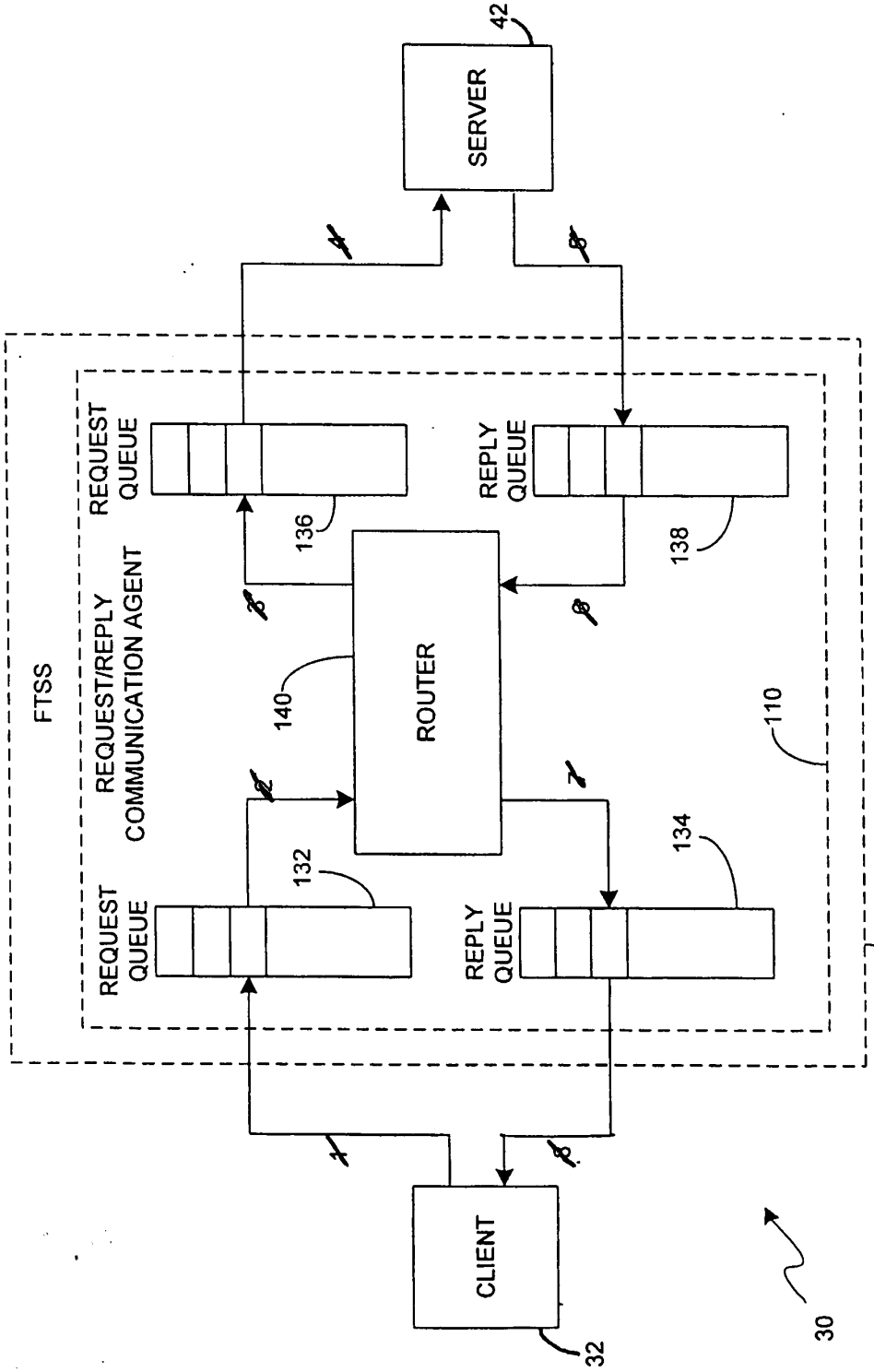


FIG. 9

ANNOTATED MARKED-UP DRAWINGS

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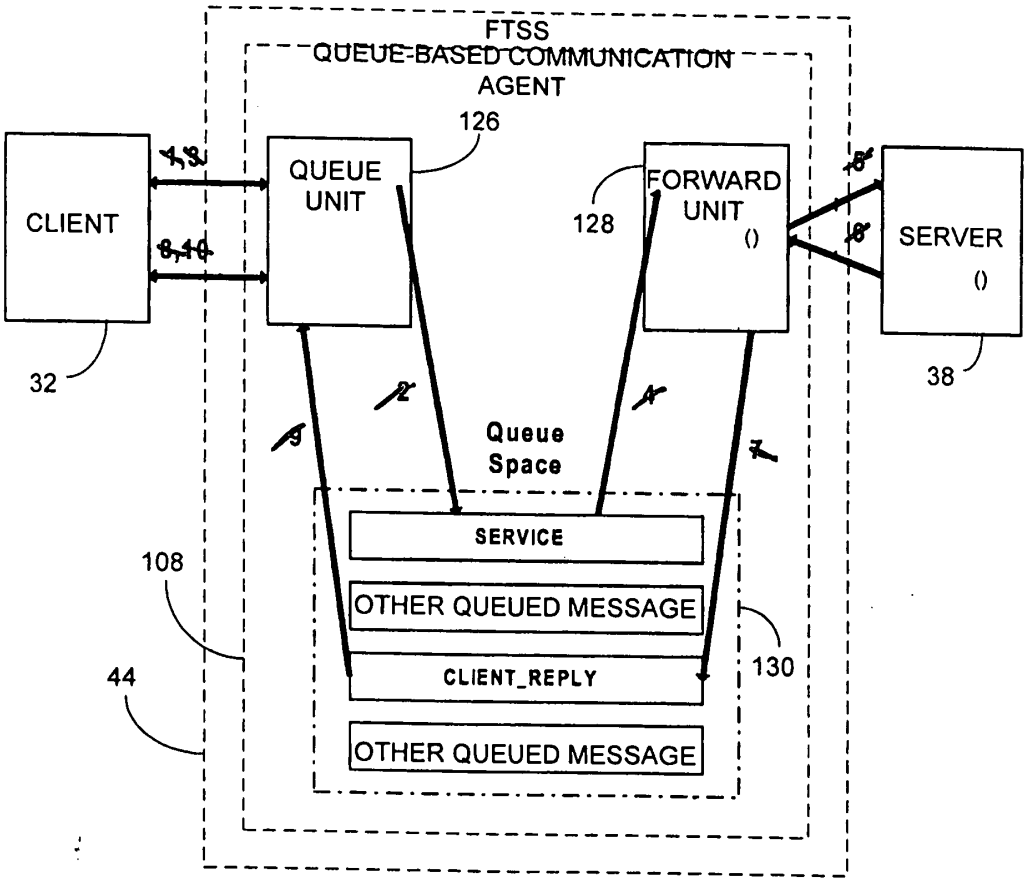


FIG. 8

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PATENT APPLICATION

ATTORNEY DOCKET NO. 10008316-1

2142

#5

12-8-03

IN THE
UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s): Blaine D. Gaither et al.

Confirmation No.:

Application No.: 09/703,427

Examiner: Lambert L. Tran

Filing Date: 10/31/2000

Group Art Unit: 2142

Title: METHOD AND APPARATUS FOR PASSING MESSAGES USING A FAULT TOLERANT STORAGE SYSTEM

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Technology Center 2100

Commissioner for Patents
PO Box 1450
Alexandria, VA 22313-1450

PETITION FOR EXTENSION OF TIME

Sir:

In an Office Action mailed on ***July 18, 2003***, on the above-identified U.S. Patent application, a shortened statutory period of ***3*** months was set for response. In accordance with 37 C.F.R. 1.136(a), applicant(s) hereby request(s) a:

(X) one month
( ) two months
( ) three months
( ) four months

time extension so that the period for response to the Office Action expires on ***Nov. 18, 2003***. Authorization to charge the fee required by 37 CFR 1.17 to Deposit Account 08-2025 appears in the enclosed transmittal letter. At any time during the pendency of this application, please charge any fees required or credit any over payment to Deposit Account 08-2025 pursuant to 37 CFR 1.25. Additionally please charge any fees to Deposit Account 08-2025 under 37 CFR 1.16 through 1.21 inclusive, and any other sections in Title 37 of the Code of Federal Regulations that may regulate fees. A duplicate copy of this sheet is enclosed.

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Date of Deposit: ***Nov. 18, 2003***

Typed Name: ***Joanne Bourguignon***

Signature: Joanne Bourguignon

Rev 05/03 (Ext Time)

Respectfully submitted,

Blaine D. Gaither et al.

By Robert W. Bergstrom

Robert W. Bergstrom

Attorney/Agent for Applicant(s)
Reg. No. ***39,906***

Date: ***Nov. 18, 2003***

Telephone No.: ***(206) 621-1933***

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/703,427	10/31/2000	Blaine D. Gaither	10008316-1	2980

22879 7590 07/18/2003

HEWLETT PACKARD COMPANY
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INTELLECTUAL PROPERTY ADMINISTRATION
FORT COLLINS, CO 80527-2400

EXAMINER
TRAN, LAMBERT L

ART UNIT	PAPER NUMBER
2142	4

DATE MAILED: 07/18/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 07-01)

Office Action Summary	Application No.	Applicant(s)	
	09/703,427	GAITHER ET AL.	
	Examiner	Art Unit	
	Lambert L Tran	2142	

-- 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) 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 the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- 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 *31 October 2000* .

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) *1-10* 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) *1-10* 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 *31 October 2000* 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).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ 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.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

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-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

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DETAILED ACTION

1. This Action is in response to the application filed on 31 October 2000.

Drawings

2. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they include the following reference sign(s) not mentioned in the description: References 1-10 of Figure 8, references 1-8 of Figure 9. A proposed drawing correction, corrected drawings, or amendment to the specification to add the reference sign(s) in the description, are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

Claim Rejections - 35 USC § 102

3. 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.

4. Claims 1-2 and 10 are rejected under 35 U.S.C. 102(b) as being anticipated by Utter et al., (Utter) U.S. Patent No 5815649.

In regards to claim 1, Utter discloses *a method of transmitting messages between a first node and a second node, wherein the first and second nodes are each coupled to a fault tolerant storage*

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system (FTSS), [see Figure 1, note the Fault Tolerant Computer System 11] *the method comprising*:

transmitting a message from the first node to a communication agent (processing node) in the FTSS [see Figure 1, col. 2, lines 61-67 and col. 3, lines 1-15];

storing the message in a data structure in highly reliable fault-tolerant storage media of the FTSS [see col. 2, lines 25-30];

processing the message at the FTSS in accordance with a messaging paradigm [see col. 2, lines 19-25 and col. 3, lines 3-15] ; and

transmitting the message from the FTSS to the second node [see Figure 1, col. 2, lines 61-67 and col. 3, lines 1-15].

5. In regards to claim 2, Utter discloses the *messaging paradigm is a request/reply communication paradigm* [see col. 4, lines 48-67, and col. 5 lines 1-14], *and:*

transmitting a message from the first node to a communication agent (processing node) in the FTSS [see Figure 1, col. 2, lines 61-67 and col. 3, lines 1-15] *comprises:*

transmitting a request message from the first node to a request/reply communication agent in the FTSS [see col. 3, lines 49-62];

storing the message in a data structure in highly reliable fault-tolerant storage media of the FTSS [see col. 4 lines 48-67, and col. 5 lines 1-14] *comprises:*

storing the request message in a request queue in highly reliable fault tolerant storage media of the FTSS [see col. 19, lines 13-43];

processing the message at the FTSS in accordance with a messaging paradigm comprises:

retrieving the request message from the request queue [see col. 9, lines 1-12, and

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col. 19, lines 13-43]; *and*

transmitting the message from the FTSS to the second node comprises:

transmitting the request message from the FTSS to a service on the second node [see col. 4, lines 48-67 and col. 5, lines 1-14]; *and the method further comprises:*

executing the service on the second node using the request message as an input and providing a reply message as an output [see col. 4, lines 48-67 and col. 5, lines 1-14];

transmitting the reply message from the second node to the request/reply communication agent in the FTSS [see col. 4, lines 48-67 and col. 5, lines 1-14];

storing the reply message in a reply queue in highly reliable fault-tolerant storage media of the FTSS [col. 19, lines 13-43];

retrieving the reply message from the reply queue [see col. 9, lines 1-12, and col. 19, lines 13-43]; *and*

transmitting the reply message from the FTSS to the first node [see col. 4, lines 48-67 and col. 5, lines 1-14].

6. In regards to claim 10, Utter discloses *transmitting a message from the first node to a communication agent in the FTSS comprises:*

transmitting a broadcast message from the first node to an unsolicited communication agent in the FTSS [see Figure 7, col. 18, lines 35-44];

processing the message at the FTSS in accordance with a messaging paradigm comprises:

accessing determining which nodes should receive the broadcast message based on the broadcast message [see col. 18, lines 53-57];

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storing the message in a data structure in highly reliable fault-tolerant storage media of the FTSS comprises:

storing the broadcast message in an unsolicited message queue in highly reliable fault-tolerant storage media of the FTSS [see col. 16, lines 41-65]*; and*

transmitting the message from the FTSS to the second node comprises:

transmitting the post message from the FTSS to all nodes that should receive the broadcast message [see col. 16, lines 41-65, and col. 19, lines 4-25].

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

8. Claims 3-5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Utter, in view of Northrup, U.S. Patent No. 6546413.

9. In regards to claim 3, Utter discloses the invention substantially as claimed. However, Utter does not explicitly disclose *wherein the messaging paradigm is a conversational communication paradigm.*

10. In the same field of endeavor, Northrup discloses an Access-Method-Independent Exchange Using A Communication Primitive. Northrup discloses *wherein the messaging*

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paradigm is a conversational communication paradigm [see Northrup, Abstract and col. 1, lines 51-61], *and:*

transmitting a message from the first node to a communication agent in the FTSS comprises:

transmitting a connect message from the first node to a conversational communication agent in the FTSS [see Northrup, col. 6, lines 10-17, col. 28, lines 15-23, col. 30, lines 12-21 and col. 30, lines 43-54];

processing the message at the FTSS in accordance with a messaging paradigm comprises:

opening (creating) a conversation queue in highly reliable fault-tolerant storage media of the FTSS [see Northrup, col. 28, lines 60-62, and col. 29, lines 7-11];

storing the message in a data structure in highly reliable fault-tolerant storage media of the FTSS comprises:

storing the connect message in the conversation queue [see Northrup, col. 6, lines 10-17, col. 28, lines 15-23, col. 29, lines 22-35]; *and*

transmitting the message from the FTSS to the second node comprises:

transmitting the connect message from the FTSS to the second node [see Northrup, col. 6, lines 10-17, col. 28, lines 15-23, col. 30, lines 12-21 and col. 30, lines 43-54].

11. Accordingly, it would have been obvious to one of ordinary skill in the networking and software programming art at the time the invention was made to have incorporated Northrup's teachings of conversational communication primitives [see Northrup, col. 4, lines 9-44] with the teachings of Utter's, for the purpose of providing the administrative controls necessary to link

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various communication devices, as well as providing software which can be commoditized and upgraded while in operation [see Northrup, Abstract]. By this rationale claim 3 is rejected.

12. In regards to claim 4, Utter-Northrup discloses *transmitting a send message from the first node to the conversational communication agent in the FTSS* [see Northrup, col. 6, lines 27-34, col. 28, lines 38-39, col. 30, lines 12-21 and col. 30, lines 43-54];

storing the send message in the conversation queue [see Northrup, col. 28, lines 65-68, col. 29, lines 22-35];

transmitting the send message to from the FTSS to a service on the second node [see Northrup, col. 28, lines 38-39, col. 30, lines 12-21 and col. 30, lines 43-54];

executing the service in the second node using the send message as an input and providing a receive message as an output [see Northrup, col. 30, lines 12-21, col. 28, lines 40-41, and col. 31, lines 23-27];

transmitting the receive message from the second node to the conversational communication agent in the FTSS [see Northrup, col.28, lines 40-41, col. 30, lines 12-21 and col. 30, lines 43-54];

storing the receive message in the conversation queue [see Northrup, col. 28, lines 40-41, col. 29, lines 22-35]; *and*

transmitting the receive message to the first node [see Northrup, col. 28, lines 40-41, col. 30, lines 12-21 and col. 30, lines 43-54].

13. By this rationale, claim 4 is rejected.

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14. In regards to claim 5, Utter-Northrup discloses *transmitting a disconnect message from the first node to the conversational communication agent in the FTSS* [see Northrup, col. 28, lines 45-46, col. 33, lines 44-47];

closing the conversation queue [see Northrup, col. 33, lines 50-54]; *and*

transmitting the disconnect message to the second node [see Northrup, col. 33, lines 55-64].

15. By this rationale, claim 5 is rejected.

16. Claims 6-9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Utter, in view of Suarez, U.S. Patent No. 5790789.

17. In regards to claim 6, Utter discloses the invention substantially as claimed. However, Utter does not explicitly disclose *wherein the messaging paradigm is an event-based communication paradigm.*

18. In the same field of endeavor, Suarez discloses a method and architecture for creation, control and deployment of services within a distributed computer environment that teaches the use of intelligent queue-based agent in network environments [see Abstract and col. 9, lines 14-39]. Suarez discloses *wherein the messaging paradigm is an event-based communication paradigm; and:*

transmitting a message from the first node to a communication agent in the FTSS comprises:

transmitting a post message from the first node to an event-based communication agent in the FTSS [see Suarez, col. 21, lines 35-51, col. 25, lines 33-42 and col. 26, lines 50-62];

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processing the message at the FTSS in accordance with a messaging paradigm comprises:

accessing a subscription manager to determine whether any nodes have subscribed to receive the event represented by the post message; [see Suarez col. 21, lines 35-51, col. 25, lines 33-42, col. 26, lines 50-62];

storing the message in a data structure in highly reliable fault-tolerant storage media of the FTSS comprises:

storing the post message in an event queue in highly reliable fault-tolerant storage media of the FTSS [see Suarez col. 21, lines 35-51, col. 25, lines 33-42, col. 26, lines 50-62]; *and*

transmitting the message from the FTSS to the second node comprises:

transmitting the post message from the FTSS to the second node if the second node has subscribed to receive the event represented by the post message. [see Suarez col. 21, lines 35-51, col. 25, lines 33-42, col. 26, lines 50-62].

19. Accordingly, it would have been obvious to one of ordinary skill in the networking and software programming art at the time the invention was made to have incorporated Suarez's teachings of intelligent queue-based communication agents [see Suarez, col. 21, lines 16-33] with the teachings of Utter's, for the purpose of providing a system that is smaller [see Suarez, col. 2, lines 63-61], modulized, compacted and maintainability. By this rationale claim 6 is rejected.

20. In regards to claim 7, Utter-Suarez discloses *transmitting a subscribe message from the second node to the event-based communication manager in the FTSS, wherein the subscribe*

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message includes an event [see Suarez col. 21, lines 35-51, col. 25, lines 33-42, col. 26, lines 50-62]; *and*

accessing the subscription manager to record that the second node has subscribed to receive post messages associated with the event [see Suarez col. 21, lines 35-51, col. 6, lines 18-29, col. 9, lines 14-39, col. 25, lines 33-42, col. 26, lines 50-62].

21. By this rationale, claim 7 is rejected.

22. In regards to claim 8, Utter-Suarez discloses *transmitting an unsubscribe message from the second node to the event-based communication manager in the FTSS, wherein the unsubscribe message includes an event* [see Suarez col. 21, lines 35-51, col. 6, lines 18-29, col. 9, lines 14-39, col. 25, lines 33-42, col. 26, lines 50-62]; *and*

accessing the subscription manager to record that the second node should no longer receive post messages associated with the event [see Suarez col. 21, lines 35-51, col. 6, lines 18-29, col. 9, lines 14-39, col. 25, lines 33-42, col. 26, lines 50-62].

23. By this rationale, claim 8 is rejected.

24. In regards to claim 9, Utter-Suarez discloses *where in the messaging paradigm is a queue-based communication paradigm* [see Suarez col. 21, lines 16-33]; *and:*

transmitting a message from the first node to a communication agent in the fault tolerant storage system comprises:

transmitting an enqueue message from the first node to a queue-based communication agent in the fault tolerant storage system [see Suarez, col. 13, lines 20-38, see Utter, Figure 1, col. 4 lines 48-67, and col. 5 lines 1-14];

storing the message in a data structure in highly reliable fault-tolerant storage media of the FTSS comprises:

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storing the enqueue message in a queue space in highly reliable fault tolerant storage media of the FTSS [see Suarez, col. 13, lines 20-38, see Utter, col. 19, lines 13-43]*;*

processing the message at the FTSS in accordance with a messaging paradigm comprises:

retrieving the enqueue message from the queue space only if the second node is available [see Suarez, col. 21, lines 16-33, see Utter, col. 9, lines 1-12]*; and*

transmitting the message from the FTSS to the second node comprises:

transmitting the enqueue message from the FTSS to a service on the second node only if the second node is available [see Suarez, col. 21, lines 16-33, see Utter, col.9, lines 13-31]; *and the method further comprises:*

executing the service on the second node using the enqueue message as an input and providing a dequeue message as an output [see Utter, col. 8, lines 25-43]*;*

transmitting the dequeue message from the second node to the queue-based communication agent in the FTSS [see Utter, Figure 1, col. 4 lines 48-67, and col. 5 lines 1-14];

storing the dequeue message in the queue space [see Utter, col. 6, lines 18-25, see Suarez, col. 21, lines 16-33];

retrieving the dequeue message from the queue space [see Utter, col. 19, lines 13-43]*; and*

transmitting the dequeue message from the FTSS to the first node [see Utter col. 3, lines 49-62, col. 5, lines 50-58].

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Conclusion

25. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

a. Luzeski et al. U.S. Patent No. 6430177: Subscribers, session manger and content manager [see col. 3, lines 47-67, and col. 4, lines 1-12].

b. Libert et al. U.S. Patent No. 6574655: Agent architecture, Resource Brokers [see col. 5, lines 43-63].

c. Gross et al. U.S. Patent No. 5555346: Event manager, event queue [see col. 5, lines 4-17, and col. 9, lines 26-52].

26. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lambert L. Tran whose telephone number is (703) 305-4663. The examiner can normally be reached on 9AM - 5PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark Powell can be reached on (703) 305-9703. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 746-7239 for regular communications and (703) 746-7238 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 305-9700.

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LLT
Patent Examiner
GAU 2142
July 8, 2003

MARK POWELL
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2100

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Notice of References Cited	Application/Control No. 09/703,427	Applicant(s)/Patent Under Reexamination GAITHER ET AL.	
	Examiner Lambert L Tran	Art Unit 2142	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
	A	US-5,815,649	09-1998	Utter et al.	714/6
	B	US-6,546,413	04-2003	Northrup, Charles J.	709/200
	C	US-5,790,789	08-1998	Suarez, Larry	709/202
	D	US-6,430,177	08-2002	Luzeski et al.	370/356
	E	US-6,574,655	06-2003	Libert et al.	709/200
	F	US-5,555,346	09-1996	Gross et al.	706/45
	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.

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L Number	Hits	Search Text	DB	Time stamp
-	1919	709/202,204-207.ccls. and @ad<20001031	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/30 11:13
-	1570	(broadcast$3 transmitt$3) same agent$3 same ("on$line transaction$ process$4" messag$4 request$reply event$base$)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/25 16:24
-	203742	("on$line transaction$ process$4" messag$4 request$reply event$base$) and @ad<20001031	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/20 14:44
-	120	(broadcast$3 transmitt$3) same agent$3 same ("fault tolerant storage system"$1 raid mirror)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/30 11:11

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-	1570	(US-4884266-$ or US-4866664-$ or US-4837798-$ or US-4825354-$ or US-4807109-$ or US-4788643-$ or US-4785396-$ or US-4766746-$ or US-4763353-$ or US-4718002-$ or US-4694483-$ or US-4689786-$ or US-4661902-$ or US-4656623-$ or US-4628504-$ or US-4617398-$ or US-4582959-$ or US-4570220-$ or US-4544501-$ or US-4509543-$ or US-4352956-$ or US-4325120-$ or US-4278199-$ or US-4270042-$ or US-4203160-$ or US-4117405-$).did. or (US-3943046-$ or US-3875067-$ or US-3679874-$ or US-3610159-$ or US-5297195-$ or US-5283905-$ or US-5283904-$ or US-5278955-$ or US-5274700-$ or US-5272382-$ or US-5271058-$ or US-5268903-$ or US-5257384-$ or US-5245652-$ or US-5235642-$ or US-5231634-$ or US-5231591-$ or US-5218539-$ or US-5181239-$ or US-5181236-$ or US-5168515-$ or US-5159551-$ or US-5153909-$ or US-5142683-$ or US-5136585-$ or US-5107470-$ or US-5073890-$).did. or (US-5062103-$ or US-5046084-$ or US-5046018-$ or US-5040208-$ or US-5039528-$ or US-5036535-$ or US-5027345-$ or US-5023868-$ or US-5008930-$ or US-5006983-$ or US-4988987-$ or US-4988209-$ or US-4947163-$ or US-4943929-$ or US-4929880-$ or US-4916443-$ or US-4914732-$ or US-4896246-$ or US-4887292-$ or US-4886790-$ or US-5504837-$ or US-5499364-$ or US-5495615-$ or US-5493564-$ or US-5490097-$ or US-5485634-$ or US-5481613-$).did. or (US-5479482-$ or US-5477038-$ or US-5473692-$ or US-5463670-$ or US-5461366-$ or US-5459717-$ or US-5444849-$ or US-5440633-$ or US-5440563-$ or US-5436966-$ or US-5426637-$ or US-5424724-$ or US-5414833-$ or US-5410710-$ or US-5410681-$ or US-5408619-$ or US-5402474-$ or US-5402431-$ or US-5398012-$ or US-5392345-$ or US-5390326-$ or US-5388147-$ or US-5386412-$ or US-5367670-$ or US-5359593-$ or US-5354069-$ or US-5347633-$).did. or (US-5341412-$ or US-5329626-$ or US-5321813-$ or US-5317135-$ or US-5309563-$ or US-5309504-$ or US-5305461-$ or US-5305374-$ or US-5664126-$ or US-5659701-$ or US-5659543-$ or US-5655081-$ or US-5650604-$ or US-5640537-$ or US-5636345-$ or US-5633924-$ or US-5632020-$ or US-5623495-$ or US-5621539-$ or US-5619648-$ or US-5613128-$ or US-5608720-$ or US-5602850-$ or US-5602536-$ or US-5598539-$ or US-5596994-$ or US-5588059-$).did. or (US-5586179-$ or US-5581594-$ or US-5577202-$ or US-5574782-$ or US-5568552-$ or US-5566225-$ or US-5559967-$ or US-5559878-$ or US-5557668-$ or US-5557658-$ or US-5557320-$ or US-5555553-$ or US-5555420-$ or US-5553073-$ or US-5551035-$ or US-5546456-$ or US-5546452-$ or US-5541911-$ or US-5539877-$ or US-5533115-$ or US-5524052-$ or US-5522070-$ or US-5519778-$ or US-5515421-$ or US-5781732-$ or US-5781703-$ or US-5781536-$).did. or (US-5778183-$ or US-5774656-$ or US-5774552-$ or US-5771387-$ or US-5764756-$ or US-5764750-$ or US-5761285-$ or US-5761284-$ or US-5758169-$ or US-5757783-$ or US-5757669-$ or US-5754627-$ or US-5754111-$ or US-5751795-$ or US-5742905-$ or US-5742845-$ or US-5742668-$ or US-5737688-$ or US-5727950-$ or US-5727058-$ or US-5724418-$ or US-5720034-$ or US-5717859-$ or US-5717689-$ or US-5710883-$ or US-5704041-$ or US-5703943-$).did. or (US-5701496-$ or US-5696976-$ or US-5691494-$ or US-5690582-$ or US-5687320-$ or US-5684988-$ or US-5682482-$ or US-5680551-$ or US-5677910-$ or US-5675735-$ or US-5671436-$ or US-5669000-$ or US-6351773-$ or US-6351771-$ or US-6353734-$ or US-6424717-$ or US-6423319-$ or US-6421714-$ or US-6421605-$ or US-6415285-$ or US-6415028-$ or US-6411810-$ or US-6411698-$ or US-6408334-$ or US-6437803-$ or US-6434607-$ or US-6438585-$).did. or (US-6442158-$ or US-6442269-$ or US-6442592-$ or US-6445922-$ or US-6408328-$ or US-6404883-$ or US-6401131-$ or US-6401113-$ or US-6400999-$ or US-6397116-$ or US-6397040-$ or US-6396395-$ or US-6393475-$ or US-6393461-$ or US-6393386-$ or US-6393379-$ or US-6393296-$ or US-6389457-$ or US-6389055-$ or US-6385646-$ or US-6378001-$ or US-6377582-$ or US-6374305-$ or US-6374295-$ or US-6370590-$ or US-6370577-$ or US-6370548-$).did. or (US-6370147-$ or US-6366967-$ or US-6366949-$ or US-6366663-$ or US-6363411-$ or US-6363145-$ or US-6360251-$ or US-6359894-$ or US-6359622-$ or US-6356633-$ or US-6356626-$ or US-6356196-$ or US-6449267-$ or US-6444384-$ or US-6434150-$ or US-6434121-$ or US-6432476-$ or US-6430978-$ or US-6430597-$ or US-6438374-$ or US-6430282-$ or US-6430271-$ or US-6427063-$ or US-6426947-$ or	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/23 11:52

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-	80690	(message$1 request$1 transaction$1 order$1) same (prox$2 mediator$1 interceptor$1 redirector$1 server$1)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/23 14:22
-	930	379/265.$$.ccls. or 379/266.$$.ccls.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/23 14:24
-	358	((message$1 request$1 transaction$1 order$1) same (prox$2 mediator$1 interceptor$1 redirector$1 server$1)) and (379/265.$$.ccls. or 379/266.$$.ccls.)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/23 14:24
-	316	(((message$1 request$1 transaction$1 order$1) same (prox$2 mediator$1 interceptor$1 redirector$1 server$1)) and (379/265.$$.ccls. or 379/266.$$.ccls.)) and (IPC queu$3 enqueu$3 dequeu$3 buffer$3 (inter adj process adj communication$1) storage fifo)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/23 14:32
-	245	((((message$1 request$1 transaction$1 order$1) same (prox$2 mediator$1 interceptor$1 redirector$1 server$1)) and (379/265.$$.ccls. or 379/266.$$.ccls.)) and (IPC queu$3 enqueu$3 dequeu$3 buffer$3 (inter adj process adj communication$1) storage fifo)) and @ad<20001031	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/24 12:21
-	22	(((((message$1 request$1 transaction$1 order$1) same (prox$2 mediator$1 interceptor$1 redirector$1 server$1)) and (379/265.$$.ccls. or 379/266.$$.ccls.)) and (IPC queu$3 enqueu$3 dequeu$3 buffer$3 (inter adj process adj communication$1) storage fifo)) and @ad<20001031) and ((fault adj toleran$2) or mirror$3 raid$1)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/23 14:38
-	21	(379/265.$$.ccls. or 379/266.$$.ccls.) and (fault adj toleran$2)	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/25 17:29
-	6591	((((message$1 request$1 transaction$1 order$1) same (prox$2 mediator$1 interceptor$1 redirector$1 server$1)) and (709/$.ccls. or 379/265.$$.ccls. or 379/266.$$.ccls.)) and (IPC queu$3 enqueu$3 dequeu$3 buffer$3 (inter adj process adj communication$1) storage fifo)) and @ad<20001031	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/24 13:03
-	5832	(((((message$1 request$1 transaction$1 order$1) same (prox$2 mediator$1 interceptor$1 redirector$1 server$1)) and (709/$.ccls. or 379/265.$$.ccls. or 379/266.$$.ccls.)) and (IPC queu$3 enqueu$3 dequeu$3 buffer$3 (inter adj process adj communication$1) storage fifo)) and @ad<20001031) and storage$3	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/24 12:42
-	327	(((((message$1 request$1 transaction$1 order$1) same (prox$2 mediator$1 interceptor$1 redirector$1 server$1)) and (709/$.ccls. or 379/265.$$.ccls. or 379/266.$$.ccls.)) and (IPC queu$3 enqueu$3 dequeu$3 buffer$3 (inter adj process adj communication$1) storage fifo)) and @ad<20001031) and "fault tolerant"	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/24 13:36
-	4	(((((message$1 request$1 transaction$1 order$1) same (prox$2 mediator$1 interceptor$1 redirector$1 server$1)) and (709/$.ccls. or 379/265.$$.ccls. or 379/266.$$.ccls.)) and (IPC queu$3 enqueu$3 dequeu$3 buffer$3 (inter adj process adj communication$1) storage fifo)) and @ad<20001031) and "fault tolerant storage"	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/24 12:51
-	26421	event$base$2 and reply$request and queu$4 conversation$3	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/24 13:45
-	53137	(event$base$2 and reply$request and queu$4 conversation$3) and @ad "20001031"	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/24 13:09

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-	11	((event$base$2 and reply$request and queu$4 conversation$3) and @ad "20001031") and "fault tolerant storage"	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/24 13:11
-	327	((((((message$1 request$1 transaction$1 order$1) same (prox$2 mediator$1 interceptor$1 redirector$1 server$1)) and (709/$.ccls. or 379/265.$$.ccls. or 379/266.$$.ccls.)) and (IPC queu$3 enqueu$3 dequeu$3 buffer$3 (inter adj process adj communication$1) storage fifo)) and @ad<20001031) and "fault tolerant") and @ad<20001031	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/24 13:41
-	306	(event$base$2 and reply$request and queu$4 conversation$3) and unsolicit$3	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/24 13:42
-	278	(event$base$2 and reply$request and queu$4 conversation$3) and unsolicit$3 and @ad<20011031	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/24 13:43
-	57336	event$base$2 reply$request queu$4	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/24 13:48
-	46	(event$base$2 reply$request queu$4) and messag$3 and "fault tolerant storage"	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/24 13:51
-	20	((event$base$2 reply$request queu$4) and messag$3 and "fault tolerant storage") and @ad<20001031	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/24 13:52
-	19741	("fault " and (node$2 message$2)) and @ad<20001031	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/25 09:43
-	1545	(("fault " and (node$2 message$2)) and @ad<20001031) and reply	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/25 09:46
-	458	(("fault " and (node$2 message$2)) and @ad<20001031) and reply same stor$4	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/25 10:02
-	1214	(("fault " and (node$2 message$2)) and @ad<20001031) and toleran$2 same stor$4	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/25 10:17
-	2	("5426688").PN.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/25 14:24
-	2	("5297193").PN.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/25 14:31

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-	10	("6493685" "6556997" "6230197" "6446076" "5710887").pn.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/25 16:58
-	389325	("fault tolerant storage system"$1 raid mirror) and @ad<20001031	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/25 17:04
-	32	(("fault tolerant storage system"$1 raid mirror) and @ad<20001031) and ((broadcast$3 transmitt$3) same agent$3 same ("on$line transaction$ process$4" messag$4 request$reply event$base$))	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/25 17:05
-	449	event$based and @ad<20001031	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/25 17:47
-	11	(event$based and @ad<20001031) and conversation	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/25 17:47
-	128	(event$based and @ad<20001031) and queu$3	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/25 17:48
-	47	(event$based and @ad<20001031) and reply	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/25 17:48
-	2	(event$based and @ad<20001031) and reply and conversation and queu$3	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/25 17:49
-	411	(messag$3 same paradigm$1) and @ad<20001031	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/26 10:26
-	34	((messag$3 same paradigm$1) and @ad<20001031) and conversation	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/07/01 17:06
-	44243	((US-6581104-$ or US-5790789-$ or US-5440719-$ or US-5555346-$ or US-6570853-$ or US-6526521-$ or US-6571354-$ or US-6571274-$ or US-6442269-$ or US-6477665-$ or US-5896523-$ or US-5815649-$ or US-6112223-$ or US-5113522-$).did. or (US-20020138704-$ or US-20010052084-$).did.) and request queue	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/27 17:21
-	1	((US-6581104-$ or US-5790789-$ or US-5440719-$ or US-5555346-$ or US-6570853-$ or US-6526521-$ or US-6571354-$ or US-6571274-$ or US-6442269-$ or US-6477665-$ or US-5896523-$ or US-5815649-$ or US-6112223-$ or US-5113522-$).did. or (US-20020138704-$ or US-20010052084-$).did.) and "request queue"	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/27 17:23
-	5	((US-6581104-$ or US-5790789-$ or US-5440719-$ or US-5555346-$ or US-6570853-$ or US-6526521-$ or US-6571354-$ or US-6571274-$ or US-6442269-$ or US-6477665-$ or US-5896523-$ or US-5815649-$ or US-6112223-$ or US-5113522-$).did. or (US-20020138704-$ or US-20010052084-$).did.) and agent	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/27 17:46

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-	5	((US-6581104-$ or US-5790789-$ or US-5440719-$ or US-5555346-$ or US-6570853-$ or US-6526521-$ or US-6571354-$ or US-6571274-$ or US-6442269-$ or US-6477665-$ or US-5896523-$ or US-5815649-$ or US-6112223-$ or US-5113522-$).did. or (US-20020138704-$ or US-20010052084-$).did.) and post$3	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/27 17:46
-	16	(US-5113522-$ or US-6571354-$ or US-6442269-$ or US-6112223-$ or US-5440719-$ or US-5790789-$ or US-6477665-$ or US-5555346-$ or US-5815649-$ or US-5896523-$ or US-6571274-$ or US-6581104-$ or US-6526521-$ or US-6570853-$).did. or (US-20010052084-$ or US-20020138704-$).did.	USPAT; US-PGPUB	2003/06/30 11:09
-	120	(US-6467915-$ or US-6560002-$ or US-6499822-$ or US-6516337-$ or US-6519901-$ or US-6525814-$ or US-6537673-$ or US-6181413-$ or US-6331878-$ or US-6219113-$ or US-6185034-$ or US-6238487-$ or US-6226933-$ or US-6460055-$ or US-6174291-$ or US-6062746-$ or US-5922606-$ or US-5841494-$ or US-5875013-$ or US-5858798-$ or US-5736977-$ or US-5692226-$ or US-5835166-$ or US-5793486-$ or US-5642189-$ or US-5435969-$).did. or (US-5642192-$ or US-5663710-$ or US-5656939-$ or US-5416323-$ or US-5428441-$ or US-5419926-$ or US-5113476-$ or US-5128175-$ or US-5304800-$ or US-5266493-$ or US-5247318-$ or US-5389548-$ or US-5411889-$ or US-5223976-$ or US-5192834-$ or US-4810614-$ or US-4668077-$ or US-4830483-$ or US-4857746-$ or US-4858081-$ or US-4920374-$ or US-4925514-$ or US-4940900-$ or US-5041386-$ or US-3692388-$ or US-4190859-$ or US-4208671-$).did. or (US-4228406-$ or US-4278199-$ or US-4286543-$ or US-4315283-$ or US-4327430-$ or US-4354509-$ or US-4360824-$ or US-RE31160-$ or US-4402018-$ or US-4404599-$ or US-4412961-$ or US-4420827-$ or US-4486791-$ or US-4541434-$ or US-4630921-$ or US-4642124-$).did. or (US-20030030850-$ or US-20030030686-$ or US-20010008469-$ or US-20020138616-$ or US-20020071463-$ or US-20020057484-$ or US-20020042767-$ or US-20020041968-$ or US-20020036975-$ or US-20020196452-$ or US-20020178251-$ or US-20020150081-$ or US-20030068639-$ or US-20030063327-$ or US-20030058384-$ or US-20030048518-$).did. or (JP-2001194095-$ or JP-2002121511-$ or JP-03142939-$ or JP-03156332-$ or JP-03162825-$ or JP-04106519-$ or JP-04116504-$ or JP-04175265-$ or JP-05163046-$ or JP-05275067-$ or JP-05322749-$ or JP-06123739-$ or JP-06233739-$ or JP-06281413-$ or JP-06281802-$ or JP-07168039-$ or JP-11003688-$ or JP-02292142-$ or JP-02157705-$ or JP-01017043-$ or JP-63289527-$ or JP-63261143-$ or JP-63172204-$ or JP-63160489-$ or JP-63029737-$ or JP-62123489-$).did. or (JP-61214139-$).did. or (US-6460055-$ or KR-2001108640-$ or JP-11183693-$ or US-5610932-$ or SU-1521112-$ or SU-1770819-$ or EP-167721-$ or JP-72013317-$).did.	USPAT; US-PGPUB; JPO; DERWENT	2003/06/30 11:11

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-	3	((US-6467915-$ or US-6560002-$ or US-6499822-$ or US-6516337-$ or US-6519901-$ or US-6525814-$ or US-6537673-$ or US-6181413-$ or US-6331878-$ or US-6219113-$ or US-6185034-$ or US-6238487-$ or US-6226933-$ or US-6460055-$ or US-6174291-$ or US-6062746-$ or US-5922606-$ or US-5841494-$ or US-5875013-$ or US-5858798-$ or US-5736977-$ or US-5692226-$ or US-5835166-$ or US-5793486-$ or US-5642189-$ or US-5435969-$).did. or (US-5642192-$ or US-5663710-$ or US-5656939-$ or US-5416323-$ or US-5428441-$ or US-5419926-$ or US-5113476-$ or US-5128175-$ or US-5304800-$ or US-5266493-$ or US-5247318-$ or US-5389548-$ or US-5411889-$ or US-5223976-$ or US-5192834-$ or US-4810614-$ or US-4668077-$ or US-4830483-$ or US-4857746-$ or US-4858081-$ or US-4920374-$ or US-4925514-$ or US-4940900-$ or US-5041386-$ or US-3692388-$ or US-4190859-$ or US-4208671-$).did. or (US-4228406-$ or US-4278199-$ or US-4286543-$ or US-4315283-$ or US-4327430-$ or US-4354509-$ or US-4360824-$ or US-RE31160-$ or US-4402018-$ or US-4404599-$ or US-4412961-$ or US-4420827-$ or US-4486791-$ or US-4541434-$ or US-4630921-$ or US-4642124-$).did. or (US-20030030850-$ or US-20030030686-$ or US-20010008469-$ or US-20020138616-$ or US-20020071463-$ or US-20020057484-$ or US-20020042767-$ or US-20020041968-$ or US-20020036975-$ or US-20020196452-$ or US-20020178251-$ or US-20020150081-$ or US-20030068639-$ or US-20030063327-$ or US-20030058384-$ or US-20030048518-$).did. or (JP-2001194095-$ or JP-2002121511-$ or JP-03142939-$ or JP-03156332-$ or JP-03162825-$ or JP-04106519-$ or JP-04116504-$ or JP-04175265-$ or JP-05163046-$ or JP-05275067-$ or JP-05322749-$ or JP-06123739-$ or JP-06233739-$ or JP-06281413-$ or JP-06281802-$ or JP-07168039-$ or JP-11003688-$ or JP-02292142-$ or JP-02157705-$ or JP-01017043-$ or JP-63289527-$ or JP-63261143-$ or JP-63172204-$ or JP-63160489-$ or JP-63029737-$ or JP-62123489-$).did. or (JP-61214139-$).did. or (US-6460055-$ or KR-2001108640-$ or JP-11183693-$ or US-5610932-$ or SU-1521112-$ or SU-1770819-$ or EP-167721-$ or JP-72013317-$).did.) and broadcast	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/06/30 11:11

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-	910	(US-6564216-$ or US-6564244-$ or US-6567848-$ or US-6564248-$ or US-6564258-$ or US-6564264-$ or US-6567818-$ or US-6567844-$ or US-6567845-$ or US-6564245-$ or US-6564246-$ or US-6564247-$ or US-6571292-$ or US-6567854-$ or US-6560637-$ or US-6560638-$ or US-6560655-$ or US-6563913-$ or US-6571278-$ or US-6571275-$ or US-6571257-$ or US-6571234-$ or US-6570606-$ or US-6574674-$ or US-6574231-$ or US-6574660-$).did. or (US-6574672-$ or US-6574655-$ or US-6574658-$ or US-6573926-$ or US-6577328-$ or US-6578025-$ or US-6578067-$ or US-6581095-$ or US-6578070-$ or US-6581092-$ or US-6466966-$ or US-6466964-$ or US-6466963-$ or US-6466932-$ or US-6463504-$ or US-6463491-$ or US-6463471-$ or US-6463464-$ or US-6463463-$ or US-6463462-$ or US-6463461-$ or US-6463460-$ or US-6463459-$ or US-6460096-$ or US-6460074-$ or US-6460073-$ or US-6460070-$).did. or (US-6460050-$ or US-6460037-$ or US-6457879-$ or US-6457076-$ or US-6457063-$ or US-6457062-$ or US-6457060-$ or US-6457055-$ or US-6457045-$ or US-6457044-$ or US-6457043-$ or US-6457039-$ or US-6453349-$ or US-6453348-$ or US-6453341-$ or US-6453340-$ or US-6453339-$ or US-6453338-$ or US-6453336-$ or US-6453335-$ or US-6453333-$ or US-6453327-$ or US-6449644-$ or US-6449640-$ or US-6449637-$ or US-6449636-$ or US-6449635-$).did. or (US-6449634-$ or US-6449633-$ or US-6449632-$ or US-6449622-$ or US-6448978-$ or US-6446118-$ or US-6446116-$ or US-6446114-$ or US-6446113-$ or US-6446112-$ or US-6480884-$ or US-6480882-$ or US-6480881-$ or US-6480861-$ or US-6480582-$ or US-6480480-$ or US-6480294-$ or US-6477575-$ or US-6477566-$ or US-6477564-$ or US-6477563-$ or US-6477551-$ or US-6477532-$ or US-6473786-$ or US-6473785-$ or US-6473784-$ or US-6473761-$).did. or (US-6473760-$ or US-6470406-$ or US-6470398-$ or US-6470379-$ or US-6466969-$ or US-6466968-$ or US-6557035-$ or US-6557029-$ or US-6557028-$ or US-6557027-$ or US-6557026-$ or US-6535912-$ or US-6535911-$ or US-6535910-$ or US-6535909-$ or US-6535907-$ or US-6532489-$ or US-6532488-$ or US-6532218-$ or US-6529976-$ or US-6493745-$ or US-6493703-$ or US-6493324-$ or US-6490624-$ or US-6490614-$ or US-6490613-$ or US-6490610-$).did. or (US-6490585-$ or US-6489935-$ or US-6487600-$ or US-6487585-$ or US-6487584-$ or US-6487583-$ or US-6487582-$ or US-6487548-$ or US-6487195-$ or US-6484211-$ or US-6484197-$ or US-6484196-$ or US-6484155-$ or US-6480895-$ or US-6480885-$ or US-6523063-$ or US-6523061-$ or US-6523060-$ or US-6519653-$ or US-6519650-$ or US-6519649-$ or US-6519642-$ or US-6519641-$ or US-6519639-$ or US-6519630-$ or US-6519628-$ or US-6519625-$).did. or (US-6519243-$ or US-6516340-$ or US-6516337-$ or US-6515576-$ or US-6513065-$ or US-6513059-$ or US-6553403-$ or US-6553401-$ or US-6553355-$ or US-6553341-$ or US-6553208-$ or US-6529947-$ or US-6529943-$ or US-6529942-$ or US-6529940-$ or US-6529936-$ or US-6529934-$ or US-6526507-$ or US-6526436-$ or US-6526424-$ or US-6557025-$ or US-6553425-$ or US-6553418-$ or US-6553416-$ or US-6546415-$ or US-6542992-$ or US-6542936-$).did. or (US-6542923-$ or US-6542922-$ or US-6542920-$ or US-6542868-$ or US-6539433-$ or US-6549938-$ or US-6549937-$ or US-6549936-$ or US-6549935-$ or US-6549932-$ or US-6557054-$ or US-6557045-$ or US-6557041-$ or US-6557036-$ or US-6539430-$ or US-6539422-$ or US-6539421-$ or US-6539420-$ or US-6539416-$ or US-6539404-$ or US-6539385-$ or US-6535916-$ or US-6496864-$ or US-6496861-$ or US-6496855-$ or US-6496853-$ or US-6496852-$).did. or (US-6496851-$ or US-6496836-$ or US-6496501-$ or US-6496201-$ or US-6493752-$ or US-6549916-$ or US-6549178-$ or US-6546488-$ or US-6546419-$ or US-6546417-$ or US-6546416-$ or US-6560633-$ or US-6560632-$ or US-6559863-$ or US-6510455-$ or US-6510454-$ or US-6510453-$ or US-6510452-$ or US-6510438-$ or US-6510229-$ or US-6509828-$ or US-6507914-$ or US-6507866-$ or US-6507865-$ or US-6549957-$ or US-6549956-$ or US-6549950-$).did. or (US-6549943-$ or US-6549939-$ or US-6507643-$ or US-6505240-$ or US-6505236-$ or US-6505235-$ or US-6505233-$ or US-6505231-$ or US-6505230-$ or US-6504915-$ or US-6502134-$ or US-6502127-$ or US-6502126-$ or US-6501852-$ or US-6499061-$ or US-6499059-$ or US-6499055-$ or US-6499054-$ or US-6499053-$ or US-6499051-$ or US-6496871-$ or US-6304788-$ or US-6301619-$ or US-6301609-$ or	USPAT; US-PGPUB	2003/06/30 11:14
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-	189	((US-6564216-$ or US-6564244-$ or US-6567848-$ or US-6564248-$ or US-6564258-$ or US-6564264-$ or US-6567818-$ or US-6567844-$ or US-6567845-$ or US-6564245-$ or US-6564246-$ or US-6564247-$ or US-6571292-$ or US-6567854-$ or US-6560637-$ or US-6560638-$ or US-6560655-$ or US-6563913-$ or US-6571278-$ or US-6571275-$ or US-6571257-$ or US-6571234-$ or US-6570606-$ or US-6574674-$ or US-6574231-$ or US-6574660-$).did. or (US-6574672-$ or US-6574655-$ or US-6574658-$ or US-6573926-$ or US-6577328-$ or US-6578025-$ or US-6578067-$ or US-6581095-$ or US-6578070-$ or US-6581092-$ or US-6466966-$ or US-6466964-$ or US-6466963-$ or US-6466932-$ or US-6463504-$ or US-6463491-$ or US-6463471-$ or US-6463464-$ or US-6463463-$ or US-6463462-$ or US-6463461-$ or US-6463460-$ or US-6463459-$ or US-6460096-$ or US-6460074-$ or US-6460073-$ or US-6460070-$).did. or (US-6460050-$ or US-6460037-$ or US-6457879-$ or US-6457076-$ or US-6457063-$ or US-6457062-$ or US-6457060-$ or US-6457055-$ or US-6457045-$ or US-6457044-$ or US-6457043-$ or US-6457039-$ or US-6453349-$ or US-6453348-$ or US-6453341-$ or US-6453340-$ or US-6453339-$ or US-6453338-$ or US-6453336-$ or US-6453335-$ or US-6453333-$ or US-6453327-$ or US-6449644-$ or US-6449640-$ or US-6449637-$ or US-6449636-$ or US-6449635-$).did. or (US-6449634-$ or US-6449633-$ or US-6449632-$ or US-6449622-$ or US-6448978-$ or US-6446118-$ or US-6446116-$ or US-6446114-$ or US-6446113-$ or US-6446112-$ or US-6480884-$ or US-6480882-$ or US-6480881-$ or US-6480861-$ or US-6480582-$ or US-6480480-$ or US-6480294-$ or US-6477575-$ or US-6477566-$ or US-6477564-$ or US-6477563-$ or US-6477551-$ or US-6477532-$ or US-6473786-$ or US-6473785-$ or US-6473784-$ or US-6473761-$).did. or (US-6473760-$ or US-6470406-$ or US-6470398-$ or US-6470379-$ or US-6466969-$ or US-6466968-$ or US-6557035-$ or US-6557029-$ or US-6557028-$ or US-6557027-$ or US-6557026-$ or US-6535912-$ or US-6535911-$ or US-6535910-$ or US-6535909-$ or US-6535907-$ or US-6532489-$ or US-6532488-$ or US-6532218-$ or US-6529976-$ or US-6493745-$ or US-6493703-$ or US-6493324-$ or US-6490624-$ or US-6490614-$ or US-6490613-$ or US-6490610-$).did. or (US-6490585-$ or US-6489935-$ or US-6487600-$ or US-6487585-$ or US-6487584-$ or US-6487583-$ or US-6487582-$ or US-6487548-$ or US-6487195-$ or US-6484211-$ or US-6484197-$ or US-6484196-$ or US-6484155-$ or US-6480895-$ or US-6480885-$ or US-6523063-$ or US-6523061-$ or US-6523060-$ or US-6519653-$ or US-6519650-$ or US-6519649-$ or US-6519642-$ or US-6519641-$ or US-6519639-$ or US-6519630-$ or US-6519628-$ or US-6519625-$).did. or (US-6519243-$ or US-6516340-$ or US-6516337-$ or US-6515576-$ or US-6513065-$ or US-6513059-$ or US-6553403-$ or US-6553401-$ or US-6553355-$ or US-6553341-$ or US-6553208-$ or US-6529947-$ or US-6529943-$ or US-6529942-$ or US-6529940-$ or US-6529936-$ or US-6529934-$ or US-6526507-$ or US-6526436-$ or US-6526424-$ or US-6557025-$ or US-6553425-$ or US-6553418-$ or US-6553416-$ or US-6546415-$ or US-6542992-$ or US-6542936-$).did. or (US-6542923-$ or US-6542922-$ or US-6542920-$ or US-6542868-$ or US-6539433-$ or US-6549938-$ or US-6549937-$ or US-6549936-$ or US-6549935-$ or US-6549932-$ or US-6557054-$ or US-6557045-$ or US-6557041-$ or US-6557036-$ or US-6539430-$ or US-6539422-$ or US-6539421-$ or US-6539420-$ or US-6539416-$ or US-6539404-$ or US-6539385-$ or US-6535916-$ or US-6496864-$ or US-6496861-$ or US-6496855-$ or US-6496853-$ or US-6496852-$).did. or (US-6496851-$ or US-6496836-$ or US-6496501-$ or US-6496201-$ or US-6493752-$ or US-6549916-$ or US-6549178-$ or US-6546488-$ or US-6546419-$ or US-6546417-$ or US-6546416-$ or US-6560633-$ or US-6560632-$ or US-6559863-$ or US-6510455-$ or US-6510454-$ or US-6510453-$ or US-6510452-$ or US-6510438-$ or US-6510229-$ or US-6509828-$ or US-6507914-$ or US-6507866-$ or US-6507865-$ or US-6549957-$ or US-6549956-$ or US-6549950-$).did. or (US-6549943-$ or US-6549939-$ or US-6507643-$ or US-6505240-$ or US-6505236-$ or US-6505235-$ or US-6505233-$ or US-6505231-$ or US-6505230-$ or US-6504915-$ or US-6502134-$ or US-6502127-$ or US-6502126-$ or US-6501852-$ or US-6499061-$ or US-6499059-$ or US-6499055-$ or US-6499054-$ or US-6499053-$ or US-6499051-$ or US-6496871-$ or US-6304788-$ or US-6301619-$ or US-6301609-$ or	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/07/01 17:40

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-	17	(US-5440719-$ or US-6112223-$ or US-5896523-$ or US-5815649-$ or US-5555346-$ or US-6571354-$ or US-5113522-$ or US-6570853-$ or US-6526521-$ or US-6581104-$ or US-6571274-$ or US-5790789-$ or US-6477665-$ or US-6442269-$).did. or (US-20030041094-$ or US-20010052084-$ or US-20020138704-$).did.	USPAT; US-PGPUB	2003/07/01 09:49
-	12	((US-5440719-$ or US-6112223-$ or US-5896523-$ or US-5815649-$ or US-5555346-$ or US-6571354-$ or US-5113522-$ or US-6570853-$ or US-6526521-$ or US-6581104-$ or US-6571274-$ or US-5790789-$ or US-6477665-$ or US-6442269-$).did. or (US-20030041094-$ or US-20010052084-$ or US-20020138704-$).did.) and queue	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/07/01 09:49
-	19	(((connect! near message) and @ad<20001031) and post) and 709/$$.ccls.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2003/07/01 17:11
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SAP - Exhibit 1102
SAP v. Valtrus et al. - IPR2025-00420
Page 386 of 704

STIC Search Report
EIC 2100

STIC Database Tracking Number: 97075

TO: Lambert Tran	From: David Holloway
Location:	Location: EIC 2100
Art Unit : 2142	PK2-4B30
Thursday, June 26, 2003	Phone: 308-7794
Case Serial Number: 09/703427	david.holloway@uspto.gov

Search Notes

Dear Examiner Tran,

Attached please find your search results for above-referenced case.
Please contact me if you have any questions or would like a re-focused search.

David

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S1      202307   FTSS OR MIRR[redacted] OR RAID? OR HIGHLY()RELIABLE [redacted](FAULT? OR
                 FAILURE? OR ERROR?)()TOLERAN?()SYSTEM? OR  REDUNDANT?()ARRAY?
S2        2773   S1(10N)(MEMOR? OR STORAGE? OR STORING)
S3     1837020   MESSAG? OR TRANSMISS? OR MAIL? OR EMAIL? OR BROADCAST? OR(-
                 COMMUNICATION OR SUBSCRIPTION)()(MANAG? OR AGENT?)
S4       71713   (CONNECT? OR INTERCONNECT?)(3N)(CABLING OR FABRIC? OR HARD-
                 WAR? OR BUS? ? OR LINE? OR WIRE? OR CABLE? OR FIBRE? OR FIBER-
                 ?) OR PHYSICAL()LAYER?
S5       59627   (DATA OR NETWORK?)()TRANSMISS?
S6           5   S2 AND S3 AND (CABL? OR FABRIC? OR BUS? ? OR LINE? OR WIRE?
                  OR FIBRE? OR FIBER?) AND (NODE? OR WORKSTATION? OR CLIENT? OR
                  WORK()STATION?)
S7           2   S2 AND S3 AND (NODE? OR WORKSTATION? OR WORK()STATION? OR -
                 CLIENT?)(3N)(NEXT? OR MULTIPL? OR PLURAL? OR MANY OR SEVERAL?
                 OR VARIOUS?)
S8          50   S2 AND (MAIL? OR EMAIL? OR MESSAGE?)
S9          16   S8 AND (NODE? OR WORKSTATION? OR WORK()STATION? OR CLIENT?)
S10         20   S6 OR S7 OR S9
S11         20   RD (unique items)
S12         16   S11 NOT PY>2000
S13         16   S12 NOT PD>20001031
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File 144:Pascal 1973-2003/Jun W2
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13/5/2 (Item 2 from file: 8)
DIALOG(R)File 8:Ei Compendex(R)
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03885800 E.I. No: EIP94071333041
Title: Polar: A storage architecture for fast checkpointing
Author: Chiueh, Tzi-cker
Corporate Source: State Univ of New York at Stony Brook, Stony Brook, NY, USA
Source: Journal of Information Science and Engineering v 9 n 1 Mar 1993. p 61-80
Publication Year: 1993
CODEN: 001501 ISSN: 1016-2364
Language: English
Document Type: JA; (Journal Article) Treatment: G; (General Review); T; (Theoretical)
Journal Announcement: 9408W2
Abstract: Checkpointing is an essential mechanism for building fault-tolerant parallel and distributed systems. Most previous checkpointing methods were based on software mechanisms. Without hardware assists, the overheads of these methods become increasingly expensive as the performance gap between CPU and I/O enlarges. Algorithms have been developed to determine the optimal checkpoint interval to minimize a program's expected overall checkpoint overhead. However, there are cases in which checkpoints are mandatory to preserve the programs' execution semantics. In these cases, the checkpoint interval is not an adjustable parameter, and system designers are forced to choose between performance and program integrity. This paper describes a storage architecture called Polar that can take a persistent snapshot of a process's address space image with significantly lower delay than conventional methods. This architecture can be used in a **node** of a **message** -passing distributed system or for checkpointing supercomputing applications. Based on a disk-**memory** **mirroring** scheme, Polar achieves this performance by exploiting the parallelism between program execution and checkpointing. Moreover, it guarantees the atomicity of a checkpoint transaction across failures, which is rather unique for asynchronous checkpointing schemes. Through a performance study based on the trace-driven simulation methodology, we show that Polar indeed achieves a significant checkpoint latency reduction, in some cases outperforming conventional checkpointing methods by an order of magnitude. (Author abstract) 20 Refs.
Descriptors: *Fault tolerant computer systems; Computer architecture; Data storage equipment; Computer system recovery; Distributed computer systems; Program debugging; Computer software; Computer programming; Data processing; Failure analysis
Identifiers: **Storage** architecture Polar; Fast checkpointing; Software fault tolerance; Disk **mirroring** ; Atomicity; Distributed transactions; Asynchronous commit; Parallel programming
Classification Codes:
722.4 (Digital Computers & Systems); 723.1 (Computer Programming); 722.1 (Data Storage, Equipment & Techniques); 723.2 (Data Processing); 723.3 (Database Systems)
722 (Computer Hardware); 723 (Computer Software)
72 (COMPUTERS & DATA PROCESSING)

13/5/3 (Item 1 from file: 35)
DIALOG(R)File 35:Dissertation Abs Online
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01741107 ORDER NO: AADAA-INQ48346

Performance analysis of distributed server systems

Author: Franks, Roy Gregory
Degree: Ph.D.
Year: 2000
Corporate Source/Institution: Carleton University (Canada) (0040)
Adviser: C. Murray Woodside
Source: VOLUME 61/04-B OF DISSERTATION ABSTRACTS INTERNATIONAL.
PAGE 2104. 271 PAGES
Descriptors: ENGINEERING, ELECTRONICS AND ELECTRICAL ; COMPUTER SCIENCE ; ENGINEERING, SYSTEM SCIENCE
Descriptor Codes: 0544; 0984; 0790
ISBN: 0-612-48346-0

Client -server systems are becoming increasingly common in the world today as users move to networks of distributed, interacting computers. This form of work demands new performance models as the interactions in **client** -server systems are more complex than the types supported by classic queueing network solvers such as Mean Value Analysis. A Layered Queueing Network is one of these models; it uses hierarchical decomposition and surrogate delays to solve the model.

This thesis describes a new analytic modeling tool called LQNS (Layered Queueing Network Solver) which extends previous techniques used to model distributed **client** -server systems. The contributions of the thesis are as follows. First, the model now supports <italic>forwarding.</italic> Forwarding is a technique where a reply to a **client** is deferred to a lower level server in a multi-level system, improving performance by reducing **message** traffic. Forwarding can also be used to convert open models to closed models. Second, systems that use <italic>early replies</italic> can be modeled. Early replies are used to reduce the response time by replying to a **client** before all of its work at a server is completed. Previous techniques have been extended to multiservers and to allow **multiple clients** . Third, <italic>activities</italic> have been introduced. Activities represent the smallest unit of modeling detail and can have arbitrary precedence relationships. Finally, the solver has been extended to handle models with both homogeneous and heterogeneous threads within a task. Homogeneous threads are used to model multiservers. Heterogeneous threads are used to model fork-join interactions such as asynchronous remote procedure calls and in **RAID storage** devices. The solver also incorporates accuracy improvements for models with early replies and for models with multiple layers.

The solver has been used to analyze numerous systems found in existence today including a tele-operator system and a transaction processing system. Finally, an extensive performance model of the Linux 2.0 Network File System (NFS) is presented.

13/5/12 (Item 2 from file: 144)
DIALOG(R)File 144:Pascal
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13747384 PASCAL No.: 98-0440137
Fault-tolerant message **routing in the extended hypercube**
KUMAR M J; PATNAIK L M; NAG B
Department of Computer Science, Curtin University of Technology, GPO Box 1987, Bentley, WA 6102, Perth 6001, Australia; Microprocessor Applications Laboratory, Department of Computer Science, Indian Institute of Science, Bangalore 560 012, India; Texas Instruments (India) Pvt. Ltd., 71 Miller Road, Bangalore 560 052, India
Journal: Journal of systems architecture, 1998, 44 (9-10) 691-702
ISSN: 1383-7621 Availability: INIST-17565; 354000072378530030
No. of Refs.: 12 ref.
Document Type: P (Serial) ; A (Analytic)
Country of Publication: Netherlands
Language: English
In real-time computing applications, it is important to have parallel computing systems that not only exhibit high performance but also continue to perform reliably under faulty conditions. The hypercube is one of the most popular and robust network topologies used for building distributed memory **message** passing multiprocessor systems. However, the hypercube does not have a constant building block and it is difficult to build hypercubes of large dimensions on account of the logarithmic degree of connectivity. The extended hypercube architecture exhibits such good properties as constant degree of **node** , low diameter and a constant basic building block. In addition it has a hierarchical, recursive and highly scalable structure. The extended hypercube is also robust to link faults. However the extended hypercube suffers from poor fault-tolerance to **node** faults as it has articulation points. In this paper we present a fault-tolerant variation of the extended hypercube, the extended hypercube with symmetrical connections. The latter topology retains all the positive features of the former and in addition exhibits improved fault-tolerant characteristics. We design efficient fault-tolerant routing algorithms for the extended hypercube architectures and report simulation results.

English Descriptors: Distributed system; Hypercube; Computer network; Distributed **memory** multiprocessor system; Routing; Graph theory; **Fault tolerant system** ; Algorithm; Numerical integration; System architecture; Graph connectivity; Computer simulation; Performance analysis

French Descriptors: Systeme reparti; Hypercube; Reseau ordinateur; Systeme multiprocesseur memoire repartie; Acheminement; Theorie graphe; Systeme tolerant les pannes; Algorithme; Integration numerique; Architecture systeme; Connectivite graphe; Simulation ordinateur; Analyse performance

Classification Codes: 001D02B04; 001D02A06; 001D02A05

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13/5/14 (Item 4 from file: 144)
DIALOG(R)File 144:Pascal
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13255885 PASCAL No.: 97-0527375
Workstation **clusters and network-based computing**
PANDA Dhabaleswar K, ed; NI Lionel M, ed
Department of Computer and Information Science, The Ohio State University, Columbus, Ohio 43210-1277, United States; Department of Computer Science, Michigan State University, East Lansing, Michigan 48824-1027, United States
Journal: Journal of parallel and distributed computing, 1997, 43 (2) 63-189
ISSN: 0743-7315 Availability: INIST-20948; 354000069993880000
No. of Refs.: dissem.
Document Type: P (Serial) ; M (Monographic)
Country of Publication: United States
Language: English

English Descriptors: Parallel system; Computer network; Distributed **memory** multiprocessor system; Parallel programming; Communication; **Message** transmission; **Fault tolerant system** ; Transmission protocol; Load balancing; Algorithm; Nearest neighbour; C++ language; Program library; System architecture; System performance; Scheduling

French Descriptors: Systeme parallele; Reseau ordinateur; Systeme multiprocesseur memoire repartie; Programmation parallele; Communication; Transmission **message** ; Systeme tolerant les pannes; Protocole transmission; Equilibrage charge; Algorithme; Plus proche voisin; Langage C++; Bibliotheque programme; Architecture systeme; Performance systeme; Ordonnancement

Classification Codes: 001D02B06; 001D02B10; 001D01A12

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13/5/15 (Item 5 from file: 144)
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12578505 PASCAL No.: 96-0263624
Stardust : an environment for parallel programming on networks of heterogeneous workstations
Stardust : un environnement pour l'execution d'applications paralleles sur reseaux de machines heterogenes
CABILLIC Gilbert; PUAUT Isabelle
CNRS. Institut de recherche en informatique et systemes aleatoires, Rennes, France; Universite de Rennes 1. Institut de recherche en informatique et systemes aleatoires, Rennes, France; Institut national des sciences appliquees de Rennes. Institut de recherche en informatique et systemes aleatoires, Rennes, France; Institut national de recherche en informatique et en automatique. Institut de recherche en informatique et systemes aleatoires, Rennes, France
Journal: Publication interne - IRISA, 1996 (1006) 34 p., fig., graph. Non-paginated pages/foldouts
Availability: INIST-22588; 354000044635100000
No. of Refs.: 26 ref.
Report No.: IRISA-PI 296-1006
Document Type: P (Serial); R (Report) ; M (Monographic)
Country of Publication: France
Language: English Summary Language: English; French
Ce rapport decrit Stardust, un environnement permettant l'execution d'applications paralleles sur reseaux de machines heterogenes. Stardust s'execute a la fois sur machine massivement parallele a memoire distribuee et sur reseau de stations de travail. Les applications qui utilisent Stardust communiquent par envois de **messages** et/ou memoire virtuelle partagee. Par ailleurs, Stardust inclut un mecanisme permettant de capturer

l'etat des applications. Cet etat peut soit etre sauvegarde sur disque dans le but de tolerer les defaillances, soit etre transfere d'un ensemble de machines a un autre pour equilibrer les charges des machines du systeme. Stardust est actuellement implante sur une machine Paragon d'Intel executant le systeme d'exploitation Paragon-OSF/1 et sur un reseau de Pentiums executant le systeme d'exploitation Chorus/classiX. Le rapport detaille la conception et la realisation de Stardust, ainsi que ses performances.

English Descriptors: Parallel programming; Virtual **memory** ; Shared **memory** ; Computer network; **Workstation** ; **Fault tolerant system** ; **Fault to leranc** e; Load balancing

French Descriptors: Programmation parallele; Memoire virtuelle; Memoire partagee; Reseau ordinateur; Station travail; Systeme tolerant les pannes ; Tolerance faute; Equilibrage charge

Classification Codes: 430A09H; 001D02B04; 001D02B09

13/5/16 (Item 6 from file: 144)
DIALOG(R)File 144:Pascal
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12039466 PASCAL No.: 95-0233033
Supporting fault-tolerant parallel programming in Linda
BAKKEN D E; SCHLICHTING R D
BBN Systems and Technologies, distributed systems dep., Cambridge MA 02138, USA
Journal: IEEE transactions on parallel and distributed systems, 1995, 6 (3) 287-302
ISSN: 1045-9219 Availability: INIST-22203; 354000056156620050
No. of Refs.: 42 ref.
Document Type: P (Serial) ; A (Analytic)
Country of Publication: USA
Language: English
Linda is a language for programming parallel applications whose most notable feature is a distributed shared memory called tuple space. While suitable for a wide variety of programs, one shortcoming of the language as commonly defined and implemented is a lack of support for writing programs that can tolerate failures in the underlying computing platform. This paper describes FT-Linda, a version of Linda that addresses this problem by providing two major enhancements that facilitate the writing of fault-tolerant applications: stable tuple spaces and atomic execution of tuple space operations. The former is a type of stable storage in which tuple values are guaranteed to persist across failures, while the latter allows collections of tuple operations to be executed in an all-or-nothing fashion despite failures and concurrency. The design of these enhancements is presented in detail and illustrated by examples drawn from both the Linda and fault-tolerance domains. An implementation of FT-Linda for a network of **workstations** is also described. The design is based on replicating the contents of stable tuple spaces to provide failure resilience and then updating the copies using atomic multicast. This strategy allows an efficient implementation in which only a single multicast **message** is needed for each atomic collection of tuple space operations

English Descriptors: Parallel programming; Programming language; Fault tolerance; Shared **memory** ; Space application; **Storage** ; Divide-and-conquer method; Concurrency; Implementation; Semantics; **Fault tolerant system** ; Distributed system; Computer network; Synchronization; Atomicity

French Descriptors: Programmation parallele; Langage programmation; Tolerance faute; Memoire partagee; Application spatiale; Stockage; Methode diviser pour gagner; Simultaneite informatique; Implementation; Semantique; Systeme tolerant les pannes; Systeme reparti; Reseau ordinateur; Synchronisation; Linda language; Atomic execution; Atomic

multicast; Atomicite

Classification Codes: 001D02B09; 001D02B04; 001D04B03

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S2        118   S1(10N)(MEMOR? OR STORAGE? OR STORING)
S3      16621   MESSAG? OR TRANSMISS? OR MAIL? OR EMAIL? OR BROADCAST? OR(-
                COMMUNICATION OR SUBSCRIPTION)()(MANAG? OR AGENT?)
S4        937   (CONNECT? OR INTERCONNECT?)(3N)(CABLING OR FABRIC? OR HARD-
                WAR? OR BUS? ? OR LINE? OR WIRE? OR CABLE? OR FIBRE? OR FIBER-
                ?) OR PHYSICAL()LAYER?
S5        197   (DATA OR NETWORK?)()TRANSMISS?
S6         17   S2 AND S3
S7          0   S6 AND (S4 OR S5)
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S9          6   S8 NOT PY>2000
S10         5   S9 NOT PD>20001031
File 256:SoftBase:Reviews,Companies&Prods. 82-2003/May
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10/3,K/1
DIALOG(R)File 256:SoftBase:Reviews,Companies&Prods.
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01065161 DOCUMENT TYPE: Product

PRODUCT NAME: IPStor (065161)

FalconStor Software Inc (711284)
125 Baylis Rd #140
Melville, NY 11747 United States
TELEPHONE: (631) 777-5188

RECORD TYPE: Directory

CONTACT: Sales Department

REVISION DATE: 20030228

...new or existing SANs, without copying existing data. IPStor includes the IPStor Server, IPStor SAN **Client** for Fibre Channel, and IPStor SAN **Client** for IP components. It also includes the Active-Active Failover, Capacity- On-Demand, and Device...

...tape drives and integrate them into SANs. IPStor also has bottleneck monitoring, traffic routing, volume **mirroring** , local and remote data replication, caching, snapshot, and other **storage** services. The system's IPStor Snapshot Agents ensure the integrity and consistency of data during replication and other snapshot operations. IPStor's Storage Optimizer consolidates duplicate **message** attachments and forwards old attachments to secondary data repositories, increasing **messaging** system storage capacity.

10/3,K/2
DIALOG(R)File 256:SoftBase:Reviews,Companies&Prods.
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00117839 DOCUMENT TYPE: Review

PRODUCT NAMES: AMASS for Windows NT Windows NT (562963)

TITLE: ADIC's optical library manager looks good
AUTHOR: Baltazar, Henry
SOURCE: PC Week, v16 n26 p81(2) Jun 28, 1999
ISSN: 0740-1604

RECORD TYPE: Review
REVIEW TYPE: Review
GRADE: B

REVISION DATE: 20020630

...a network drive. With Amass for NT, companies can migrate rarely used files, including e- **mail** archives, to optical libraries so that space is freed up on high-cost, high performance **RAID** units. Moreover, optical **storage** can in the long run eliminate the need to purchase new file servers and **RAID** units. Microsoft plans release of a Remote **Storage** Manager component in Windows 2000 that will operate in a like manner. Amass for NT...

...library. This feature is especially useful to IT managers, who can track utilization and bill **clients** accurately.

10/3,K/3
DIALOG(R)File 256:SoftBase:Reviews,Companies&Prods.
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00081768 DOCUMENT TYPE: Review

PRODUCT NAMES: NetWare (699683); Novell IPX/SPX (579327); TCP/IP (830058); ARCserve (200638); Lotus Notes (550418)

TITLE: Tapping Into A Cool, Clear Network For OCWA
AUTHOR: Zapryluk, Maureen
SOURCE: Network Computing, v6 n11 p122(1) Sep 15, 1995
ISSN: 1046-4468
HOMEPAGE: http://www.NetworkComputing.com

RECORD TYPE: Review
REVIEW TYPE: Product Analysis
GRADE: Product Analysis, No Rating

REVISION DATE: 20030527

Novell's NetWare network operating system and IPX/SPX **transmission** protocol, along with **Transmission** Control Protocol/Internet Protocol (TCP/IP), and ARCserve backup and restore products, help Ontario, Canada... ...plants with multiprotocol NPR Cisco routers. The WAN now includes more than 200 connected, distributed **nodes** spanning 1,500 miles. **Redundant Arrays** of Inexpensive Disks (**RAID**) Level five **storage** supports headquarters operations; each of seven office and 10 plants has individual backup servers. The...

10/3,K/4
DIALOG(R)File 256:SoftBase:Reviews,Companies&Prods.
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00064179 DOCUMENT TYPE: Review

PRODUCT NAMES: Derwent World Patents Index (WPI) (507431); MAID for Notes (487139)

TITLE: European Firms Instrumental in Bringing Images to Users
AUTHOR: Blake, Paul
SOURCE: Information Today, v11 n4 p11(2) Apr 1994
ISSN: 8755-6286
HOMEPAGE: http://www.infotoday.com

RECORD TYPE: Review
REVIEW TYPE: Product Analysis
GRADE: Product Analysis, No Rating

REVISION DATE: 20021226

...from Perfect Information, a company that offers imaged stock exchange reports and announcements, uses ISDN **transmission** to provide data on Microsoft Windows-based PCs. The company plans to speed up image delivery with use of **RAID** , instead of optical disc **storage** media. The scientific patent field also has a new offering that includes 1.5 million...

...technical drawings and diagrams in the World Patents (WPI) database. MAID for Notes is a **client** /server product that allows users to retrieve text, graphs, and charts and to store them...

DESCRIPTORS: **Client** /server; Content Providers; IBM PC & Compatibles; Image Processing; Information Retrieval; Network Software; Notes/Domino ; Patents...

10/3,K/5
DIALOG(R)File 256:SoftBase:Reviews,Companies&Prods.
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00063052 DOCUMENT TYPE: Review

PRODUCT NAMES: StarWorks (420204)

TITLE: Streaming RAID--A Disk Array Management System for Video Files
AUTHOR: Tobagi, Frank
SOURCE: Computer Technology Review, v14 n3 ps66(2) Mar 1994
ISSN: 0287-9647
HOMEPAGE: http://www.westworldproductions.com

RECORD TYPE: Review
REVIEW TYPE: Product Analysis
GRADE: Product Analysis, No Rating

REVISION DATE: 20010730

...for a video application server. StarWorks consists of server software, which turns a PC or **workstation** into a streaming video server, and **client** software to transmit and receive video stream data over the network. A video signal is...
...in a data stream, which is constant and of very high rate. To maximize the **client** 's memory requirement, and the latency involved in accessing stored files, **transmission** of digital video data between server and **client** is best done in a stream fashion. Streaming **RAID** is a **storage** system suitable for video servers with large physical storage needs, where it is necessary to...

```
Set     Items   Description
S1     643620   FTSS OR MIRROR? OR RAID? OR HIGHLY()RELIABLE OR (FAULT? OR
              FAILURE? OR ERROR?)()TOLERAN?()SYSTEM? OR  REDUNDANT?()ARRAY?
S2      44372   S1(10N)(MEMOR? OR STORAGE? OR STORING)
S3    7605583   MESSAG? OR TRANSMISS? OR MAIL? OR EMAIL? OR BROADCAST? OR(-
              COMMUNICATION OR SUBSCRIPTION)()(MANAG? OR AGENT?)
S4     441917   (CONNECT? OR INTERCONNECT?)(3N)(CABLING OR FABRIC? OR HARD-
              WAR? OR BUS? ? OR LINE? OR WIRE? OR CABLE? OR FIBRE? OR FIBER-
              ?) OR PHYSICAL()LAYER?
S5     154535   (DATA OR NETWORK?)()TRANSMISS?
S6         94   S2(S)S3(S)S4
S7          0   S6(S)(NODE? OR WORKSTATION? OR CLIENT?)(3N)(NEXT? OR FOLLO-
              W? OR ADDITIONAL? OR MULTIPL? OR PLURAL? OR MANY OR SEVERAL)
S8          7   S5(S)S6
S9         35   S6(S)(MAIL? ? OR EMAIL? OR MESSAG?)
S10        41   S6(S)(NODE? OR WORKSTATION? OR WORK()STATION? OR CLIENT?)
S11        64   (S8 OR S9 OR S10)
S12        42   RD (unique items)
S13        16   S12 NOT PY>2000
S14        15   S13 NOT PD>20001031
S15       274   S2(5N)S3
S16        13   S15(10N)S4
S17         3   RD (unique items)
S18         1   S17 NOT S12
S19        16   S14 OR S18
File 275:Gale Group Computer DB(TM) 1983-2003/Jun 26
         (c) 2003 The Gale Group
File  47:Gale Group Magazine DB(TM) 1959-2003/Jun 23
         (c) 2003 The Gale group
File 636:Gale Group Newsletter DB(TM) 1987-2003/Jun 24
         (c) 2003 The Gale Group
File  16:Gale Group PROMT(R) 1990-2003/Jun 25
         (c) 2003 The Gale Group
File 624:McGraw-Hill Publications 1985-2003/Jun 25
         (c) 2003 McGraw-Hill Co. Inc
File 484:Periodical Abs Plustext 1986-2003/Jun W4
         (c) 2003 ProQuest
File 613:PR Newswire 1999-2003/Jun 25
         (c) 2003 PR Newswire Association Inc
File 813:PR Newswire 1987-1999/Apr 30
         (c) 1999 PR Newswire Association Inc
File 141:Readers Guide 1983-2003/May
         (c) 2003 The HW Wilson Co
File 696:DIALOG Telecom. Newsletters 1995-2003/Jun 25
         (c) 2003 The Dialog Corp.
File 621:Gale Group New Prod.Annou.(R) 1985-2003/Jun 24
         (c) 2003 The Gale Group
File 674:Computer News Fulltext 1989-2003/Jun W4
         (c) 2003 IDG Communications
File 369:New Scientist 1994-2003/Jun W3
         (c) 2003 Reed Business Information Ltd.
File 160:Gale Group PROMT(R) 1972-1989
         (c) 1999 The Gale Group
File 635:Business Dateline(R) 1985-2003/Jun 25
         (c) 2003 ProQuest Info&Learning
File  15:ABI/Inform(R) 1971-2003/Jun 25
         (c) 2003 ProQuest Info&Learning
File   9:Business & Industry(R) Jul/1994-2003/Jun 25
         (c) 2003 Resp. DB Svcs.
File  13:BAMP 2003/Jun W1
         (c) 2003 Resp. DB Svcs.
File 810:Business Wire 1986-1999/Feb 28
         (c) 1999 Business Wire
File 610:Business Wire 1999-2003/Jun 25
         (c) 2003 Business Wire.
File 647:CMP  Computer Fulltext 1988-2003/Jun W1
         (c) 2003 CMP Media, LLC
File  98:General Sci Abs/Full-Text 1984-2003/May
```

(c) 2003 The HW Wilson Co.
File 148:Gale Group Trade & Industry DB 1976-2003/Jun 25
(c)2003 The Gale Group

19/3,K/1 (Item 1 from file: 275)
DIALOG(R)File 275:Gale Group Computer DB(TM)
(c) 2003 The Gale Group. All rts. reserv.

02365897 SUPPLIER NUMBER: 58947642 (USE FORMAT 7 OR 9 FOR FULL TEXT)
Agilent Technologies and Adaptec Partner to Boost Use of Fibre Channel Technology With PC Servers.(Company Business and Marketing)
EDGE: Work-Group Computing Report, NA
Jan 24, 2000
LANGUAGE: English RECORD TYPE: Fulltext
WORD COUNT: 751 LINE COUNT: 00069

... servers to utilize Fibre Channel -- an industry standard, serial-interconnect technology that operates at gigabit **transmission** rates -- to communicate with **storage** devices such as tape drives, **RAID** arrays, and **storage** clusters. **Fibre** Channel provides the **connectivity** and bandwidth needed to move large data files between storage, server, and **client nodes** . It is ideal for SANs, which off-load mass storage from individual servers and move...

19/3,K/2 (Item 2 from file: 275)
DIALOG(R)File 275:Gale Group Computer DB(TM)
(c) 2003 The Gale Group. All rts. reserv.

02271957 SUPPLIER NUMBER: 53939974 (USE FORMAT 7 OR 9 FOR FULL TEXT)
Storage: IBM Storage Area Network Initiative Enables Access to Information Any Time, Anywhere. (Company Business and Marketing)
EDGE: Work-Group Computing Report, NA
Feb 22, 1999
LANGUAGE: English RECORD TYPE: Fulltext
WORD COUNT: 1276 LINE COUNT: 00112

TEXT:
...Connectivity, management, exploitation and services make up the foundation of IBM SAN deployment. SANs combine **connectivity hardware** such as **Fibre** Channel hubs, switches and gateways with software management that accommodates both IBM and non-IBM...

...environment. IBM Launches SAN Connectivity Solutions Providing SAN connectivity solutions, IBM Wednesday announced the IBM **Storage** Area Network Data Gateway. Fibre Channel **RAID Storage** Server and Fibre Channel **Storage** Hub designed to help businesses maximize the access, flow and protection of information seamlessly, any...

...Hubs, distances up to 11 kilometers between servers at a primary operations site and remote **storage** system locations can be supported. IBM Fibre Channel **RAID Storage** Server The IBM Fibre Channel **RAID Storage** Server meets the requirements of high-performance systems running large database applications such as ERP...

...With RAID levels of 0, 1, 3, 5 and 0+1, the IBM Fibre Channel **RAID Storage** Server provides industry-standard Fibre Channel attachment for small clusters of UNIX-based servers from...

...Sun Microsystems and Hewlett-Packard, and Intel-based servers running NT. "IBM's Fibre Channel **RAID Storage** Server has not only provided Indiana University students with continuous and fast access to computing...

...our investment is protected by the scalability of industry-standard Fibre Channel." With dual-active **RAID** controllers, the IBM Fibre Channel **RAID Storage** Server is ideal for one or two homogeneous servers running critical applications that require a...

...new Expandable Storage Unit and high-performance IBM Ultrastar disk drives, the IBM Fibre Channel **RAID Storage** Server's **storage** capacity can start at 18 gigabytes (GB) and grow to over one terabyte (TB) by... cost-effective, single-point Fibre Channel solution that supports up to 100 MB per second **data transmission** speeds between system servers and storage servers. Hot-pluggable ports enable the attachment of new...

...with minimal impact to daily operations. SAN Management Software Solutions The IBM StorWatch Fibre Channel **RAID** specialist, a network-based integrated **storage** management tool, lets **storage** administrators configure, monitor, dynamically change, and manage multiple Fibre Channel **RAID Storage** Servers from a single Windows 95 or NT **Workstation** . High availability and full redundancy are provided with the host-specific Fibre Channel Storage Manager...

...StorWatch SAN Data Gateway Specialist runs on attached host servers and network-attached Windows NT **workstations** . For more information regarding IBM storage products visit: http://www.ibm.com/storage.

19/3,K/12 (Item 1 from file: 674)
DIALOG(R)File 674:Computer News Fulltext
(c) 2003 IDG Communications. All rts. reserv.

079903
Amdahl guns for EMC with high-end storage server
Code-named Next Storage Product, the offering increases connectivity options.
Byline: MARC SONGINI
Journal: Network World Page Number: 12
Publication Date: December 06, 1999
Word Count: 434 Line Count: 41

Text:
... hubs using a host of different protocols, including Enterprise Systems Connection (ESCON), IBM's proprietary **Fibre Connectivity** Channel (FICON), **Fibre** Channel and SCSI. Amdahl's Platinum servers work only with ESCON, SCSI and Fibre Channel...

... shops.NSP will be built by Fujitsu using Amdahl specifications, including its high-speed Synfinity **interconnect - message** switching **fabric** , which is optimized for low latency and reliability. NSP will be able to process up...

...be Tivoli software manageable, and it is likely they will boast internal and external disk **mirroring** , virtual **storage** capabilities for optimizing disk **storage** , and upwards of 11 terabytes of capacity.Amdahl declined to disclose NSP pricing, but sources...

```
Set     Items   Description
S1     214470   FTSS OR MIRROR? OR RAID? OR HIGHLY()RELIABLE OR (FAULT? OR
              FAILURE? OR ERROR?)()TOLERAN?()SYSTEM? OR  REDUNDANT?()ARRAY?
S2       2927   S1(10N)(MEMOR? OR STORAGE? OR STORING)
S3    1921528   MESSAG? OR TRANSMISS? OR MAIL? OR EMAIL? OR BROADCAST? OR(-
              COMMUNICATION OR SUBSCRIPTION)()(MANAG? OR AGENT?)
S4      75543   (CONNECT? OR INTERCONNECT?)(3N)(CABLING OR FABRIC? OR HARD-
              WAR? OR BUS? ? OR LINE? OR WIRE? OR CABLE? OR FIBRE? OR FIBER-
              ?) OR PHYSICAL()LAYER?
S5      69300   (DATA OR NETWORK?)()TRANSMISS?
S6          3   S2 AND S3 AND S4
S7        185   S2 AND S3
S8         20   S7 AND S5
S9         43   S2(5N)S3
S10        31   S1 AND S3 AND S4 AND S5
S11        83   S6 OR S8 OR S9 OR S10
S12        70   RD (unique items)
S13        59   S12 NOT PY>2000
S14        59   S13 NOT PD>20001031
File   8:Ei Compendex(R) 1970-2003/Jun W3
         (c) 2003 Elsevier Eng.  Info. Inc.
File  35:Dissertation Abs Online 1861-2003/May
         (c) 2003 ProQuest Info&Learning
File  65:Inside Conferences 1993-2003/Jun W4
         (c) 2003 BLDSC all rts. reserv.
File   2:INSPEC 1969-2003/Jun W3
         (c) 2003 Institution of Electrical Engineers
File  94:JICST-EPlus 1985-2003/Jun W4
         (c)2003 Japan Science and Tech Corp(JST)
File 111:TGG Natl.Newspaper Index(SM) 1979-2003/Jun 23
         (c) 2003 The Gale Group
File 233:Internet & Personal Comp. Abs. 1981-2003/May
         (c) 2003 Info. Today Inc.
File   6:NTIS 1964-2003/Jun W4
         (c) 2003 NTIS, Intl Cpyrght All Rights Res
File 144:Pascal 1973-2003/Jun W2
         (c) 2003 INIST/CNRS
File  34:SciSearch(R) Cited Ref Sci 1990-2003/Jun W4
         (c) 2003 Inst for Sci Info
File  99:Wilson Appl. Sci & Tech Abs 1983-2003/May
         (c) 2003 The HW Wilson Co.
```

14/5/13 (Item 1 from f[redacted]: 2)
DIALOG(R)File 2:INSPEC
(c) 2003 Institution of Electrical Engineers. All rts. reserv.

6734293 INSPEC Abstract Number: C2000-11-5470-021
Title: Fast cluster failover using virtual memory-mapped communication
Author(s): Yuanyuan Zhou; Chen, P.M.; Kai Li
Author Affiliation: Dept. of Comput. Sci., Princeton Univ., NJ, USA
Conference Title: Conference Proceedings of the 1999 International Conference on Supercomputing p.373-82
Publisher: ACM, New York, NY, USA
Publication Date: 1999 Country of Publication: USA xi+509 pp.
ISBN: 1 58113 164 X Material Identity Number: XX-1999-01365
U.S. Copyright Clearance Center Code: 1 58113 164 X/99/06...$5.00
Conference Title: Proceedings of the 13th Association for Computer Machinery International Conference on Supercomputing
Conference Sponsor: ACM
Conference Date: 20-25 June 1999 Conference Location: Rhodes, Greece
Language: English Document Type: Conference Paper (PA)
Treatment: Practical (P)
Abstract: This paper proposes a novel way to use virtual memory-mapped communication (VMMC) to reduce the failover time on clusters. With the VMMC model, applications' virtual address space can be efficiently **mirrored** on remote **memory** either automatically or via explicit **messages** . When a machine fails, its applications can restart from the most recent checkpoints on the failover node with minimal memory copying and disk I/O overhead. This method requires little change to applications' source code. We developed two fast failover protocols: deliberate update failover protocol (DU) and automatic update failover protocol (AU). The first can run on any system that supports VMMC, whereas the other requires special network interface support. We implemented these two protocols on two different clusters that supported VMMC communication. Our results with three transaction-based applications show that both protocols work quite well. The deliberate update protocol imposes 4-21% overhead when taking checkpoints every 2 seconds. If an application can tolerate 20% overhead, this protocol can failover to another machine within 4 milliseconds in the best case and from 0.1 to 3 seconds in the worst case. The failover performance can be further improved by using special network interface hardware. The automatic update protocol is able to take checkpoints every 0.1 seconds with only 3-12% overhead. If 10% overhead is allowed, it can failover applications from 0.01 to 0.4 seconds in the worst case. (38 Refs)
Subfile: C
Descriptors: protocols; safety-critical software; software fault tolerance; software performance evaluation; transaction processing
Identifiers: cluster failover; virtual memory-mapped communication; VMMC model; virtual address space; remote memory mirror; explicit messages; deliberate update failover protocol; automatic update failover protocol; transaction-based applications; checkpoints; performance; network interface hardware
Class Codes: C5470 (Performance evaluation and testing); C5640 (Protocols); C6110B (Software engineering techniques)
Copyright 2000, IEE

14/5/40 (Item 5 from file: 6)
DIALOG(R)File 6:NTIS
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0876976 NTIS Accession Number: PB81-144370/XAB
GRIDNET
(Interim rept)
Moore, R. T.
National Bureau of Standards, Washington, DC. Inst. for Computer Sciences and Technology.
Corp. Source Codes: 004692266
Sponsor: Defense Nuclear Agency, Washington, DC.
Report No.: NBSIR-80-2149
Oct 80 75p
Languages: English
Journal Announcement: GRAI8110
Sponsored in part by Defense Nuclear Agency, Washington, DC.
Order this product from NTIS by: phone at 1-800-553-NTIS (U.S. customers); (703)605-6000 (other countries); fax at (703)321-8547; and email at orders@ntis.fedworld.gov. NTIS is located at 5285 Port Royal Road, Springfield, VA, 22161, USA.
NTIS Prices: PC A04/MF A01
Country of Publication: United States
This report describes a **highly reliable** and survivable digital data communication system. It is based on the multiple **interconnection** of dual **fiber** optic loops, with up to about twenty data communications stations being served by each dual loop. The dual loop configuration is called CROSSFIRE. The interconnection of many of these to form a large network is called GRIDNET. The network is highly connected and many alternate routes are available for transmitting a **message** between two stations located at different points on the network. The intelligence required for the control of communications and the routing of traffic is distributed among a number of data communication nodes called gateway stations. Network survival is not dependent on the survival of any node or link, but requires instead that the network not be fragmented.
Descriptors: **Data transmission** ; Digital techniques; Pulse communication; Routing; Survival; Reliability
Identifiers: Communication networks; Protocols; **Message** processing; NTISCOMNBS; NTISDODSD
Section Headings: 45C (Communication--Common Carrier and Satellite)

14/5/46 (Item 4 from file: 144)
DIALOG(R)File 144:Pascal
(c) 2003 INIST/CNRS. All rts. reserv.

14913049 PASCAL No.: 01-0062695
Conditions on input vectors for consensus solvability in asynchronous distributed systems
Une nouvelle approche pour resoudre le consensus : les conditions sur les vecteurs des valeurs proposees
MOSTEFAOUI Achour; RAJSBAUM Sergio; RAYNAL Michel
CNRS. Institut de recherche en informatique et systemes aleatoires, Rennes, France; Universite de Rennes 1. Institut de recherche en informatique et systemes aleatoires, Rennes, France; Institut national des sciences appliquees de Rennes. Institut de recherche en informatique et systemes aleatoires, Rennes, France; Institut national de recherche en informatique et en automatique. Institut de recherche en informatique et systemes aleatoires, Rennes, France
Journal: Publication interne - IRISA, 2000 (1355) 28 p.
ISSN: 1166-8687 Availability: INIST-22588; 354000092309550000
No. of Refs.: 37 ref.
Report No.: IRISA-PI 200-1355
Document Type: P (Serial); R (Report) ; M (Monographic)
Country of Publication: France
Language: English Summary Language: English; French
Resume : Ce rapport introduit une nouvelle approche visant a resoudre le probleme du consensus dans les systemes repartis asynchrones. Il s'agit d'une approche fondee sur les conditions qui, lorsqu'elles sont satisfaites par le vecteur des valeurs proposees, permettent de resoudre le probleme. Le premier resultat du rapport est un protocole generique pour le modele a memoire partagee. Ce protocole garantit toujours l'inviolabilite de la propriete d'accord du consensus, et la propriete de terminaison lorsqu'il n'y a pas defaillance, ou lorsque le vecteur d'entree satisfait la condition avec laquelle le protocole a ete instancie. Deux conditions particulierement interessantes d'un point de vue pratique sont presentees et etudiees. Le rapport presente ensuite un second resultat, a savoir, une caracterisation des conditions qui permettent de resoudre le consensus. Le protocole est ensuite adapte au modele de communication par messages. Il est egalement montre comment la propriete de surete peut etre affaiblie pour favoriser la terminaison.

English Descriptors: Distributed system; Asynchronous **transmission** ; **Fault tolerant system** ; **Message** passing; Shared **memory** ; Concensus ; Crash failure; Atomic snapshot

French Descriptors: Systeme reparti; Transmission asynchrone; Systeme tolerant les pannes; Envoi message; Memoire partagee; Concensus; Panne franche; Lecture atomique

Classification Codes: 430A09H; 001D02B04

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14/5/49 (Item 7 from file: 144)
DIALOG(R)File 144:Pascal
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13272601 PASCAL No.: 97-0546778
A new checkpoint mechanism for Real Time Operating systems
RODRIGUEZ S; PEREZ A; MENDEZ R
Departamento de Arquitectura y Tecnologia de Sistemas Informaticos, Universidad Politecnica de Madrid, Spain
Journal: Operating systems review, 1997, 31 (4) 55-62
ISSN: 0163-5980 CODEN: OSRED8 Availability: INIST-18399; 354000069742410060
No. of Refs.: 10 ref.
Document Type: P (Serial) ; A (Analytic)
Country of Publication: United States
Language: English
This paper presents an overview of a proposed protocol to provide application-transparent fault tolerant services in a Real Time Operating system. Fault tolerance is achieved by saving checkpoints of the processes belonging to a real time application. This approach proposes the extension of some real time system calls in order to save a recovery point when the user invokes them. This protocol allows a real time application designer to know the temporal specifications of every system call. Current real time applications are composed of several Real Time processes and they have to share data by using interprocess communication facilities provided by the operating system. The operating system has to take into account these interactions to ensure the consistency of checkpoints. This is done by tracking the communications performed since the last checkpoint and forcing dependent processes to perform a checkpoint at the same time.

English Descriptors: Real time system; Operating system; **Message transmission** ; **Storage** management; Procedure call; **Fault tolerant system** ; System architecture; Experimental study; System performance

French Descriptors: Systeme temps reel; Systeme exploitation; Transmission message; Gestion memoire; Appel procedure; Systeme tolerant les pannes; Architecture systeme; Etude experimentale; Performance systeme

Classification Codes: 001D02B07C; 001D04B03A

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14/5/50 (Item 8 from file: 144)
DIALOG(R)File 144:Pascal
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13255885 PASCAL No.: 97-0527375
Workstation clusters and network-based computing
PANDA Dhabaleswar K, ed; NI Lionel M, ed
Department of Computer and Information Science, The Ohio State University, Columbus, Ohio 43210-1277, United States; Department of Computer Science, Michigan State University, East Lansing, Michigan 48824-1027, United States
Journal: Journal of parallel and distributed computing, 1997, 43 (2) 63-189
ISSN: 0743-7315 Availability: INIST-20948; 354000069993880000
No. of Refs.: dissem.
Document Type: P (Serial) ; M (Monographic)
Country of Publication: United States
Language: English

English Descriptors: Parallel system; Computer network; Distributed **memory** multiprocessor system; Parallel programming; Communication; **Message transmission** ; **Fault tolerant system** ; **Transmission** protocol; Load balancing; Algorithm; Nearest neighbour; C++ language; Program library; System architecture; System performance; Scheduling

French Descriptors: Systeme parallele; Reseau ordinateur; Systeme multiprocesseur memoire repartie; Programmation parallele; Communication; Transmission message; Systeme tolerant les pannes; Protocole transmission ; Equilibrage charge; Algorithme; Plus proche voisin; Langage C++; Bibliotheque programme; Architecture systeme; Performance systeme; Ordonnancement

Classification Codes: 001D02B06; 001D02B10; 001D01A12

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14/5/52 (Item 10 from file: 144)
DIALOG(R)File 144:Pascal
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12651373 PASCAL No.: 96-0345777
Efficient rollback-recovery technique in distributed computing systems
CHIU G M; YOUNG C R
Department of Electrical Engineering and Technology, National Taiwan Institute of Technology, 43 Keelung Rd., Sec. 4, Taipei, Taiwan
Journal: IEEE transactions on parallel and distributed systems, 1996, 7 (6) 565-577
ISSN: 1045-9219 Availability: INIST-22203; 354000060499780030
No. of Refs.: 17 ref.
Document Type: P (Serial) ; A (Analytic)
Country of Publication: United States
Language: English
In this paper we propose a new approach for implementing rollback-recovery in a distributed computing system. A concept of logical ring is introduced for the maintenance of information required for consistent recovery from a system crash. **Message** processing order of a process is kept by all other processes on its logical ring. **Transmission** of data **messages** are accompanied by the circulation of the associated order **messages** on the ring. The sizes of the order **messages** are small. In addition, redundant **transmission** of order information is avoided, thereby reducing the communication overhead incurred during failure-free operation. Furthermore, updating of the order information and garbage collection task are simplified in the proposed mechanism. Our approach does not require information about **message** processing order be written to stable storage; in fact, the time-consuming operations of saving information in stable storage are confined to the checkpointing activities. When failures occur, a surviving process need roll back only if some preceding order information is totally lost, which is relatively unlikely considering the ever growing speed of communication networks. It is shown that a system can recover correctly as long as there exists at least one surviving process.

English Descriptors: Recovery; Failures; Distributed system; **Fault tolerant system** ; **Data transmission** ; Communication; **Message transmission** ; Information **transmission** ; Information processing; Information **storage** ; Updating

French Descriptors: Recuperation; Defaillance; Systeme reparti; Systeme tolerant les pannes; **Transmission** donnee; Communication; **Transmission message** ; **Transmission** information; Traitement information; Stockage information; Mise a jour; Checpoint; Crash recovery; Logical ring; Rollback

Classification Codes: 001D02B04; 001D02B07D

14/5/56 (Item 14 from file: 144)
DIALOG(R)File 144:Pascal
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12123148 PASCAL No.: 95-0353940
Sharing memory robustly in message-passing systems
ATTIYA H; BAR-NOY A; DOLEV D
dep. computer sci., Haifa 32000, Israel
Journal: Journal of the Association for Computing Machinery, 1995, 42 (1) 124-142
ISSN: 0004-5411 CODEN: JACOAH Availability: INIST-8076; 354000056956230050
No. of Refs.: 1 p.1/2
Document Type: P (Serial) ; A (Analytic)
Country of Publication: USA
Language: English
Emulators that translate algorithms from the shared-memory model to two different message-passing models are presented. Both are achieved by implementing a wait-free, atomic, single-writer multi-reader register in unreliable, asynchronous networks. The two message-passing models considered are a complete network with processor failures and an arbitrary network with dynamic link failures. These results make it possible to view the shared-memory model as a higher-level language for designing algorithms in asynchronous distributed systems. Any wait-free algorithm based on atomic, single-writer multi-reader registers can be automatically emulated in message-passing systems, provided that at least a majority of the processors are not faulty and remain connected. The overhead introduced by these emulations is polynomial in the number of processors in the system. Immediate new results are obtained by applying the emulators to known shared-memory algorithms. These include, among others, protocols to solve the following problems in the message-passing model in the presence of processor or link failures: multi-writer multi-reader registers, concurrent time-stamp systems, l-exclusion, atomic snapshots, randomized consensus, and implementation of data structures

English Descriptors: Distributed system; Emulator; **Fault tolerant system** ; Asynchronous; Shared **memory** ; **Message transmission** ; Algorithm

French Descriptors: Systeme reparti; Emulateur; Systeme tolerant les pannes ; Asynchrone; Memoire partagee; Transmission message; Algorithme

```
Set     Items   Description
S1     208367   FTSS OR MIRROR? OR RAID? OR HIGHLY()RELIABLE OR (FAULT? OR
             FAILURE? OR ERROR?)()TOLERAN?()SYSTEM? OR  REDUNDANT?()ARRAY?
S2       3160   S1(10N)(MEMOR? OR STORAGE? OR STORING)
S3    1232860   MESSAG? OR TRANSMISS? OR MAIL? OR EMAIL? OR BROADCAST? OR(-
             COMMUNICATION OR SUBSCRIPTION)()(MANAG? OR AGENT?)
S4     363324   (CONNECT? OR INTERCONNECT?)(3N)(CABLING OR FABRIC? OR HARD-
             WAR? OR BUS? ? OR LINE? OR WIRE? OR CABLE? OR FIBRE? OR FIBER-
             ?) OR PHYSICAL()LAYER?
S5      59035   (DATA OR NETWORK?)()TRANSMISS?
S6         11   S2 AND S3 AND S4
S7         12   S2 AND S3 AND S5
S8        156   S2 AND S3
S9          5   S8 AND IC=(H04L-001? OR H04L-012?)
S10        26   S6 OR S7 OR S9
S11        26   IDPAT (sorted in duplicate/non-duplicate order)
S12        26   IDPAT (primary/non-duplicate records only)
S13         5   S8 AND MC=(W01-A03B OR W01-A06A1 OR W01-A06G2 OR W01-A06G3-
             ?)
S14         2   S13 NOT S10
File 347:JAPIO Oct 1976-2003/Feb(Updated 030603)
         (c) 2003 JPO & JAPIO
File 350:Derwent WPIX 1963-2003/UD,UM &UP=200340
         (c) 2003  Thomson Derwent
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14/5/1 (Item 1 from file: 350)
DIALOG(R)File 350:Derwent WPIX
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014796715 **Image available**
WPI Acc No: 2002-617421/200266
Related WPI Acc No: 2002-268434
XRPX Acc No: N02-488620
Network map generation method for directing traffic to mirrored website, involves assigning Internet protocol address of common routing point as core point in address space of local server
Patent Assignee: LEIGHTON F T (LEIG-I); LEVINE M (LEVI-I); SOVIANI A (SOVI-I); SUNDARAM R (SUND-I)
Inventor: LEIGHTON F T; LEVINE M; SOVIANI A; SUNDARAM R
Number of Countries: 001 Number of Patents: 001
Patent Family:

Patent No	Kind	Date	Applicat No	Kind	Date	Week
US 20020078237	A1	20020620	US 2000207518	A	20000526	200266 B
			US 2000208014	A	20000526	
			US 2001866884	A	20010529	

Priority Applications (No Type Date): US 2001866884 A 20010529; US 2000207518 P 20000526; US 2000208014 P 20000526
Patent Details:

Patent No	Kind	Lan	Pg	Main IPC	Filing Notes
US 20020078237	A1		14	G06F-015/173	Provisional application US 2000207518
					Provisional application US 2000208014

Abstract (Basic): US 20020078237 A1
NOVELTY - A route from each of the two data centers to a specified local server is executed and an intersection of the routes at a common routing point is located. An Internet protocol (IP) address of the common routing point is assigned as a core point in the address space of the local server.
DETAILED DESCRIPTION - INDEPENDENT CLAIMS are included for the following:
(1) Content request routing map generation method; and
(2) Mirror site determination map generation method.
USE - For creating network maps used in directing traffic to **mirrored** websites, directing caches to **storage** servers, directing streaming servers to signal acquisition points, directing logging process to log archiving servers, directing **mail** processes to **mail** server, etc.
ADVANTAGE - Reduces size of the network map and enables intelligent traffic redirection load balancing for local server by creating a generalized core point.
DESCRIPTION OF DRAWING(S) - The figure shows the global traffic management system.
pp; 14 DwgNo 2/8
Title Terms: NETWORK; MAP; GENERATE; METHOD; DIRECT; TRAFFIC; MIRROR; ASSIGN; PROTOCOL; ADDRESS; COMMON; ROUTE; POINT; CORE; POINT; ADDRESS; SPACE; LOCAL; SERVE
Derwent Class: T01; W01
International Patent Class (Main): G06F-015/173
File Segment: EPI

14/5/2 (Item 2 from file: 350)
DIALOG(R)File 350:Derwent WPIX
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013519029 **Image available**
WPI Acc No: 2001-003235/200101
XRPX Acc No: N01-002836
Cross-bar switch for communication network, has status mirror **register to store status information of** memory **during communication**
Patent Assignee: NIPPON DENKI ENG KK (NIDE)

Number of Countries: 001 Number of Patents: 001
Patent Family:

Patent No	Kind	Date	Applicat No	Kind	Date	Week	
JP 2000287230	A	20001013	JP 9989641	A	19990330	200101	B

Priority Applications (No Type Date): JP 9989641 A 19990330
Patent Details:

Patent No	Kind	Lan	Pg	Main IPC	Filing Notes
JP 2000287230	A		10	H04Q-003/52	

Abstract (Basic): JP 2000287230 A
NOVELTY - The data memory (M) of LSI cross-bar switches (X1-1-X2-2) stores data received via **transmission** paths. During communication, status information of **memory** of destination port, is read from status **mirror** register (R) which is connected to intersection of **transmission** and reception paths of communication ports (1-8).
USE - For communication network.
ADVANTAGE - Since status information is stored in status mirror register present in LSI cross-bar switch, no new output pins are required.
DESCRIPTION OF DRAWING(S) - The figure shows block diagram of cross-bar switch.
LSI cross-bar switches (X1-1-X2-2)
Data memory (M)
Status mirror register (R)
Communication ports (1-8)
pp; 10 DwgNo 1/9
Title Terms: CROSS; BAR; SWITCH; COMMUNICATE; NETWORK; STATUS; MIRROR; REGISTER; STORAGE; STATUS; INFORMATION; MEMORY; COMMUNICATE
Derwent Class: W01
International Patent Class (Main): H04Q-003/52
File Segment: EPI

12/5/1 (Item 1 from file: 350)
DIALOG(R)File 350:Derwent WPIX
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015268742 **Image available**
WPI Acc No: 2003-329671/200331
XRPX Acc No: N03-263786
Input/output adaptor for data processing system, has doorbell circuit and mirroring directory coupled to message passing circuit connected to high-speed serial bus between input/output adaptors
Patent Assignee: BAKKE B E (BAKK-I); GALBRAITH R E (GALB-I); HUSS F L (HUSS-I); MOERTL D F (MOER-I); REULAND P G (REUL-I); SCHIMKE T J (SCHI-I)
Inventor: BAKKE B E; GALBRAITH R E; HUSS F L; MOERTL D F; REULAND P G; SCHIMKE T J
Number of Countries: 001 Number of Patents: 001
Patent Family:

Patent No	Kind	Date	Applicat No	Kind	Date	Week	
US 20030005202	A1	20030102	US 2001894428	A	20010627	200331	B

Priority Applications (No Type Date): US 2001894428 A 20010627
Patent Details:

Patent No	Kind	Lan	Pg	Main IPC	Filing Notes
US 20030005202	A1		12	G06F-013/38	

Abstract (Basic): US 20030005202 A1
NOVELTY - A **message** passing circuit is coupled to a high speed serial **bus** **connected** between the input/output (I/O) adaptors, for data transfer operation. A doorbell circuit and a mirroring directory are coupled to the **message** passing circuit, for providing low level communication between adaptors and for mirroring cache directory writes.
DETAILED DESCRIPTION - INDEPENDENT CLAIMS are included for the following:
(1) dual storage adaptor; and
(2) data processing system.
USE - For data processing system (claimed).
ADVANTAGE - Enables **mirroring** required data and directory information between two clustered **storage** adaptors, thereby achieving fast data transfer that requires no firmware support on adaptors.
DESCRIPTION OF DRAWING(S) - The figure shows the block diagram of data processing system.
pp; 12 DwgNo 1/4
Title Terms: INPUT; OUTPUT; ADAPT; DATA; PROCESS; SYSTEM; CIRCUIT; MIRROR; DIRECTORY; COUPLE; **MESSAGE** ; PASS; CIRCUIT; CONNECT; HIGH; SPEED; SERIAL ; BUS; INPUT; OUTPUT; ADAPT
Derwent Class: T01
International Patent Class (Main): G06F-013/38
File Segment: EPI

12/5/2 (Item 2 from file: 350)
DIALOG(R)File 350:Derwent WPIX
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015238646 **Image available**
WPI Acc No: 2003-299572/200329
Related WPI Acc No: 2003-299571; 2003-341529
XRPX Acc No: N03-238335
Data replica updating method using Internet, involves generating replica for transmission to data replication facility of electronic device, when replica held by remote storage device cannot be updated due to error in storage network
Patent Assignee: SUN MICROSYSTEMS INC (SUNM)
Inventor: CROSLAND S; NEWTON P; TELOH J
Number of Countries: 001 Number of Patents: 001
Patent Family:

Patent No	Kind	Date	Applicat No	Kind	Date	Week

US 20030014433 A1 2003011[redacted] US 2001905436 A 20010713 [redacted]329 B
US 2001988854 A 20011119

Priority Applications (No Type Date): US 2001905436 A 20010713; US 2001988854 A 20011119
Patent Details:
Patent No Kind Lan Pg Main IPC Filing Notes
US 20030014433 A1 18 G06F-012/00 Cont of application US 2001905436

Abstract (Basic): US 20030014433 A1
NOVELTY - A data replication facility of an electronic device is instructed to replicate data corresponding to writes identified in a local storage device (24), to generate a replica, when the replica held by a remote storage device (26) of a storage network cannot be updated due to an error condition in the network. The generated replica is then output to a data replication facility of another electronic device using a communication protocol.
DETAILED DESCRIPTION - INDEPENDENT CLAIMS are included for the following:
(1) communication link failure handling method; and
(2) readable medium storing data replica updating program.
USE - For replicating data from a central repository including corporation's headquarters, government agency, etc., to remote repositories through a computer network e.g. Internet.
ADVANTAGE - Enables remote data **mirroring** amongst multiple remote **storage** devices across **data transmission** paths having various **transmission** capabilities and remote mirroring sites operating on various platforms. Thus, achieves data protection and supports data utilization by multiple employees and clients across diverse geographical areas.
DESCRIPTION OF DRAWING(S) - The figure shows the block diagram of the data replica updating system.
local storage device (24)
remote storage device (26)
pp; 18 DwgNo 1/9
Title Terms: DATA; REPLICA; UPDATE; METHOD; GENERATE; REPLICA; **TRANSMISSION** ; DATA; REPLICA; FACILITY; ELECTRONIC; DEVICE; REPLICA; HELD ; REMOTE; STORAGE; DEVICE; UPDATE; ERROR; STORAGE; NETWORK
Derwent Class: T01; W01
International Patent Class (Main): G06F-012/00
File Segment: EPI

12/5/3 (Item 3 from file: 350)
DIALOG(R)File 350:Derwent WPIX
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015113754 **Image available**
WPI Acc No: 2003-174274/200317
XRPX Acc No: N03-137187
Controller device for data transmission **in between data storage system and host computer, has separate interconnection channel connecting interfaces of memory controllers of auxiliary processors**
Patent Assignee: INT BUSINESS MACHINES CORP (IBMC)
Inventor: OTTERNESS N S; SKAZINSKI J G
Number of Countries: 001 Number of Patents: 001
Patent Family:
Patent No Kind Date Applicat No Kind Date Week
US 20020152355 A1 20021017 US 2001836806 A 20010416 200317 B

Priority Applications (No Type Date): US 2001836806 A 20010416
Patent Details:
Patent No Kind Lan Pg Main IPC Filing Notes
US 20020152355 A1 19 G06F-013/00

Abstract (Basic): US 20020152355 A1
NOVELTY - A primary processor (25) and an auxiliary processor (29) are connected by a peripheral component **interconnect bus** (40). An

interface of a memory controller of the auxiliary processor (29) is connected to an interface of a memory controller of another auxiliary processor (30) by an interconnection channel separate from the peripheral component **interconnect bus** .

DETAILED DESCRIPTION - INDEPENDENT CLAIMS are included for the following:

(1) a write operation execution method in data storage system;

(2) a computer program product for write operation execution; and

(3) a **message** communicating apparatus.

USE - Controller device for **data transmission** in between data **storage** system e.g. **redundant array** of inexpensive disk **storage** system and host computer.

ADVANTAGE - Increases available storage device interconnect channel capacity by routing controller-to-controller **messages** through interconnection channel separate from peripheral component **interconnect bus** used for communicating redundant array of inexpensive disk data. Reduces performance bottlenecks and reduces the number of storage device accesses and the associated impact on the system bandwidth.

DESCRIPTION OF DRAWING(S) - The figure shows the diagrammatic illustration of controller configuration providing multiple specialized processor/memory controllers and associated memories in addition to central processing unit and multiple independent disk loops.

Primary processor (25)

Auxiliary processors (29,30)

Interconnect bus (40)

pp; 19 DwgNo 2/8

Title Terms: CONTROL; DEVICE; DATA; **TRANSMISSION** ; DATA; STORAGE; SYSTEM; HOST; COMPUTER; SEPARATE; INTERCONNECT; CHANNEL; CONNECT; INTERFACE; MEMORY; CONTROL; AUXILIARY; PROCESSOR

Derwent Class: T01; T03; W01

International Patent Class (Main): G06F-013/00

File Segment: EPI

12/5/4 (Item 4 from file: 350)

DIALOG(R)File 350:Derwent WPIX

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014872529 **Image available**

WPI Acc No: 2002-693235/200275

XRPX Acc No: N02-546872

Data processing system for graphics applications, has signal sampling circuit and mirror memory **circuit that are** connected **through** transmission line **terminated at one end where** mirror memory **circuit is present**

Patent Assignee: SONY COMPUTER ENTERTAINMENT INC (SONY); SONY COMPUTER ENTERTAINMENT KK (SONY)

Inventor: TAKASHIMA S

Number of Countries: 028 Number of Patents: 003

Patent Family:

Patent No	Kind	Date	Applicat No	Kind	Date	Week	
EP 1246068	A2	20021002	EP 20027042	A	20020327	200275	B
US 20020162054	A1	20021031	US 2002113746	A	20020401	200279	
JP 2002358250	A	20021213	JP 200252965	A	20020228	200311	

Priority Applications (No Type Date): JP 200252965 A 20020228; JP 200198317 A 20010330

Patent Details:

Patent No	Kind	Lan	Pg	Main IPC	Filing Notes
EP 1246068	A2	E	18	G06F-011/34	
	Designated States (Regional): AL AT BE CH CY DE DK ES FI FR GB GR IE IT LI LT LU LV MC MK NL PT RO SE SI TR				
US 20020162054	A1			H02H-003/05	
JP 2002358250	A		10	G06F-013/00	

Abstract (Basic): EP 1246068 A2

NOVELTY - A sampling memory circuit (40) holds data transmitted

between memory circuit (11) and memory controller (12). A signal sampling circuit (20) transfers the transmitted data to a **mirror memory** circuit (30). The signal sampling circuit and the **mirror memory** circuit are connected through a single end terminated **transmission** line that is terminated at one end where the **mirror memory** circuit is present.

DETAILED DESCRIPTION - INDEPENDENT CLAIMS are included for the following:

(1) Data processing method; and

(2) Data processing program.

USE - Data processing system for graphical applications.

ADVANTAGE - The sampling **memory** circuit keeps the data transmitted between **mirror memory** circuit and signal sampling circuit connected through single end terminated **transmission** line such that the data on the **transmission** line is monitored easily and accurately.

DESCRIPTION OF DRAWING(S) - The figure shows the block diagram of the electronic machine.

Memory circuit (11)

Memory controller (12)

Signal sampling circuit (20)

Mirror memory circuit (30)

Sampling memory circuit (40)

pp; 18 DwgNo 1/7

Title Terms: DATA; PROCESS; SYSTEM; GRAPHIC; APPLY; SIGNAL; SAMPLE; CIRCUIT ; MIRROR; MEMORY; CIRCUIT; CONNECT; THROUGH; **TRANSMISSION** ; LINE; TERMINATE; ONE; END; MIRROR; MEMORY; CIRCUIT; PRESENT

Derwent Class: T01

International Patent Class (Main): G06F-011/34; G06F-013/00; H02H-003/05

File Segment: EPI

12/5/5 (Item 5 from file: 350)

DIALOG(R)File 350:Derwent WPIX

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014805722 **Image available**

WPI Acc No: 2002-626428/200267

XRPX Acc No: N02-495371

Redundant array of inexpensive disk controller for data transmission , **has** RAID **level programs stored in read only** memory **to control process control unit for** data transmission **to host system**

Patent Assignee: HUNG M (HUNG-I)

Inventor: HUNG M

Number of Countries: 001 Number of Patents: 001

Patent Family:

Patent No	Kind	Date	Applicat No	Kind	Date	Week	
US 20020078276	A1	20020620	US 2001952606	A	20010913	200267	B

Priority Applications (No Type Date): TW 2000U222113 U 20001220

Patent Details:

Patent No	Kind	Lan	Pg	Main IPC	Filing Notes
US 20020078276	A1		7	G06F-013/10	

Abstract (Basic): US 20020078276 A1

NOVELTY - A CPU (14) responds to interrupt commands from the host and disk array IDE interface to execute data read/write commands and stores them in a buffer **memory** unit (9). A ROM (33) stores the **redundant array** of inexpensive disks (RAID) level 3, level 4, level 5, level 6 programs to control a process control unit (23) connected to the CPU, and process the stored data to be transmitted to a host system (200) or to the disk arrays (101,102), respectively.

USE - For **data transmission** between host system and disk array system.

ADVANTAGE - The CPU is able to read data stored in the array, checks whether the data is defective or not and restores the defective data of necessary and transmit them back to the host system effectively.

DESCRIPTION OF DRAWING(S) - The figure shows the block diagram of the RAID controller.
Buffer memory unit (9)
CPU (14)
Process control unit (23)
Read only memory (33)
Disk arrays (101,102)
Host system (200)
pp; 7 DwgNo 1/3
Title Terms: REDUNDANT; ARRAY; INEXPENSIVE; DISC; CONTROL; DATA; **TRANSMISSION** ; RAID; LEVEL; PROGRAM; STORAGE; READ; MEMORY; CONTROL; PROCESS; CONTROL; UNIT; DATA; **TRANSMISSION** ; HOST; SYSTEM
Derwent Class: T01; T03
International Patent Class (Main): G06F-013/10
File Segment: EPI

12/5/6 (Item 6 from file: 350)
DIALOG(R)File 350:Derwent WPIX
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014739456 **Image available**
WPI Acc No: 2002-560161/200260
XRPX Acc No: N02-443489
Data interconnection system has FTSS architecture combines internal and network transmission
Patent Assignee: HEWLETT-PACKARD CO (HEWP)
Inventor: GAITHER B D; MCKEE B A
Number of Countries: 001 Number of Patents: 001
Patent Family:

Patent No	Kind	Date	Applicat No	Kind	Date	Week	
FR 2818849	A1	20020628	FR 200113950	A	20011029	200260	B

Priority Applications (No Type Date): US 2000703428 A 20001031
Patent Details:

Patent No	Kind	Lan	Pg	Main IPC	Filing Notes
FR 2818849	A1		51	H04L-012/46	

Abstract (Basic): FR 2818849 A1
NOVELTY - A data interconnection system couples servers (80, 82, 84, 86, 88, 90) to an FTSS system through **FTSS** architecture (94) and stores packets on arrival in reliable permanent **memory** (92) with packet receipts sent to an external network (96) on arrival at the correct server system.
USE - Fault tolerant interconnection system for **data transmission** .
ADVANTAGE - Ensures reliable handling of packets. Combines internal file input output and external **transmission** functions.
DESCRIPTION OF DRAWING(S) - The drawing is a system block diagram. (Drawing includes non English language text)
Servers (80, 82, 84, 86, 88, 90)
Fault Tolerant Server System (FTSS) architecture (94)
External network (96)
pp; 51 DwgNo 4/8
Title Terms: DATA; INTERCONNECT; SYSTEM; ARCHITECTURE; COMBINATION; INTERNAL; NETWORK; **TRANSMISSION**
Derwent Class: W01
International Patent Class (Main): **H04L-012/46**
International Patent Class (Additional): **H04L-001/00**
File Segment: EPI

12/5/7 (Item 7 from file: 350)
DIALOG(R)File 350:Derwent WPIX
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014464201 **Image available**
WPI Acc No: 2002-284904/200233

XRPX Acc No: N02-222713
FIFO memory for clock-cross-over circuit of transmission **device, synchronizes read and write clock signals with read-out and write-in pulse signals from respective counters and provides to capacity monitoring counter**
Patent Assignee: FUJITSU LTD (FUIT)
Number of Countries: 001 Number of Patents: 001
Patent Family:

Patent No	Kind	Date	Applicat No	Kind	Date	Week	
JP 2001285346	A	20011012	JP 200090105	A	20000329	200233	B

Priority Applications (No Type Date): JP 200090105 A 20000329
Patent Details:

Patent No	Kind	Lan	Pg	Main IPC	Filing Notes
JP 2001285346	A		9	H04L-012/56	

Abstract (Basic): JP 2001285346 A
NOVELTY - The clock signals (CKA,CKB) corresponding to read and write signals are synchronized with respective read-out and write-in counter (WCTR) (32), which are input to a capacity monitoring counter (MCTR) (37).
USE - For use in clock-cross-over circuit of **transmission** devices.
ADVANTAGE - Provides a **highly reliable** FIFO **memory** that effectively counts the number of data read from or written into the memory using the capacity monitoring counter and thus avoids malfunctioning of the memory.
DESCRIPTION OF DRAWING(S) - The figure shows a diagram explaining the operation principle of the FIFO memory. (Drawing includes non-English language text).
WCTR (32)
MCTR (37)
Clock signals (CKA,CKB)
pp; 9 DwgNo 1/7
Title Terms: FIFO; MEMORY; CLOCK; CROSS; CIRCUIT; **TRANSMISSION** ; DEVICE; SYNCHRONISATION; READ; WRITING; CLOCK; SIGNAL; READ; WRITING; PULSE; SIGNAL; RESPECTIVE; COUNTER; CAPACITY; MONITOR; COUNTER
Derwent Class: T01; U14; W01
International Patent Class (Main): **H04L-012/56**
International Patent Class (Additional): G06F-005/06; G06F-012/00; G11C-007/00; **H04L-012/28** ; H04L-013/08
File Segment: EPI

12/5/8 (Item 8 from file: 350)
DIALOG(R)File 350:Derwent WPIX
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013990039 **Image available**
WPI Acc No: 2001-474253/200151
System and method for overcoming raid fault through cache mirroring
Patent Assignee: SAMSUNG ELECTRONICS CO LTD (SMSU)
Inventor: OH G S
Number of Countries: 001 Number of Patents: 001
Patent Family:

Patent No	Kind	Date	Applicat No	Kind	Date	Week	
KR 2001011204	A	20010215	KR 9930451	A	19990726	200151	B

Priority Applications (No Type Date): KR 9930451 A 19990726
Patent Details:

Patent No	Kind	Lan	Pg	Main IPC	Filing Notes
KR 2001011204	A		1	G06F-011/00	

Abstract (Basic): KR 2001011204 A
NOVELTY - A system and a method for overcoming RAID(Redundant Array of Inexpensive Disk) fault are provided for safe **transmission** of data from a host server to a RAID array(500) by using, instead of malfunctioned RAID controller, auxiliary RAID performing cache

mirroring with the malf[redacted]tioned RAID.

DETAILED DESCRIPTION - A host server transmits data to store. A RAID array(500) contains a number of disk drive and stores data from the host server. A pair of RAID controller(400,410) having same structure each other are connected respectively to the RAID array(500) and control the RAID array(500) by request of the host server. A serial **cable** (1) makes a **connection** between the pair of RAID controller for cache mirroring duplicating cache data of the pair of RAID controller(400,410) each other. The RAID controller(400,410) comprises respectively a pair of RAID management block(403,413) for management of the RAID array(500), a regional cache(401) and a remote cache(411) each for temporal **storage** of data from the host server and cache **mirroring** , a pair of cache block(402,412) for control of the cache(401,411) and a pair of interface block(404,414) for supplying **connection** via the serial **cable** (1) between the pair of cache block (402,412) to perform cache mirroring.

pp; 1 DwgNo 1/10

Title Terms: SYSTEM; METHOD; OVERCOME; RAID; FAULT; THROUGH; CACHE; MIRROR
Derwent Class: T01
International Patent Class (Main): G06F-011/00
File Segment: EPI

12/5/9 (Item 9 from file: 350)
DIALOG(R)File 350:Derwent WPIX
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013595977 **Image available**
WPI Acc No: 2001-080184/200109
XRPX Acc No: N01-061120

Network-based mail **attachment storage system transmits appended electronic** mail **item including uniform resource locator but excluding stored attachment, based on forwarding specification**

Patent Assignee: THINMAIL INC (THIN-N)
Inventor: POLLACK J
Number of Countries: 090 Number of Patents: 003
Patent Family:

Patent No	Kind	Date	Applicat No	Kind	Date	Week	
WO 200067133	A1	20001109	WO 2000US9561	A	20000411	200109	B
AU 200043384	A	20001117	AU 200043384	A	20000411	200111	
US 6505236	B1	20030107	US 99302877	A	19990430	200306	

Priority Applications (No Type Date): US 99302877 A 19990430
Patent Details:

Patent No	Kind	Lan	Pg	Main IPC	Filing Notes
WO 200067133	A1	E	31	G06F-013/00	

Designated States (National): AE AL AM AT AU AZ BA BB BG BR BY CA CH CN CR CU CZ DE DK DM 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 NO NZ PL PT RO RU SD SE SG SI SK SL TJ TM TR TT TZ UA UG UZ VN YU ZA ZW
Designated States (Regional): AT BE CH CY DE DK EA ES FI FR GB GH GM GR IE IT KE LS LU MC MW NL OA PT SD SE SL SZ TZ UG ZW

AU 200043384	A	G06F-013/00	Based on patent WO 200067133
US 6505236	B1	G06F-015/16	

Abstract (Basic): WO 200067133 A1

NOVELTY - A storage device (26) stores stripped attachment (20') at preset address (40) with specific file name (38). Generator (42) generates uniform resource locator (URL) (44) related to preset address and file name. Appender (46) appends URL to electronic **mail** item (14). A portal (48) transmits the appended e- **mail** including URL but excluding the stored attachment (20), based on forwarding specification (18).

DETAILED DESCRIPTION - A portal (12) receives the electronic **mail** item (14) containing forwarding specification (18) and an attachment (20). An attachment stripper (24) detaches the attachment from electronic **mail** item. A parser (41) extracts a recipient address (19) from forwarding specification. An attachment retriever (50) enables

recipient (22) to retri[redacted] the stored data attachment (2[redacted] from the storage device. A policy interpreter (52) determines if recipient is to be charged a fee for retrieving stored attachments. A timer (54) calculates a deletion time after which stored attachment is to be deleted. An attachment deleter (56) deletes stored attachment upon expiration of deletion time. A sender notifier (58) notifies sender (16) when recipient retrieved stored attachment. A comparator (60) compares stored attachment to previously stored attachments, to determine if any attachment are identical. A redundancy deleter (62) deletes stored attachment when it is identical to previously stored attachment. A redirector (64) redirects the uniform resource locator pointing to deleted attachment so that it points to identical previously stored attachment. The storage device which stores stripped attachment is chosen from the group consisting of hard drives (28), optical drives (30), random access **memories** (32), tape drives (34) and **RAID** arrays (36). INDEPENDENT CLAIMS are also included for the following:

(a) network-based **mail** attachment storage method;

(b) network-based **mail** attachment storage program

USE - Network-based **mail** attachment storage system for detaching and storing electronic **mail** attachments.

ADVANTAGE - Since e- **mail** attachments are detached from user's e- **mail** , the content of e- **mail** can be downloaded quickly and easily by user. Since detached e- **mail** attachment is stored and content of e- **mail** is appended to include uniform resource locator, the user can retrieve the e- **mail** attachment at a later time.

DESCRIPTION OF DRAWING(S) - The figure shows the diagrammatic view of the network-based e- **mail** attachment storage system.

Portal (12,48)
Electronic **mail** item (14)
Sender (16)
Specification (18)
Recipient address (19)
Attachments (20,20')
Recipient (22)
Attachment stripper (24)
Storage device (26)
Hard drives (28)
Optical drives (30)
Random access memories (32)
Tape drives (34)
RAID arrays (36)
File name (38)
Present address (40)
Parser (41)
Generator (42)
URL (44)
Appender (46)
Retriever (50)
Policy interpreter (52)
Timer (54)
Deleter (56)
Sender notifier (58)
Comparator (60)
Redundancy deleter (62)
Redirector (64)
pp; 31 DwgNo 1/4

Title Terms: NETWORK; BASED; **MAIL** ; ATTACH; STORAGE; SYSTEM; TRANSMIT; APPENDAGE; ELECTRONIC; **MAIL** ; ITEM; UNIFORM; RESOURCE; LOCATE; EXCLUDE; STORAGE; ATTACH; BASED; FORWARDING; SPECIFICATION
Derwent Class: T01; W01
International Patent Class (Main): G06F-013/00; G06F-015/16
International Patent Class (Additional): G06F-015/167; G06F-017/30; **H04L-012/00**
File Segment: EPI

12/5/10 (Item 10 from file: 350)

DIALOG(R)File 350:Derwent W[redacted]
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012676642 **Image available**
WPI Acc No: 1999-482749/199941
XRPX Acc No: N99-359779
Data transmission **device - has controller which regulates operating condition of optical deflecting components in optical deflecting unit based on digital data stored in memory**
Patent Assignee: ASAHI OPTICAL CO LTD (ASAO)
Number of Countries: 001 Number of Patents: 001
Patent Family:

Patent No	Kind	Date	Applicat No	Kind	Date	Week	
JP 11202227	A	19990730	JP 9815019	A	19980109	199941	B

Priority Applications (No Type Date): JP 9815019 A 19980109
Patent Details:

Patent No	Kind	Lan	Pg	Main IPC	Filing Notes
JP 11202227	A		8	G02B-026/08	

Abstract (Basic): JP 11202227 A
NOVELTY - A controller (16) regulates the operating condition of each optical deflecting component based on the digital data stored in the memory. DETAILED DESCRIPTION - A memory (11) stores data consisting of several bits. An optical deflecting unit (20) contains two-dimensional micro mirrors (21) which can selectively set up the ON state, which deflects incidented light rays at a predetermined direction, and an OFF state in which no deflection is performed.INDEPENDENT CLAIMS are also included for the following:a data receiver; a data communication system.
USE - None given.
ADVANTAGE - Speeds up optical communication. DESCRIPTION OF DRAWING(S) - The figure shows the schematic component diagram of the data communication unit. (11) **Memory** ; (16) Controller; (20) Optical deflecting unit; (21) Micro **mirrors** .
Dwg.1/13
Title Terms: DATA; **TRANSMISSION** ; DEVICE; CONTROL; REGULATE; OPERATE; CONDITION; OPTICAL; DEFLECT; COMPONENT; OPTICAL; DEFLECT; UNIT; BASED; DIGITAL; DATA; STORAGE; MEMORY
Derwent Class: P81; W02
International Patent Class (Main): G02B-026/08
International Patent Class (Additional): H04B-010/00; H04B-010/04; H04B-010/06; H04B-010/14; H04B-010/26; H04B-010/28
File Segment: EPI; EngPI

12/5/11 (Item 11 from file: 350)
DIALOG(R)File 350:Derwent WPIX
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012564474 **Image available**
WPI Acc No: 1999-370580/199931
XRPX Acc No: N99-276309
Redundant memory cell array for semiconductor memory such as dynamic random access memory (DRAM)
Patent Assignee: MITSUBISHI ELECTRIC CORP (MITQ); MITSUBISHI DENKI KK (MITQ)
Inventor: AMANO T; ARIMOTO K; FUJINO T; KINOSHITA M; KOBAYASHI M; MORISHITA F; TANIZAKI T; TSURUDA T
Number of Countries: 002 Number of Patents: 002
Patent Family:

Patent No	Kind	Date	Applicat No	Kind	Date	Week	
US 5914907	A	19990622	US 98122760	A	19980727	199931	B
JP 11219598	A	19990810	JP 9821806	A	19980203	199942	

Priority Applications (No Type Date): JP 9821806 A 19980203
Patent Details:

Patent No	Kind	Lan	Pg	Main IPC	Filing Notes

US 5914907 A 23 G11C 8/00
JP 11219598 A 17 G11C-029/00
Abstract (Basic): US 5914907 A
NOVELTY - A redundant memory cell array is arranged at the intersection of a second row and column, which is further divided into subblocks having a predetermined number of memory cell rows and columns. The defective subblock of a **memory** cell array is replaced with a corresponding subblock of the **redundant array** based on an external setting.
DETAILED DESCRIPTION - Eight memory cell arrays are arranged by dividing the mounting surface into three rows and columns, except the region located at the intersection of the second row and the second column. Each array includes intersecting word and bit lines. Several memory cells are provided corresponding to the intersection of a word line and a bit line.
USE - For e.g. a DRAM.
ADVANTAGE - Minimizes delays in **data transmission** and accessing time and thus provides efficient error detection and a **highly reliable memory** . Allows the number of subblocks for redundancy operation to be minimized and chip area to be reduced since a redundant circuit is not required for each regular memory cell array.
DESCRIPTION OF DRAWING(S) - The figure shows a configuration of a plan view of the semiconductor memory device.
pp; 23 DwgNo 1/17
Title Terms: REDUNDANT; MEMORY; CELL; ARRAY; SEMICONDUCTOR; MEMORY; DYNAMIC ; RANDOM; ACCESS; MEMORY; DRAM
Derwent Class: U13; U14
International Patent Class (Main): G11C-008/00; G11C-029/00
International Patent Class (Additional): G11C-007/00
File Segment: EPI

12/5/12 (Item 12 from file: 350)
DIALOG(R)File 350:Derwent WPIX
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012526442 **Image available**
WPI Acc No: 1999-332548/199928
XRPX Acc No: N99-250183
Video cassette tape with memory, for signal recording-reproducing apparatus e.g. digital video tape recorder (VTR) - has power supply that produces DC power from power supply signal of power supply signal receiving coil, and supplies DC power as drive power to required location in cassette tape body
Patent Assignee: HITACHI LTD (HITA)
Number of Countries: 001 Number of Patents: 001
Patent Family:

Patent No	Kind	Date	Applicat No	Kind	Date	Week	
JP 11120741	A	19990430	JP 97280509	A	19971014	199928	B

Priority Applications (No Type Date): JP 97280509 A 19971014
Patent Details:

Patent No	Kind	Lan	Pg	Main IPC	Filing Notes
JP 11120741	A		9	G11B-023/30	

Abstract (Basic): JP 11120741 A
NOVELTY - A power supply (1e4) produces DC power from power supply signal from a power supply signal receiving coil (1g), and to supply the DC power as a drive power to a required location in a cassette tape body (1a). The coil receives the power signal from the power signal **transmission** coil (35) of a power supply circuit (37) in a non-contact state. DETAILED DESCRIPTION - A **data transmission** -receiving coil (1f) performs the non-contact **transmission** and reception of data to and from the data transmitting-receiving coil (34) a data interface (36). A data interface circuit (1e1) forwards and receives data to and from the data interface (36) via the **data transmission** -receiving coil (1f) and the coil (34). The data from the data interface circuit are written in a memory (1e). A microcomputer (1e3) reads the data from

the memory and forwards the read data to the data interface circuit.An INDEPENDENT CLAIMS is included for a signal recording-reproducing apparatus.

USE - For e.g. digital VTR.

ADVANTAGE - Prevents e.g. contact failure, destruction of circuit elements e.g. **memory** due to static charge, thus ensuring **highly reliable** video cassette tape. DESCRIPTION OF DRAWING(S) - The figure shows the block diagram of the video cassette tape. (1a) Cassette tape body; (1e) Memory; (1e3) Microcomputer; (1e4) Power supply; (1f) **Data transmission** -receiving coil; (1g) Power supply signal receiving coil; (34) Data transmitting-receiving coil; (35) Power signal **transmission** coil; (36) Data interface; (37) Power supply circuit.

Dwg.1/5

Title Terms: VIDEO; CASSETTE; TAPE; MEMORY; SIGNAL; RECORD; REPRODUCE; APPARATUS; DIGITAL; VIDEO; TAPE; RECORD; VTR; POWER; SUPPLY; PRODUCE; DC; POWER; POWER; SUPPLY; SIGNAL; POWER; SUPPLY; SIGNAL; RECEIVE; COIL; SUPPLY; DC; POWER; DRIVE; POWER; REQUIRE; LOCATE; CASSETTE; TAPE; BODY

Derwent Class: T03; W04

International Patent Class (Main): G11B-023/30

International Patent Class (Additional): G11B-015/07

File Segment: EPI

12/5/13 (Item 13 from file: 350)

DIALOG(R)File 350:Derwent WPIX

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012422771 **Image available**

WPI Acc No: 1999-228879/199919

Related WPI Acc No: 1998-100603

XRPX Acc No: N99-169372

Fault tolerant controller system for digital data transmission

Patent Assignee: EMC CORP (EMCE-N)

Inventor: BRANT W A; HOWARD G W; NIELSON M E

Number of Countries: 001 Number of Patents: 001

Patent Family:

Patent No	Kind	Date	Applicat No	Kind	Date	Week	
US 5887270	A	19990323	US 95561337	A	19951121	199919	B
			US 97934909	A	19970922		

Priority Applications (No Type Date): US 95561337 A 19951121; US 97934909 A 19970922

Patent Details:

Patent No	Kind	Lan	Pg	Main IPC	Filing Notes
US 5887270	A		11	G06F-012/00	Div ex application US 95561337
					Div ex patent US 5708771

Abstract (Basic): US 5887270 A

NOVELTY - Data associated with write requests from host computer are inserted in duplicate locations within portion of buffer **memory** dedicated for write recording. Data is concurrently handled in **mirrored** fashion within the portion of buffer **memory** dedicated to write requests.

DETAILED DESCRIPTION - The system is used for supervising the operation of a buffer memory functions under the direction of attached controller which transfers data into and out of satellite data storage units in response to data read and write requests. An interfacing module (25A,25B) is used for monitoring write requests from the host computer and determines an anticipated quantity of storage needed for temporarily retaining data in buffer memory.

Based on quantity of storage needed for accommodating outstanding write data requests from host computer, a boundary (44) is established within the memory. The memory is controlled so that only write data is allowed in the buffer side on one side of the boundary and only read data is recorded on the other side of the boundary. Data is also handled on a higher band width non- **mirror** fashion in portion of buffer **memory** dedicated to host computer read requests. The controller and memory are powered from a primary source and an

auxiliary power source. Contents of the memory are transferred to another memory when primary source fails.

USE - For digital **data transmission** between host computer and caching disk array controller systems.

ADVANTAGE - Inclusion of redundant power systems enhances ability of data storage controller to recover from a single point of failure as well as to provide the ability to recover from a major system power loss. Increases reliability as data received for writing is duplicated.

DESCRIPTION OF DRAWING(S) - The drawing shows the fault tolerant disk array controller and **mirrored memory** .

Interfacing module (25A,25B)

Boundary (44)

pp; 11 DwgNo 1,2/4

Title Terms: FAULT; TOLERATE; CONTROL; SYSTEM; DIGITAL; DATA; **TRANSMISSION**

Derwent Class: T01
International Patent Class (Main): G06F-012/00
File Segment: EPI

12/5/14 (Item 14 from file: 350)

DIALOG(R)File 350:Derwent WPIX
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011272233 **Image available**
WPI Acc No: 1997-250136/199723
XRPX Acc No: N97-206565

Memory accessing method for information processor - in which notification of access end signal is output to information processor when data judged by first and second judging unit, contain no error

Patent Assignee: FUJI ELECTRIC CO LTD (FJIE); FUJIFACON CORP (FUJX)
Number of Countries: 001 Number of Patents: 001
Patent Family:

Patent No	Kind	Date	Applicat No	Kind	Date	Week	
JP 9081463	A	19970328	JP 95236420	A	19950914	199723	B

Priority Applications (No Type Date): JP 95236420 A 19950914
Patent Details:

Patent No	Kind	Lan	Pg	Main IPC	Filing Notes
JP 9081463	A		30	G06F-012/16	

Abstract (Basic): JP 9081463 A

The method is applicable for reading/writing of data between an information processor (101) and a data memory device (102). When a memory access demand is output then the output of information processor is **connected** to a **transmission cable** (8). A first latch unit (105) latches the data and a second error detecting code output through a second bus (7) from the data memory device, is input through a first bus (6). A first error detecting code generation/judging unit judges error in latched data by first latch unit, using the received second error detecting code. Based on the demand from the first judging unit, data latch operation and data latch release operation are performed repeatedly at regular intervals.

When the next memory access demand is output, then the output of data memory device is **connected** through **transmission cable** . A second latch unit (106) latches the received data and a first error detecting code output through the first bus of information processor is input through the second bus. A second error detecting code generation/judging unit judges error in the latched data using the error detecting code. Based on the demand from the second judging unit, data latch operation and data latch release operation is repeatedly performed at regular intervals. But, when the data judged by the first and second judging units contain no error, then a notification of access end signal is output to the information processor.

ADVANTAGE - Realizes **highly reliable memory** accessing method. Avoids exclusive mechanism for retry operation, thereby reduces cost of appts.

12/5/16 **(Item 16 from file: 350)**
DIALOG(R)File 350:Derwent WPIX
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010374219 **Image available**
WPI Acc No: 1995-275581/199536
XRPX Acc No: N95-210604
Networking module for fault-tolerant transmission **of system management information - has primary** transmission **and secondary back-up** transmission **using two system management buses with microprocessor controllers**
Patent Assignee: CABLETRON SYSTEMS INC (CABL-N); FEE B (FEEB-I); OLIVER C (OLIV-I)
Inventor: FEE B; OLIVER C
Number of Countries: 020 Number of Patents: 005
Patent Family:

Patent No	Kind	Date	Applicat No	Kind	Date	Week	
WO 9520853	A1	19950803	WO 95US1177	A	19950126	199536	B
AU 9516950	A	19950815	AU 9516950	A	19950126	199546	
US 5485576	A	19960116	US 94188033	A	19940128	199609	
EP 741939	A1	19961113	EP 95908729	A	19950126	199650	
			WO 95US1177	A	19950126		
JP 9508483	W	19970826	JP 95520220	A	19950126	199744	
			WO 95US1177	A	19950126		

Priority Applications (No Type Date): US 94188033 A 19940128
Cited Patents: 2.Jnl.Ref
Patent Details:

Patent No	Kind	Lan	Pg	Main IPC	Filing Notes
WO 9520853	A1	E	23	H04L-029/14	
Designated States (National): AU JP					
Designated States (Regional): AT BE CH DE DK ES FR GB GR IE IT LU MC NL PT SE					
AU 9516950	A			H04L-029/14	Based on patent WO 9520853
US 5485576	A		11	G06F-011/20	
EP 741939	A1	E	1	H04L-029/14	Based on patent WO 9520853
Designated States (Regional): AT BE CH DE DK ES FR GB GR IE IT LI LU MC NL PT SE					
JP 9508483	W		32	G06F-013/00	Based on patent WO 9520853

Abstract (Basic): WO 9520853 A

The networking module (10) is positionable in a chassis and has several modules connected by two (20,26) system management buses. Each module has a processor. A fault-tolerant communication and control system on each module has a microprocessor controller (22), coupled between the first system management bus and a processor (CPU) located on the networking module.

The secondary path includes a second microprocessor controller and a dual-port memory. The second controller system is coupled to the second system management bus and to a first port of the memory, and a second port of the memory is coupled to the CPU. The dual-port memory provides an interface between the CPU and the second microprocessor controller system to provide isolation and allow the memory to be accessible by either processor.

USE/ADVANTAGE - **Fault tolerant system** management buses. Information **storage** accessed and transmitted over backup **transmission** path in event of failure of primary path.

Dwg.1/7

Title Terms: MODULE; FAULT; TOLERATE; **TRANSMISSION** ; SYSTEM; MANAGEMENT; INFORMATION; PRIMARY; **TRANSMISSION** ; SECONDARY; BACK; UP; **TRANSMISSION** ; TWO; SYSTEM; MANAGEMENT; BUS; MICROPROCESSOR; CONTROL
Derwent Class: T01; W01
International Patent Class (Main): G06F-011/20; G06F-013/00; H04L-029/14
International Patent Class (Additional): **H04L-012/40**
File Segment: EPI

12/5/17 (Item 17 from file: 350)
DIALOG(R)File 350:Derwent WPIX
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009272481 **Image available**
WPI Acc No: 1992-399892/199249
XRPX Acc No: N92-304918
Processor-periphery control signal detector - has circuit providing continuous comparison of bus voltage with capacitor generated voltage to produce output when equal
Patent Assignee: TEXAS INSTR DEUT GMBH (TEXI)
Inventor: KIML H
Number of Countries: 001 Number of Patents: 002
Patent Family:

Patent No	Kind	Date	Applicat No	Kind	Date	Week	
DE 4117007	A	19921126	DE 4117007	A	19910524	199249	B
DE 4117007	C2	19930513	DE 4117007	A	19910524	199319	

Priority Applications (No Type Date): DE 4117007 A 19910524
Patent Details:

Patent No	Kind	Lan	Pg	Main IPC	Filing Notes
DE 4117007	A		5	G08C-025/00	
DE 4117007	C2		5	G08C-025/00	

Abstract (Basic): DE 4117007 A
An interface used to connect peripheral equipment to a central processor is coupled to the communications bus (10). A comparator (12) receives the bus signal and generates an output whenever the voltage level equals that determined by a capacitor (C).
The capacitor is charged by a unit that forms a constant current regulator that contains a current mirror stage (16) having a pair of PNP transistors (T1, T2). A second stage (18) delivers a sum current value (IS1). A difference amplifier (24) provides a control input.
ADVANTAGE - Controls **transmission** to peripherals coupled onto long bus.
Dwg.1/1
Title Terms: PROCESSOR; PERIPHERAL; CONTROL; SIGNAL; DETECT; CIRCUIT; CONTINUOUS; COMPARE; BUS; VOLTAGE; CAPACITOR; GENERATE; VOLTAGE; PRODUCE; OUTPUT; EQUAL
Derwent Class: T01; W01; W05
International Patent Class (Main): G08C-025/00
International Patent Class (Additional): G06F-013/38; G08C-019/02
File Segment: EPI

12/5/18 (Item 18 from file: 350)
DIALOG(R)File 350:Derwent WPIX
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009214467 **Image available**
WPI Acc No: 1992-341887/199242
XRPX Acc No: N92-260755
Raid storage **system for host computer - uses controller with number of array channels between host and disc drives which can be reconfigured into different raid levels**
Patent Assignee: HYUNDAI ELECTRONICS AMERICA (HYUN-N); NCR INT INC (NATC) ; SYMBIOS INC (SYMB-N); AT & T GLOBAL INFORMATION SOLUTIONS INT INC (AMTT); SYMBIOS LOGIC INC (SYMB-N); NCR CORP (NATC)
Inventor: JIBBE M K; MCCOMBS C C; THOMPSON K J
Number of Countries: 005 Number of Patents: 006
Patent Family:

Patent No	Kind	Date	Applicat No	Kind	Date	Week	
EP 508604	A2	19921014	EP 92302098	A	19920311	199242	B
US 5345565	A	19940906	US 91668660	A	19910313	199435	
EP 508604	A3	19930922	EP 92302098	A	19920311	199509	
EP 508604	B1	19991117	EP 92302098	A	19920311	199953	
DE 69230299	E	19991223	DE 630299	A	19920311	200006	
			EP 92302098	A	19920311		

JP 3159768 B2 20010423 JP 9286576 A 19920311 20[redacted]25
Priority Applications (No Type Date): US 91668660 A 19910313
Cited Patents: No-SR.Pub; EP 294287; EP 320107; EP 369707; US 4899342; US 4914656
Patent Details:

Patent No	Kind	Lan	Pg	Main IPC	Filing Notes
EP 508604	A2	E	32	G06F-003/06	
Designated States (Regional): DE FR GB					
US 5345565	A		31	G06F-011/10	
EP 508604	A3			G06F-003/06	
EP 508604	B1	E		G06F-003/06	
Designated States (Regional): DE FR GB					
DE 69230299	E			G06F-003/06	Based on patent EP 508604
JP 3159768	B2		32	G06F-003/06	Previous Publ. patent JP 6180623

Abstract (Basic): EP 508604 A
The disc array controller system provides data transfer between a host (12) and various disc drives. The discs can be organised to perform as a RAID level 1, 3, 4 or 5 disc array. The controller system includes a number of array channels (21-25) to couple selected disc drives with the hose bus (16). Circuitry generates parity information during write operations.
Each array channel has a data **bus connected** between the host **bus** and its associated disc drive, and also the input and output of the parity generation circuitry. Bus drivers control the configuration of the disc array.
ADVANTAGE - System can be readily reconfigured to provide different styles of RAID system.
Dwg.1/18
Title Terms: RAID; STORAGE; SYSTEM; HOST; COMPUTER; CONTROL; NUMBER; ARRAY; CHANNEL; HOST; DISC; DRIVE; CAN; RECONFIGURE; RAID; LEVEL
Derwent Class: T01; T03
International Patent Class (Main): G06F-003/06; G06F-011/10
International Patent Class (Additional): G06F-013/42
File Segment: EPI

12/5/19 (Item 19 from file: 350)
DIALOG(R)File 350:Derwent WPIX
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008612298 **Image available**
WPI Acc No: 1991-116328/199116
XRPX Acc No: N91-089495
Data storage processing code series error detector - has data and clock input rails connected to LSB and shift permit inputs of shift register
Patent Assignee: VASILENKO V S (VASI-I)
Inventor: VADYTKO A B; VASILENKO V S; VERESENKO V A
Number of Countries: 001 Number of Patents: 001
Patent Family:

Patent No	Kind	Date	Applicat No	Kind	Date	Week	
SU 1569996	A	19900607	SU 4462594	A	19880720	199116	B

Priority Applications (No Type Date): SU 4462594 A 19880720

Abstract (Basic): SU 1569996 A
The error detector has shift register (3), registers (4.1, 4.2,7), memory (5), adder (6), counters (8,13), decoders (9,14), NOT-gate (10), AND-gates (11.1,11.2,15,17), OR-gate (12) and recording pulse shaper (16). With any error occurrence in one of remainders, a received number exceeds the range limits and in the sign bit of the adder (6) a unity is formed, otherwise it is zero.
USE/ADVANTAGE - In computer engineering, in digital devices for data processing, **storage** and **transmission** and **highly reliable data transmission** systems. Reduced hardware. Bul.21/7.6.90. (4pp Dwg.No.1/1)
Title Terms: DATA; STORAGE; PROCESS; CODE; SERIES; ERROR; DETECT; DATA; CLOCK; INPUT; RAIL; CONNECT; LSB; SHIFT; PERMIT; INPUT; SHIFT; REGISTER

Derwent Class: U21
International Patent Class (Additional): H03M-013/00
File Segment: EPI

12/5/20 (Item 20 from file: 350)
DIALOG(R)File 350:Derwent WPIX
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008432276 **Image available**
WPI Acc No: 1990-319276/199042
XRPX Acc No: N90-244647
Codes monitor for computer and data transmission **engineering - has data input rail connected to data input of reception permit flip-flop**
Patent Assignee: KLYUCHKO V I (KLYU-I)
Inventor: KLYUCHKO V I; PETUKHOV V E; TKACHENKO A V
Number of Countries: 001 Number of Patents: 001
Patent Family:

Patent No	Kind	Date	Applicat No	Kind	Date	Week	
SU 1552382	A	19900323	SU 4329949	A	19871117	199042	B

Priority Applications (No Type Date): SU 4329949 A 19871117

Abstract (Basic): SU 1552382 A
The codes monitor includes counter (1), flip flop (9), first comparison-to-constant comparator (10) and OR-gate (15). Now it incorporates AND-gates (3,12,13) and second comparison-to-constant comparator (11). The counter (1) is for counting a number of zeroes and resetting on arrival of a unity signal at the input (4). With arrival a unity signal at the input (7) the counter (1) is loaded by a constant t. When more than (2.t+1) zero signal arrival it is then cleared.
USE/ADVANTAGE - For monitoring the min. and optimal Fibonacci codes and also monitoring t-count system. The design allows ALU devices to be tested, for **highly reliable storage** devices etc.
Bul.11/23.3.90.
Dwg.1/2
Title Terms: CODE; MONITOR; COMPUTER; DATA; **TRANSMISSION** ; ENGINEERING; DATA; INPUT; RAIL; CONNECT; DATA; INPUT; RECEPTION; PERMIT; FLIP-FLOP
Derwent Class: T01; U21; W01
International Patent Class (Additional): H03M-013/00
File Segment: EPI

12/5/21 (Item 21 from file: 350)
DIALOG(R)File 350:Derwent WPIX
(c) 2003 Thomson Derwent. All rts. reserv.

007565406 **Image available**
WPI Acc No: 1988-199338/198829
XRPX Acc No: N88-152114
Rear view mirror system for motor vehicle - has processor storing **pre-selected orientation of** mirror **and producing control signal after comparison with position sensor signal**
Patent Assignee: BRITAX WINGARD LTD (WNGA)
Inventor: ANSTEE C J
Number of Countries: 004 Number of Patents: 004
Patent Family:

Patent No	Kind	Date	Applicat No	Kind	Date	Week	
EP 274848	A	19880720	EP 87310594	A	19871202	198829	B
US 4871953	A	19891003	US 87127224	A	19871201	198949	
EP 274848	B	19910612				199124	
DE 3770797	G	19910718				199130	

Priority Applications (No Type Date): GB 8629826 A 19861213
Cited Patents: DE 3311229; DE 3609695; EP 190697; EP 216372; US 3864578; EP 230203
Patent Details:

Patent No	Kind	Lan	Pg	Main IPC	Filing Notes

Title Terms: DIGITAL; INFOR[redacted]ION; STORAGE; FIBRE-OPTIC; **TRA[redacted]MISSION** ; SYSTEM; MULTIPLEX; ROUTE; SIGNAL; OPTICAL; FIBRE; PROPAGATE; PERIOD; ACT; DATA; STORAGE
Derwent Class: T01; V07; W01; W02
International Patent Class (Additional): H04B-009/00
File Segment: EPI

12/5/23 (Item 23 from file: 347)
DIALOG(R)File 347:JAPIO
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06587098 **Image available**
ONBOARD ETC DEVICE

PUB. NO.: 2000-172891 [JP 2000172891 A]
PUBLISHED: June 23, 2000 (20000623)
INVENTOR(s): HAKOZAKI HIROTOSHI
OKADA SHIMON
APPLICANT(s): MITSUBISHI ELECTRIC CORP
APPL. NO.: 10-347107 [JP 98347107]
FILED: December 07, 1998 (19981207)
INTL CLASS: G07B-015/00; B60R-001/12

ABSTRACT

PROBLEM TO BE SOLVED: To provide an onboard ETC device (electronic toll collection system) which can be attached later to an already existing room mirror in a vehicle without hindering a communicating function nor the visual range of the driver and, in addition, improved in input operability, etc.

SOLUTION: An onboard ETC device which is aboard a vehicle and makes ETC **data transmission** and reception with an on-road ETC device is provided with an onboard ETC device body 13 having a displaying section for displaying ETC data, an IC card inserting port 16 into which an IC card **storing** ETC data is inserted, and a **mirror** section 14 provided on the front face of the device body 13. The device is also provided with an antenna section 15 provided on the back of the device body 13 and a spring holding section 21 for integrally holding the device body 13 by the room mirror in a vehicle.

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12/5/24 (Item 24 from file: 347)
DIALOG(R)File 347:JAPIO
(c) 2003 JPO & JAPIO. All rts. reserv.

06497366 **Image available**
DIGITAL SIGNAL **TRANSMISSION** CIRCUIT OF SEMICONDUCTOR DEVICE, SMALL SIGNAL SENSE CIRCUIT AND SEMICONDUCTOR DEVICE USING DIGITAL SIGNAL **TRANSMISSION** CIRCUIT OR SMALL SIGNAL SENSE CIRCUIT

PUB. NO.: 2000-083069 [JP 2000083069 A]
PUBLISHED: March 21, 2000 (20000321)
INVENTOR(s): TAKEUCHI MIKI
NAKAGOME YOSHINOBU
TANAKA TOSHIHIRO
SHINAGAWA YUTAKA
SUZUKAWA KAZUFUMI
FUJITO MASAMICHI
APPLICANT(s): HITACHI LTD
APPL. NO.: 11-133455 [JP 99133455]
FILED: May 14, 1999 (19990514)
PRIORITY: 10-195269 [JP 98195269], JP (Japan), July 10, 1998 (19980710)
INTL CLASS: H04L-025/02; G11C-011/417; G11C-011/409; H03K-019/0175

ABSTRACT

PROBLEM TO BE SOLVED: To provide a semiconductor device that realizes a signal **transmission** system whose noise and power consumption alike are small and which is suitable for high speed signal **transmission** between physically separated blocks or a small sense circuit which is suitable to read **memory storage** information and is high in speed and **highly reliable** .

SOLUTION: In this signal **transmission** circuit where a preceding stage logic circuit 10 and an output circuit 20 on a transmitting side and an input circuit 30 and a next stage logic circuit 40 on a receiving side exist on different semiconductor chips or are arranged at separate positions on the same chip and they are connected by a pair of complementary signal lines, digital signal **transmission** is performed by the complementary signal line pair that symmetrically shifts from almost middle potential between high potential and low potential and the input circuit 30 where one of the complementary signal **line** pair is **connected** to the source of a 1st field effect transistor M1T and the gate of a 2nd field effect transistor M1B, the other is connected to the gate of the M1T and the source of the M1B and the drains of the M1T and M1B are connected to a transistor conduction detection circuit 310 is provided.

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12/5/25 (Item 25 from file: 347)
DIALOG(R)File 347:JAPIO
(c) 2003 JPO & JAPIO. All rts. reserv.

05993104 **Image available**
ATM BEST EFFORT SERVICE SUPPLY METHOD USING PRELIMINARY BAND

PUB. NO.: 10-276204 [JP 10276204 A]
PUBLISHED: October 13, 1998 (19981013)
INVENTOR(s): UEMATSU HITOSHI
HARADA KAZUYUKI
KONDO AKIHIKO
YASUSHI TETSUJIROU
WATANABE SHIGERU
KANAYAMA YUKIHARU
KAWAMURA RYUTARO
APPLICANT(s): NIPPON TELEGR & TELEPH CORP <NTT> [000422] (A Japanese Company or Corporation), JP (Japan)
APPL. NO.: 09-077843 [JP 9777843]
FILED: March 28, 1997 (19970328)
INTL CLASS: [6] **H04L-012/28** ; H04Q-003/00
JAPIO CLASS: 44.3 (COMMUNICATION -- Telegraphy); 44.4 (COMMUNICATION -- Telephone)

ABSTRACT

PROBLEM TO BE SOLVED: To improve best effort service by permitting a path or a line executing **highly reliable** communication to duplex routes between facing devices, **storing** the path or the line executing best effort service in one route and switching the routes in accordance with the fault situation of the route.

SOLUTION: The path (highly reliable VP.VC) supplying highly reliable communication by an asynchronous transfer mode communication system is duplexes in the **transmission** lines 21-24 of the facing devices 11 and 12 and the path (best effort VP.VC) supplying best effort service is not duplexed and is stored in the **transmission** lines 22 and 24. In the devices 11-14, the priority of highly reliable VP is made to be the highest and that of best effort VP is made to be lowest. When a fault does not occur in the **transmission** line, highly reliable VP.VC selects the **transmission** lines 22 and 24. When the fault occurs in the **transmission** line, highly reliable VP.VC detects the fault and switches the lines to the **transmission** lines 21 and 23. When the fault is restored, highly reliable VP.VC is returned to the **transmission** lines 22 and 24.

```
Set     Items   Description
S1      23612   SAN OR FTSS OR STORAGE()AREA()NETWORK? OR RAID? OR HIGHLY(-
             )RELIABLE OR (FAULT? OR FAILURE? OR ERROR?)()TOLERAN?()SYSTEM?
              OR FTSS
S2       1150   S1(10N)(MEMOR? OR STORAGE? OR STORING)
S3    1232860   MESSAG? OR TRANSMISS? OR MAIL? OR EMAIL? OR BROADCAST? OR(-
             COMMUNICATION OR SUBSCRIPTION)()(MANAG? OR AGENT?)
S4     363324   (CONNECT? OR INTERCONNECT?)(3N)(CABLING OR FABRIC? OR HARD-
             WAR? OR BUS? ? OR LINE? OR WIRE? OR CABLE? OR FIBRE? OR FIBER-
             ?) OR PHYSICAL()LAYER?
S5      59035   (DATA OR NETWORK?)()TRANSMISS?
S6         77   S2 AND S3
S7         11   S2 AND S5
S8          6   S4 AND S6
S9         15   S6 AND IC=H04L-012?
S10         9   S6 AND MC=(W01-A03B OR W01-A06A1 OR W01-A06G2 OR W01-A06G3)
S11        30   S7 OR S8 OR S9 OR S10
S12        30   IDPAT (sorted in duplicate/non-duplicate order)
S13        30   IDPAT (primary/non-duplicate records only)
File 347:JAPIO Oct 1976-2003/Feb(Updated 030603)
         (c) 2003 JPO & JAPIO
File 350:Derwent WPIX 1963-2003/UD,UM &UP=200340
         (c) 2003  Thomson Derwent
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13/5/1 (Item 1 from file: 350)
DIALOG(R)File 350:Derwent WPIX
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015359241 **Image available**
WPI Acc No: 2003-420179/200339
XRPX Acc No: N03-335556
Transmission **control protocol segment receiving apparatus has two independent machines for recovering Internet small computer system interface protocol data unit and for routing portion of payload of protocol data unit**
Patent Assignee: SILIQUENT TECHNOLOGIES INC (SILI-N)
Inventor: GRINFELD R; MIZRACHI S; SHALOM R
Number of Countries: 001 Number of Patents: 001
Patent Family:

Patent No	Kind	Date	Applicat No	Kind	Date	Week	
US 20030058870	A1	20030327	US 2001317620	P	20010906	200339	B
			US 2002236768	A	20020906		

Priority Applications (No Type Date): US 2001317620 P 20010906; US 2002236768 A 20020906
Patent Details:

Patent No	Kind	Lan	Pg	Main IPC	Filing Notes
US 20030058870	A1		27	H04L-012/28	Provisional application US 2001317620

Abstract (Basic): US 20030058870 A1

NOVELTY - A parsing machine (153) parses the **transmission** control protocol (TCP) segment (162), to recover an Internet small computer systems interface protocol data unit (iSCSI-PDU). The PDU includes header and portion of a payload. An analysis machine independent of parsing machine, evaluates the header to receive and route portion of payload for the iSCSI-PDU.

DETAILED DESCRIPTION - INDEPENDENT CLAIMS are also included for the following:

(1) network interface apparatus;

(2) method of receiving sequence of **transmission** control protocol segments; and

(3) method of processing sequence of **transmission** control protocol segments.

USE - For receiving sequence of **transmission** control protocol segments in **storage area network** (**SAN**).

ADVANTAGE - The incoming TCP segments are immediately parsed without waiting to assemble a complete PDU, thereby increasing speed and throughput. The TCP segments are processed directly with no intermediate buffering and thereby improves speed and minimizes resource use.

DESCRIPTION OF DRAWING(S) - The figure shows the data flow diagram.

parsing machine (153)
transmission control protocol segment (162)
pp; 27 DwgNo 5/9

Title Terms: **TRANSMISSION** ; CONTROL; PROTOCOL; SEGMENT; RECEIVE; APPARATUS ; TWO; INDEPENDENT; MACHINE; RECOVER; COMPUTER; SYSTEM; INTERFACE; PROTOCOL; DATA; UNIT; ROUTE; PORTION; PAYLOAD; PROTOCOL; DATA; UNIT
Derwent Class: T01; W01
International Patent Class (Main): **H04L-012/28**
File Segment: EPI

13/5/2 (Item 2 from file: 350)
DIALOG(R)File 350:Derwent WPIX
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015358921 **Image available**
WPI Acc No: 2003-419859/200339
XRPX Acc No: N03-335238
Computer system has validation engine that is operated to dynamically validate configuration of selected storage area network **elements**
Patent Assignee: DELL PROD LP (DELL-N)

Inventor: BRISSE M P
Number of Countries: 003 Number of Patents: 003
Patent Family:

Patent No	Kind	Date	Applicat No	Kind	Date	Week	
US 20030055932	A1	20030320	US 2001956349	A	20010919	200339	B
FR 2831292	A1	20030425	FR 200211431	A	20020916	200339	
DE 10243595	A1	20030424	DE 1043595	A	20020919	200339	

Priority Applications (No Type Date): US 2001956349 A 20010919
Patent Details:

Patent No	Kind	Lan	Pg	Main IPC	Filing Notes
US 20030055932	A1		11	G06F-015/173	
FR 2831292	A1			G06F-015/177	
DE 10243595	A1			G06F-013/00	

Abstract (Basic): US 20030055932 A1
NOVELTY - A design module graphically configures selected **storage area network** (**SAN**) elements. A validation engine is operated to dynamically validate the configuration of the selected SAN elements.
DETAILED DESCRIPTION - INDEPENDENT CLAIMS are also included for the following:
(1) SAN configuration tool; and
(2) **storage area network** designing method.
USE - Computer system with **storage area network** elements configuration validation engine.
ADVANTAGE - Allows to save the SAN configuration in the disk, with the file extensions. Reduces the file size, to facilitate sharing information regarding the SAN configuration over network such as Internet or electronic **mail** .
DESCRIPTION OF DRAWING(S) - The figure shows an user interface showing SAN configuration tool.
pp; 11 DwgNo 3/6
Title Terms: COMPUTER; SYSTEM; VALID; ENGINE; OPERATE; DYNAMIC; VALID; CONFIGURATION; SELECT; STORAGE; AREA; NETWORK; ELEMENT
Derwent Class: T01; W01
International Patent Class (Main): G06F-013/00; G06F-015/173; G06F-015/177
International Patent Class (Additional): G06F-013/10; **H04L-012/12** ; **H04L-012/24**
File Segment: EPI

13/5/3 (Item 3 from file: 350)
DIALOG(R)File 350:Derwent WPIX
(c) 2003 Thomson Derwent. All rts. reserv.

015353043 **Image available**
WPI Acc No: 2003-413981/200339
Method and device for remotely connecting hardware **using network**
Patent Assignee: KIM H G (KIMH-I)
Inventor: KIM H G
Number of Countries: 001 Number of Patents: 001
Patent Family:

Patent No	Kind	Date	Applicat No	Kind	Date	Week	
KR 2003005580	A	20030123	KR 200140935	A	20010709	200339	B

Priority Applications (No Type Date): KR 200140935 A 20010709
Patent Details:

Patent No	Kind	Lan	Pg	Main IPC	Filing Notes
KR 2003005580	A		1	G06F-015/16	

Abstract (Basic): KR 2003005580 A
NOVELTY - A method and device for remotely **connecting hardware** using the network are provided to supply a comfortable working environment by separating a hardware device from a main body of a host computer including a CPU memory through a LAN, thereby separating a person from the host computer which discharges a heat and a noise sufficiently.
DETAILED DESCRIPTION - Input/output devices(320) and a hard disk(310) are connected to a host computer(300) indirectly, that is,

connected through a LAN(330) such as the Ethernet by a remote control. Namely, **hardware** devices are **connected** or separated to/from the host computer(300) at a predetermined time dynamically. For a separation between a user and the hard disk(310), a network is constituted for connecting the host computer(300) to the hard disk(310) using an additional hard disk private LAN(340) such as an **SAN** (**Storage Area Network**). Thus, a velocity trouble of a **data transmission** caused by a limit of a **transmission** bandwidth of a LAN is solved.

pp; 1 DwgNo 1/10

Title Terms: METHOD; DEVICE; REMOTE; CONNECT; HARDWARE; NETWORK
Derwent Class: T01; W01
International Patent Class (Main): G06F-015/16
File Segment: EPI

13/5/4 (Item 4 from file: 350)

DIALOG(R)File 350:Derwent WPIX
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015197592
WPI Acc No: 2003-258126/200326
XRPX Acc No: N03-204756

SAN and internet based broadcasting **and television collecting, editing and presentating integral system**

Patent Assignee: GU S (GUSS-I)
Inventor: GU S; WU J C
Number of Countries: 001 Number of Patents: 001
Patent Family:

Patent No	Kind	Date	Applicat No	Kind	Date	Week	
CN 1372402	A	20021002	CN 2002112801	A	20020326	200326	B

Priority Applications (No Type Date): CN 2002112801 A 20020326
Patent Details:

Patent No	Kind	Lan	Pg	Main IPC	Filing Notes
CN 1372402	A			H04L-012/16	

Abstract (Basic): CN 1372402 A

NOVELTY - This invention of SAN and internet-based **broadcast** and TV collecting, editing and presentating integral system is a network autoamtic **broadcasting** system of broadcart/TV composed of internet, networkserver, network memory, computer, network high definition program collecting equipment, **broadcasting** control, transmitting equipment satellite, cable TV and software, using **SAN** like large volume of **storage** equipments, to store program signals, and using the storage region equipment to correct errors to guarantee the reliability of the system and data, which with high quality, but also can realifethe automatic collection edition, **broadcast** of the next generation TV with high definition and realife the remote real-time collection, remote edition of **broadcast** /TV programs and internet network **broadcast** , and nettowkr vidio ordering to make up 'network **broadcast** /TV' in the future to suit the needs of network **broadcast** /TV acquisition.

DwgNo 0/0

Title Terms: SAN; BASED; **BROADCAST** ; TELEVISION; COLLECT; EDIT; INTEGRAL; SYSTEM
Derwent Class: W01
International Patent Class (Main): **H04L-012/16**
File Segment: EPI

13/5/5 (Item 5 from file: 350)

DIALOG(R)File 350:Derwent WPIX
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015007818 **Image available**
WPI Acc No: 2003-068335/200306
XRPX Acc No: N03-053044

Cell-based switch for fibre channel protocols uses end of packet character system

Patent Assignee: INRANGE TECHNOLOGIES CORP (INRA-N)
Inventor: BRANCO R; KOELLNER G L; PAUL H V; PEARSON J W
Number of Countries: 100 Number of Patents: 002
Patent Family:

Patent No	Kind	Date	Applicat No	Kind	Date	Week	
WO 2002102002	A1	20021219	WO 2002US18659	A	20020613	200306	B
US 20020191615	A1	20021219	US 2001297454	P	20010613	200315	
			US 2001995605	A	20011129		

Priority Applications (No Type Date): US 2001297454 P 20010613; US 2001995605 A 20011129
Patent Details:

Patent No	Kind	Lan	Pg	Main IPC	Filing Notes
WO 2002102002	A1	E	24	H04L-012/56	

Designated States (National): 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 NO NZ OM PH PL PT RO RU SD SE SG SI SK SL TJ TM TN TR TT TZ UA UG US UZ VN YU ZA ZM ZW
Designated States (Regional): AT BE CH CY DE DK EA ES FI FR GB GH GM GR IE IT KE LS LU MC MW MZ NL OA PT SD SE SL SZ TR TZ UG ZM ZW

US 20020191615	A1		H04L-012/56	Provisional application US 2001297454

Abstract (Basic): WO 2002102002 A1

NOVELTY - A cell-based switch fabric receives cells that are packed as a fibre channel frame and immediately transmits through the switch fabric. The switch fabric is capable of providing an end of packet character to a cell in the packet.

DETAILED DESCRIPTION - INDEPENDENT CLAIMS are also included for an apparatus and method for rendering a fixed length cell-based switch fabric.

USE - For fibre channel protocols and other **storage area network** protocols.

ADVANTAGE - The system provides an early packet termination such that prior to the complete **transmission** of the number of cells specified in the first cell of a packet, a crossbar connection is released.

DESCRIPTION OF DRAWING(S) - The drawing shows a typical variable length frame.

pp; 24 DwgNo 3B/3

Title Terms: CELL; BASED; SWITCH; FIBRE; CHANNEL; END; PACKET; CHARACTER; SYSTEM
Derwent Class: W01
International Patent Class (Main): **H04L-012/56**
International Patent Class (Additional): H04L-029/06
File Segment: EPI

13/5/6 (Item 6 from file: 350)

DIALOG(R)File 350:Derwent WPIX
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014929173 **Image available**
WPI Acc No: 2002-749882/200281
XRPX Acc No: N02-590560

Secure data transport and storage system e.g. for telephone conversation, e-mail, has pseudo random key generator that generates cryptographic keys based on configuration data including time or event memory data

Patent Assignee: AU D C (AUDC-I); BARTHOLET T G (BART-I); FRUEHAUF H (FRUE-I); ZYFER INC (ZYFE-N)
Inventor: AU D C; BARTHOLET T G; FRUEHAUF H
Number of Countries: 099 Number of Patents: 002
Patent Family:

Patent No	Kind	Date	Applicat No	Kind	Date	Week	
US 20020114453	A1	20020822	US 2001790021	A	20010221	200281	B
WO 200269558	A1	20020906	WO 2002US5413	A	20020220	200281	

Priority Applications (No Type Date): US 2001790021 A 20010221
Patent Details:
Patent No Kind Lan Pg Main IPC Filing Notes
US 20020114453 A1 15 H04L-009/00
WO 200269558 A1 E H04L-009/00
Designated States (National): 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 NO NZ OM PH PL PT RO RU SD SE SG SI SK SL TJ TM TR TT TZ UA UG US UZ VN YU ZA ZM ZW
Designated States (Regional): AT BE CH CY DE DK EA ES FI FR GB GH GM GR IE IT KE LS LU MC MW MZ NL OA PT SD SE SL SZ TR TZ UG ZM ZW

Abstract (Basic): US 20020114453 A1
NOVELTY - A pseudo random key generator (106) generates cryptographic keys based on configuration data including time or event memory data that are setup by a set up module (102). An encryptor (115) and decrypters (107-109) respectively encrypts and decrypts the received data based on the cryptographic keys. A data marker (113) appends or associates the data with configuration data.
DETAILED DESCRIPTION - INDEPENDENT CLAIMS are included for the following:
(1) Secure data transport and storage method;
(2) Secure data storage retrieval method;
(3) Processor readable medium storing secure data transport and storage program;
(4) Method for creating virtual separation of data files stored within a physical storage device; and
(5) Data file management method.
USE - For secure transport storage of cryptographic data such as telephone conversations, e-mail within **storage** system e.g. **storage area network** (**SAN**) or network attached **storage** (NAS).
ADVANTAGE - By using the pseudo random key generator (PKG) all the cryptographic keys are internally generated, thereby requirement of key management infrastructure and associated cost for cryptographic **data transmission** and storage of files and data are eliminated.
DESCRIPTION OF DRAWING(S) - The figure shows the block diagram of the secured communication and storage retrieval system.
Setup module (102)
Pseudo random key generator (106)
Decrypters (107-109)
Data marker (113)
Encryptor (115)
pp; 15 DwgNo 1/4
Title Terms: SECURE; DATA; TRANSPORT; STORAGE; SYSTEM; TELEPHONE; CONVERSATION; MAIL; PSEUDO; RANDOM; KEY; GENERATOR; GENERATE; CRYPTOGRAPHIC; KEY; BASED; CONFIGURATION; DATA; TIME; EVENT; MEMORY; DATA
Derwent Class: T01; W01
International Patent Class (Main): H04L-009/00
File Segment: EPI

13/5/7 (Item 7 from file: 350)
DIALOG(R)File 350:Derwent WPIX
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014853438 **Image available**
WPI Acc No: 2002-674144/200272
Related WPI Acc No: 2002-435907; 2002-444468; 2002-444474; 2002-463533; 2002-463683; 2002-463694; 2002-470871; 2002-471665; 2002-471777; 2002-478954; 2002-479821; 2002-479822; 2002-479823; 2002-479824; 2002-479825; 2002-479826; 2002-479827; 2002-479837; 2002-479839; 2002-479843; 2002-479848; 2002-508236; 2002-508581; 2002-518257; 2002-527982; 2002-527983; 2002-643064; 2002-697577; 2003-017033; 2003-046164; 2003-120031; 2003-156136; 2003-288656
XRPX Acc No: N02-533060
Switch fabric usage method for content delivery systems, involves

connecting **processors to switch** fabric **through corresponding interfaces which recognize data and control** message

Patent Assignee: BAILEY B W (BAIL-I); CANION R S (CANI-I); GARVENS T E (GARV-I); JACKSON G J (JACK-I); JOHNSON S C (JOHN-I); RICHTER R K (RICH-I); WEBB T S (WEBB-I)

Inventor: BAILEY B W; CANION R S; GARVENS T E; JACKSON G J; JOHNSON S C; RICHTER R K; WEBB T S

Number of Countries: 001 Number of Patents: 001

Patent Family:

Patent No	Kind	Date	Applicat No	Kind	Date	Week	
US 20020105972	A1	20020808	US 2000187211	P	20000303	200272	B
			US 2000246373	P	20001107		
			US 2001797404	A	20010301		

Priority Applications (No Type Date): US 2001797404 A 20010301; US 2000187211 P 20000303; US 2000246373 P 20001107

Patent Details:

Patent No	Kind	Lan	Pg	Main IPC	Filing Notes
US 20020105972	A1		41	H04L-012/50	Provisional application US 2000187211
					Provisional application US 2000246373

Abstract (Basic): US 20020105972 A1

NOVELTY - The processors are **connected** to switch **fabric** using corresponding switch fabric interface. The interfaces recognize data and control **messages** contained in the data unit.

DETAILED DESCRIPTION - INDEPENDENT CLAIMS are included for the following:

(1) Switch fabric interface;
(2) Network node system;
(3) Network endpoint system;
(4) Method of processing network data;
(5) Method of operating network endpoint system;
(6) Method of providing network endpoint termination;
(7) Method of providing content delivery system;
(8) Network connectable computing system;
(9) Network connectable content delivery system.

USE - For general purpose servers, specialized servers, network appliances, **storage area networks** , content delivery systems, corporate data centers, application service providers, home or laptop computers modeling and simulation system, graphic rendering systems.

ADVANTAGE - Switch fabric allows installation of additional subsystem modules without significant degradation of system performance.

DESCRIPTION OF DRAWING(S) - The figure shows the block diagram of the content delivery system.

pp; 41 DwgNo 1A/4

Title Terms: SWITCH; FABRIC; METHOD; CONTENT; DELIVER; SYSTEM; CONNECT; PROCESSOR; SWITCH; FABRIC; THROUGH; CORRESPOND; INTERFACE; RECOGNISE; DATA; CONTROL; **MESSAGE**

Derwent Class: T01; W01

International Patent Class (Main): **H04L-012/50**

File Segment: EPI

13/5/8 (Item 8 from file: 350)

DIALOG(R)File 350:Derwent WPIX

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014805722 **Image available**

WPI Acc No: 2002-626428/200267

XRPX Acc No: N02-495371

Redundant array of inexpensive disk controller for data transmission , **has** RAID **level programs stored in read only** memory **to control process control unit for** data transmission **to host system**

Patent Assignee: HUNG M (HUNG-I)

Inventor: HUNG M

Number of Countries: 001 Number of Patents: 001

Patent Family:
Patent No Kind Date Applicat No Kind Date Week
US 20020078276 A1 20020620 US 2001952606 A 20010913 200267 B

Priority Applications (No Type Date): TW 2000U222113 U 20001220
Patent Details:
Patent No Kind Lan Pg Main IPC Filing Notes
US 20020078276 A1 7 G06F-013/10

Abstract (Basic): US 20020078276 A1
NOVELTY - A CPU (14) responds to interrupt commands from the host and disk array IDE interface to execute data read/write commands and stores them in a buffer memory unit (9). A ROM (33) stores the redundant array of inexpensive disks (RAID) level 3, level 4, level 5, level 6 programs to control a process control unit (23) connected to the CPU, and process the stored data to be transmitted to a host system (200) or to the disk arrays (101,102), respectively.
USE - For **data transmission** between host system and disk array system.
ADVANTAGE - The CPU is able to read data stored in the array, checks whether the data is defective or not and restores the defective data of necessary and transmit them back to the host system effectively.
DESCRIPTION OF DRAWING(S) - The figure shows the block diagram of the RAID controller.
Buffer memory unit (9)
CPU (14)
Process control unit (23)
Read only memory (33)
Disk arrays (101,102)
Host system (200)
pp; 7 DwgNo 1/3
Title Terms: REDUNDANT; ARRAY; INEXPENSIVE; DISC; CONTROL; DATA; TRANSMISSION; RAID; LEVEL; PROGRAM; STORAGE; READ; MEMORY; CONTROL; PROCESS; CONTROL; UNIT; DATA; TRANSMISSION; HOST; SYSTEM
Derwent Class: T01; T03
International Patent Class (Main): G06F-013/10
File Segment: EPI

13/5/9 (Item 9 from file: 350)
DIALOG(R)File 350:Derwent WPIX
(c) 2003 Thomson Derwent. All rts. reserv.

014739456 **Image available**
WPI Acc No: 2002-560161/200260
XRPX Acc No: N02-443489
Data interconnection system has FTSS architecture combines internal and network transmission
Patent Assignee: HEWLETT-PACKARD CO (HEWP)
Inventor: GAITHER B D; MCKEE B A
Number of Countries: 001 Number of Patents: 001
Patent Family:
Patent No Kind Date Applicat No Kind Date Week
FR 2818849 A1 20020628 FR 200113950 A 20011029 200260 B

Priority Applications (No Type Date): US 2000703428 A 20001031
Patent Details:
Patent No Kind Lan Pg Main IPC Filing Notes
FR 2818849 A1 51 H04L-012/46

Abstract (Basic): FR 2818849 A1
NOVELTY - A data interconnection system couples servers (80, 82, 84, 86, 88, 90) to an FTSS system through **FTSS** architecture (94) and stores packets on arrival in reliable permanent **memory** (92) with packet receipts sent to an external network (96) on arrival at the correct server system.
USE - Fault tolerant interconnection system for **data**

transmission .
ADVANTAGE - Ensures reliable handling of packets. Combines internal file input output and external **transmission** functions.
DESCRIPTION OF DRAWING(S) - The drawing is a system block diagram. (Drawing includes non English language text)
Servers (80, 82, 84, 86, 88, 90)
Fault Tolerant Server System (FTSS) architecture (94)
External network (96)
pp; 51 DwgNo 4/8
Title Terms: DATA; INTERCONNECT; SYSTEM; ARCHITECTURE; COMBINATION; INTERNAL; NETWORK; **TRANSMISSION**
Derwent Class: W01
International Patent Class (Main): **H04L-012/46**
International Patent Class (Additional): H04L-001/00
File Segment: EPI

13/5/10 (Item 10 from file: 350)
DIALOG(R)File 350:Derwent WPIX
(c) 2003 Thomson Derwent. All rts. reserv.

014635444 **Image available**
WPI Acc No: 2002-456148/200249
XRPX Acc No: N02-359659
Data transfer method in local area network, involves concatenating network destination addresses to generate network data-frame compatible with corresponding network
Patent Assignee: SANCASTLE TECHNOLOGIES LTD (SANC-N)
Inventor: BRUCHIAN G; CZEIGER M
Number of Countries: 027 Number of Patents: 002
Patent Family:

Patent No	Kind	Date	Applicat No	Kind	Date	Week	
EP 1206099	A2	20020515	EP 2001201383	A	20010417	200249	B
JP 2002171274	A	20020614	JP 2001125205	A	20010424	200254	

Priority Applications (No Type Date): US 2000712616 A 20001114
Patent Details:

Patent No	Kind	Lan	Pg	Main IPC	Filing Notes
EP 1206099	A2	E	12	H04L-029/06	
	Designated States (Regional): AL AT BE CH CY DE DK ES FI FR GB GR IE IT LI LT LU LV MC MK NL PT RO SE SI TR				
JP 2002171274	A		11	H04L-012/46	

Abstract (Basic): EP 1206099 A2
NOVELTY - A network destination address is received from a source client (34) in a network (12) operating under standard protocol. Another network destination address from the destination client (36) is read from a content addressable memory (CAM) (26), using predetermined address as an index. The two destination addresses are concatenated to generate network data-frame compatible with another protocol for **transmission** over another network.
DETAILED DESCRIPTION - An INDEPENDENT CLAIM is included for data transfer apparatus.
USE - For transferring data in local area network, **storage area network** , etc.
ADVANTAGE - Content addressable memory translates the addresses between the clients quickly, hence efficiency is improved.
DESCRIPTION OF DRAWING(S) - The figure shows the schematic block diagram of data transfer apparatus.
Network (12)
Content addressable memory (26)
Source client (34)
Destination client (36)
pp; 12 DwgNo 1/5
Title Terms: DATA; TRANSFER; METHOD; LOCAL; AREA; NETWORK; NETWORK; DESTINATION; ADDRESS; GENERATE; NETWORK; DATA; FRAME; COMPATIBLE; CORRESPOND; NETWORK
Derwent Class: T01; W01

International Patent Class (Main): **H04L-012/46** ; H04L-029/06
International Patent Class (Additional): **H04L-012/66**
File Segment: EPI

13/5/11 (Item 11 from file: 350)
DIALOG(R)File 350:Derwent WPIX
(c) 2003 Thomson Derwent. All rts. reserv.

014634271 **Image available**
WPI Acc No: 2002-454975/200248
XRPX Acc No: N02-358770

Communications architecture for storage-based devices for communicating between hosts and data store devices is adapted to support communications between multiple hosts and storage devices via a switching network

Patent Assignee: SILICON IMAGE (SILI-N); JEONG D (JEON-I); KONG S (KONG-I); LEE D D (LEED-I); SHIN Y (SHIN-I); LEE D (LEED-I)
Inventor: JEONG D; KONG S; LEE D D; SHIN Y; LEE D
Number of Countries: 099 Number of Patents: 010
Patent Family:

Patent No	Kind	Date	Applicat No	Kind	Date	Week
WO 200243319	A2	20020530	WO 2001US43474	A	20011121	200248 B
AU 200236450	A	20020603	AU 200236450	A	20011121	200263
US 20020154633	A1	20021024	US 2000252724	P	20001122	200273
			US 200135591	A	20011107	
US 20020157054	A1	20021024	US 2000252724	P	20001122	200273
			US 200136794	A	20011107	
US 20020159450	A1	20021031	US 2000252724	P	20001122	200274
			US 200145348	A	20011107	
US 20020159552	A1	20021031	US 2000252724	P	20001122	200274
			US 200137168	A	20011107	
US 20020167945	A1	20021114	US 2000252724	P	20001122	200277
			US 200136135	A	20011107	
US 20020172200	A1	20021121	US 2000252724	P	20001122	200279
			US 200145625	A	20011107	
US 20020191475	A1	20021219	US 2000252724	P	20001122	200303
			US 200145297	A	20011107	
US 20020191603	A1	20021219	US 2000252724	P	20001122	200303
			US 200145606	A	20011107	

Priority Applications (No Type Date): US 200153461 A 20011107; US 2000252724 P 20001122; US 200135591 A 20011107; US 200135911 A 20011107; US 200136135 A 20011107; US 200136794 A 20011107; US 200137168 A 20011107 ; US 200145297 A 20011107; US 200145348 A 20011107; US 200145393 A 20011107; US 200145600 A 20011107; US 200145601 A 20011107; US 200145606 A 20011107; US 200145625 A 20011107
Patent Details:

Patent No	Kind	Lan	Pg	Main IPC	Filing Notes
WO 200243319	A2	E	165	H04L-012/00	

Designated States (National): 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 NO NZ OM PH PL PT RO RU SD SE SG SI SK SL TJ TM TR TT TZ UA UG US UZ VN YU ZA ZW
Designated States (Regional): AT BE CH CY DE DK EA ES FI FR GB GH GM GR IE IT KE LS LU MC MW MZ NL OA PT SD SE SL SZ TR TZ UG ZM ZW

AU 200236450 A	H04L-012/00	Based on patent WO 200243319	
US 20020154633 A1	H04J-003/22	Provisional application US 2000252724	
US 20020157054 A1	H03M-013/00	Provisional application US 2000252724	
US 20020159450 A1	H04L-012/28	Provisional application US 2000252724	
US 20020159552 A1	H04L-007/00	Provisional application US 2000252724	
US 20020167945 A1	H04L-012/28	Provisional application US 2000252724	
US 20020172200 A1	H04J-003/06	Provisional application US 2000252724	

US 20020191475 A1 G11C-008/00 Provisional application US 2000252724

US 20020191603 A1 H04J-001/16 Provisional application US 2000252724

Abstract (Basic): WO 200243319 A2

NOVELTY - A serial communications architecture for communicating between hosts and data store devices. The Storage Link architecture is specially adapted to support communications between multiple hosts and **storage** devices via a switching network such as a **storage area network** . The **Storage** link architecture specifies various communications techniques that can be combined to reduce the overall cost and increase the overall performance of communications.

DETAILED DESCRIPTION - The Storage Link architecture may provide packet ordering based on packet type, dynamic segmentation of packets, asymmetric packet ordering, packet nesting, variable-sized packet headers, and use of out-of-band symbols to transmit control information as described below in more detail. The Storage Link architecture may also specify encoding techniques to optimize transitions and to ensure DC-balance. INDEPENDENT CLAIMS are made for: a) a network for transmitting data between hosts and data storage devices; b) a method in a receiving device for compensating for differences in clock frequencies; c) a method in a receiving device for maintaining synchronisation between the receiving device with a transmitting device; d) an aligner in a receiving device; e) a method for encoding and decoding data; f) a memory device g) a method in a communications device for transmitting packets; h) a communications device; i) a method in a network of switches for handling errors; j) a switch comprising means for detecting an error; k) a method in transmitting communications device for transmitting a packet; l) a method in a communications device for segmenting a packet; m) a method for transmitting and receiving packets; n) a method for transmitting control information during **transmission** of packets; o) a method for receiving control information while receiving a packet; p) a method for DC-balancing of a communications link; q) a memory bank having words that are addressable by addresses.

USE - Communications architecture for storage-based devices.

ADVANTAGE - Provides high performance for applications (e.g. data-storage based applications and memory-based applications) at low cost, thereby allowing communication techniques to be tailored to particular applications.

DESCRIPTION OF DRAWING(S) - The drawing shows a block diagram illustrating components of the storage link architecture.

pp; 165 DwgNo 1/49

Title Terms: COMMUNICATE; ARCHITECTURE; STORAGE; BASED; DEVICE; COMMUNICATE ; HOST; DATA; STORAGE; DEVICE; ADAPT; SUPPORT; COMMUNICATE; MULTIPLE; HOST; STORAGE; DEVICE; SWITCH; NETWORK

Derwent Class: W01

International Patent Class (Main): G11C-008/00; H03M-013/00; H04J-001/16; H04J-003/06; H04J-003/22; H04L-007/00; **H04L-012/00** ; **H04L-012/28**

International Patent Class (Additional): H04J-003/16; **H04L-012/56**

File Segment: EPI

13/5/12 (Item 12 from file: 350)

DIALOG(R)File 350:Derwent WPIX

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014464201 **Image available**

WPI Acc No: 2002-284904/200233

XRPX Acc No: N02-222713

FIFO memory for clock-cross-over circuit of transmission **device, synchronizes read and write clock signals with read-out and write-in pulse signals from respective counters and provides to capacity monitoring counter**

Patent Assignee: FUJITSU LTD (FUIT)

Number of Countries: 001 Number of Patents: 001

Patent Family:

Patent No Kind Date Applicat No Kind Date Week
JP 2001285346 A 20011012 JP 200090105 A 20000329 200233 B

Priority Applications (No Type Date): JP 200090105 A 20000329
Patent Details:
Patent No Kind Lan Pg Main IPC Filing Notes
JP 2001285346 A 9 H04L-012/56

Abstract (Basic): JP 2001285346 A
NOVELTY - The clock signals (CKA,CKB) corresponding to read and write signals are synchronized with respective read-out and write-in counter (WCTR) (32), which are input to a capacity monitoring counter (MCTR) (37).
USE - For use in clock-cross-over circuit of **transmission** devices.
ADVANTAGE - Provides a **highly reliable** FIFO **memory** that effectively counts the number of data read from or written into the memory using the capacity monitoring counter and thus avoids malfunctioning of the memory.
DESCRIPTION OF DRAWING(S) - The figure shows a diagram explaining the operation principle of the FIFO memory. (Drawing includes non-English language text).
WCTR (32)
MCTR (37)
Clock signals (CKA,CKB)
pp; 9 DwgNo 1/7
Title Terms: FIFO; MEMORY; CLOCK; CROSS; CIRCUIT; **TRANSMISSION** ; DEVICE; SYNCHRONISATION; READ; WRITING; CLOCK; SIGNAL; READ; WRITING; PULSE; SIGNAL; RESPECTIVE; COUNTER; CAPACITY; MONITOR; COUNTER
Derwent Class: T01; U14; W01
International Patent Class (Main): **H04L-012/56**
International Patent Class (Additional): G06F-005/06; G06F-012/00; G11C-007/00; **H04L-012/28** ; H04L-013/08
File Segment: EPI

13/5/13 (Item 13 from file: 350)
DIALOG(R)File 350:Derwent WPIX
(c) 2003 Thomson Derwent. All rts. reserv.

014446533 **Image available**
WPI Acc No: 2002-267236/200231
XRPX Acc No: N02-207756
Customer address translation method in storage area network , **involves swapping customer source and destination information included in received data packet with carrier assigned source and destination information**
Patent Assignee: CAWTHORNE D (CAWT-I); DEMARGERIE S (DEMA-I); ELLIS D R (ELLI-I); FRANK S J (FRAN-I); MURTON C (MURT-I); ROMAGNINO S (ROMA-I); WALLACE R B (WALL-I)
Inventor: CAWTHORNE D; DEMARGERIE S; ELLIS D R; FRANK S J; MURTON C; ROMAGNINO S; WALLACE R B
Number of Countries: 001 Number of Patents: 001
Patent Family:
Patent No Kind Date Applicat No Kind Date Week
US 20020010790 A1 20020124 US 2000218970 P 20000717 200231 B
US 2000223911 P 20000809
US 2001822181 A 20010402

Priority Applications (No Type Date): US 2001822181 A 20010402; US 2000218970 P 20000717; US 2000223911 P 20000809
Patent Details:
Patent No Kind Lan Pg Main IPC Filing Notes
US 20020010790 A1 13 G06F-015/173 Provisional application US 2000218970
Provisional application US 2000223911

Abstract (Basic): US 20020010790 A1

NOVELTY - A data packet (200) with a header (201) containing customer source and destination information is received at a carrier access network. Customer source and destination information are swapped with carrier assigned source and destination information, to form a data packet (220) with header (210) including carrier assigned source and destination information.

DETAILED DESCRIPTION - An INDEPENDENT CLAIM is also included for customer address translation apparatus.

USE - For translating customer address of a data packet to carrier address in **storage area network** (**SAN**), also for other networks such as SONET, asynchronous transfer mode network, Internet protocol network, ethernet, fiber channel networks.

ADVANTAGE - Allows several users to use the same network to transport data from mass storage devices and to share the same storage device. Ensures that the data from one user is not accessible by any other user. Address scheme required by a specific user is not known to other users, hence great security and reliability for service level agreements with customers to quickly locate faults in the network are provided. **Transmission** and storage media errors are eliminated.

DESCRIPTION OF DRAWING(S) - The figure shows the illustration of virtual private address encapsulation mechanism.

Data packets (200,220)

Headers (201,210)

pp; 13 DwgNo 2/6

Title Terms: CUSTOMER; ADDRESS; TRANSLATION; METHOD; STORAGE; AREA; NETWORK ; CUSTOMER; SOURCE; DESTINATION; INFORMATION; RECEIVE; DATA; PACKET; CARRY; ASSIGN; SOURCE; DESTINATION; INFORMATION

Derwent Class: T01; W01

International Patent Class (Main): G06F-015/173

File Segment: EPI

13/5/14 (Item 14 from file: 350)

DIALOG(R)File 350:Derwent WPIX

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014417114 **Image available**

WPI Acc No: 2002-237817/200229

XRPX Acc No: N02-183084

Data transmission **optimization method for Internet protocol storage involves adjusting data transfer rate in direct correlation with data transfer congestion level as indicated by marked or unmarked data**

Patent Assignee: WILSON A W (WILS-I)

Inventor: WILSON A W

Number of Countries: 001 Number of Patents: 001

Patent Family:

Patent No	Kind	Date	Applicat No	Kind	Date	Week	
US 20010032269	A1	20011018	US 2000189639	P	20000314	200229	B
			US 2000726676	A	20001129		

Priority Applications (No Type Date): US 2000189639 P 20000314; US 2000726676 A 20001129

Patent Details:

Patent No	Kind	Lan	Pg	Main IPC	Filing Notes
US 20010032269	A1		23	G06F-015/16	Provisional application US 2000189639

Abstract (Basic): US 20010032269 A1

NOVELTY - Data transfer congestion level within the transfer system is monitored. Monitoring includes marking data during data transfer congestion and detecting marked data. Data transfer rate is adjusted corresponding to the data transfer congestion level such that data transfer rate is increased or decreased in direct correlation with data transfer congestion level as indicated by unmarked data or marked data, respectively, in a round trip time.

DETAILED DESCRIPTION - INDEPENDENT CLAIMS are also included for the following:

(a) Network system;

(b) Method for actively controlling congestion to optimize **data**

transmission

USE - For optimizing data transfer level in transfer system such as LAN, WAN, **Storage Area Network** (**SAN**) for Internet protocol **storage** .

ADVANTAGE - Since data transfer rate is adjusted with respect to data transfer congestion level, data transfer efficiency is enhanced.

DESCRIPTION OF DRAWING(S) - The figure shows the flowchart for the data transfer optimization method.

pp; 23 DwgNo 2/9

Title Terms: DATA; TRANSMISSION; OPTIMUM; METHOD; PROTOCOL; STORAGE; ADJUST ; DATA; TRANSFER; RATE; DIRECT; CORRELATE; DATA; TRANSFER; CONGESTED; LEVEL; INDICATE; MARK; UNMARKED; DATA

Derwent Class: T01; W01

International Patent Class (Main): G06F-015/16

File Segment: EPI

13/5/15 (Item 15 from file: 350)

DIALOG(R)File 350:Derwent WPIX

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014189924 **Image available**

WPI Acc No: 2002-010621/200201

XRPX Acc No: N02-008876

Datastream delivery method for storage area networks , **involves transferring retrieved data content to client, from controller associated with storage system, over communication network through port**

Patent Assignee: YOTTA YOTTA INC (YOTT-N); KARPOFF W T (KARP-I)

Inventor: KARPOFF W T

Number of Countries: 095 Number of Patents: 004

Patent Family:

Patent No	Kind	Date	Applicat No	Kind	Date	Week	
WO 200171524	A1	20010927	WO 2001US9440	A	20010322	200201	B
US 20010049740	A1	20011206	US 2000191237	P	20000322	200203	
			US 2001815824	A	20010322		
AU 200187250	A	20011003	AU 200187250	A	20010322	200210	
EP 1301865	A1	20030416	EP 2001959938	A	20010322	200328	
			WO 2001US9440	A	20010322		

Priority Applications (No Type Date): US 2000191237 P 20000322; US 2001815824 A 20010322

Patent Details:

Patent No	Kind	Lan	Pg	Main IPC	Filing Notes
WO 200171524	A1	E	53	G06F-015/16	

Designated States (National): AE AG AL AM AT AU AZ BA BB BG BR BY BZ CA CH CN CR CU CZ DE DK DM DZ 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 NO NZ PL PT RO RU SD SE SG SI SK SL TJ TM TR TT TZ UA UG US UZ VN YU ZA ZW

Designated States (Regional): AT BE CH CY DE DK EA ES FI FR GB GH GM GR IE IT KE LS LU MC MW MZ NL OA PT SD SE SL SZ TR TZ UG ZW

US 20010049740	A1		G06F-015/16	Provisional application US 2000191237
AU 200187250	A		G06F-015/16	Based on patent WO 200171524
EP 1301865	A1	E	G06F-015/16	Based on patent WO 200171524

Designated States (Regional): AL AT BE CH CY DE DK ES FI FR GB GR IE IT LI LT LU LV MC MK NL PT RO SE SI TR

Abstract (Basic): WO 200171524 A1

NOVELTY - A controller associated with storage system storing data content is identified, based on request from a client is received. A data request **message** is transmitted from server to the controller, to retrieve streaming data contents. The retrieved data content is transferred to client over communication network, through a port.

USE - For delivering video datastream for multimedia applications using **storage area networks** (**SAN**), wide area network (WAN) such as public telephone networks, local area networks (LAN), metropolitan area network (MAN), **broadcast** area network (BAN).

ADVANTAGE - Since retrieved data content is directly transmitted to

client, time required for administrative functions such as replication and backups is reduced and latency between individual blades is significantly reduced and bandwidth between blades are improved. Provides multicast communication to other blades, even though external network does not support multicast.

DESCRIPTION OF DRAWING(S) - The figure illustrates a typical infiniband fabric architecture on the network.

pp; 53 DwgNo 4B/17

Title Terms: DELIVER; METHOD; STORAGE; AREA; NETWORK; TRANSFER; RETRIEVAL; DATA; CONTENT; CLIENT; CONTROL; ASSOCIATE; STORAGE; SYSTEM; COMMUNICATE; NETWORK; THROUGH; PORT

Derwent Class: T01; W01; W02

International Patent Class (Main): G06F-015/16

International Patent Class (Additional): G06F-017/30; H04J-003/24; **H04L-012/46**

File Segment: EPI

13/5/16 (Item 16 from file: 350)

DIALOG(R)File 350:Derwent WPIX

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014096892 **Image available**

WPI Acc No: 2001-581106/200165

XRPX Acc No: N01-432874

Small computer system interface protocol encapsulating method for data communication system, involves encapsulating input/output phase between local hosts and remote devices repeatedly

Patent Assignee: CROSSROADS SYSTEMS INC (CROS-N)

Inventor: HAECHTEN J B; REYNOLDS R A; SMELTZER K D

Number of Countries: 094 Number of Patents: 003

Patent Family:

Patent No	Kind	Date	Applicat No	Kind	Date	Week	
WO 200144891	A2	20010621	WO 2000US42087	A	20001113	200165	B
AU 200147070	A	20010625	AU 200147070	A	20001113	200165	
EP 1240575	A2	20020918	EP 2000992795	A	20001113	200269	
			WO 2000US42087	A	20001113		

Priority Applications (No Type Date): US 99165194 P 19991112

Patent Details:

Patent No	Kind	Lan	Pg	Main IPC	Filing Notes
WO 200144891	A2	E	17	G06F-000/00	
AU 200147070	A			G06F-000/00	Based on patent WO 200144891
EP 1240575	A2	E		G06F-001/00	Based on patent WO 200144891

Designated States (National): AE AG AL AM AT AU AZ BA BB BG BR BY BZ CA CH CN CR CU CZ DE DK DM DZ 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 NO NZ PL PT RO RU SD SE SG SI SK SL TJ TM TR TT TZ UA UG UZ VN YU ZA ZW

Designated States (Regional): AT BE CH CY DE DK EA ES FI FR GB GH GM GR IE IT KE LS LU MC MW MZ NL OA PT SD SE SL SZ TR TZ UG ZW

Designated States (Regional): AL AT BE CH CY DE DK ES FI FR GB GR IE IT LI LT LU LV MC MK NL PT RO SE SI TR

Abstract (Basic): WO 200144891 A2

NOVELTY - All available nodes (120,130,150) on a packet based network, and remote device connected to each node, are identified. One or more remote devices are represented such that they are made available to one or more local hosts (110,115). The input/output (I/O) phase is encapsulated between one or more local hosts and remote devices repeatedly, for subsequent I/O phases.

DETAILED DESCRIPTION - An INDEPENDENT CLAIM is also included for small computer system interface (SCSI) protocol encapsulating system.

USE - For **data transmission** between nodes across packet-based network such as asynchronous transfer mode (ATM) network, Ethernet network, IP network, SONET network for data communication system.

ADVANTAGE - The encapsulation protocol can link multiple **storage area networks** over packet-based network in seamless fashion, such that multiple **storage area networks** (SANs) operate as single

unified **SAN** . Enables extending **SAN** model to many SANs over distances much greater than that currently allowed by fiber channel protocol.

DESCRIPTION OF DRAWING(S) - The figure shows the simplified block diagram illustrating typical SAN environment.

Local hosts (110,115)

Nodes (120,130,150)

pp; 17 DwgNo 1/1

Title Terms: COMPUTER; SYSTEM; INTERFACE; PROTOCOL; ENCAPSULATE; METHOD; DATA; COMMUNICATE; SYSTEM; ENCAPSULATE; INPUT; OUTPUT; PHASE; LOCAL; HOST ; REMOTE; DEVICE; REPEAT

Derwent Class: T01

International Patent Class (Main): G06F-000/00; G06F-001/00

File Segment: EPI

13/5/17 (Item 17 from file: 350)

DIALOG(R)File 350:Derwent WPIX

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013968855 **Image available**

WPI Acc No: 2001-453068/200149

XRPX Acc No: N01-335443

Error processing method for multi vendor Storage Area Networks **using a topography map, problem determination information table and diagnostic table to pin point faulty network components**

Patent Assignee: INT BUSINESS MACHINES CORP (IBMC); IBM CORP (IBMC)

Inventor: BARNETT B S; BOSSEN D C

Number of Countries: 027 Number of Patents: 002

Patent Family:

Patent No	Kind	Date	Applicat No	Kind	Date	Week	
EP 1115225	A2	20010711	EP 2000311661	A	20001222	200149	B
JP 2001249856	A	20010914	JP 2000397033	A	20001227	200168	

Priority Applications (No Type Date): US 2000478306 A 20000106

Patent Details:

Patent No	Kind	Lan	Pg	Main IPC	Filing Notes
EP 1115225	A2	E		H04L-012/24	
	Designated States (Regional): AL AT BE CH CY DE DK ES FI FR GB GR IE IT LI LT LU LV MC MK NL PT RO SE SI TR				
JP 2001249856	A		20	G06F-013/00	

Abstract (Basic): EP 1115225 A2

NOVELTY - The **Storage Area Network** (**SAN**) consists of computer hosts or peripheral systems linked by Communication Architecture Elements (CAE). Each CAE (313) is registered by a Communication Architecture Manager (CAM) (304) which generates a SAN Problem Determination Information Table (SPDIT). Combining the to pography map and SPDIT to create a SAN Diagnostic Table (SDT) allows the CAM to analyze error packets and determine if a CAE is faulty.

DETAILED DESCRIPTION - INDEPENDENT CLAIMS are also included for a data processing system and computer program used to monitor SAN performance.

USE - To monitor **Storage Area Network** performance and to improve fault isolation.

ADVANTAGE - The SDT used by the CAM is unique to each CAM's connected CAE's, allowing CAEs from different manufacturers running different operating systems to be integrated into the network monitoring system. By comparing the timing and content of an error **message** against the SDT, the CAM can determine which CAE in its network path is producing the error, even if a fault in one CAE causes error packets from other CAE's in the same network path.

DESCRIPTION OF DRAWING(S) - The drawing shows a diagram of the SAN detailing the CAM and dependent CAE's

Communication Architecture Manager (CAM) (304)Communication Architecture Elements (CAE) (313)

DwgNo 3/8

Title Terms: ERROR; PROCESS; METHOD; MULTI; VENDING; STORAGE; AREA; NETWORK

; TOPOGRAPHICAL; MAP; PROBLEM; DETERMINE; INFORMATION; TABLE; DIAGNOSE; TABLE; PIN; POINT; FAULT; NETWORK; COMPONENT
Derwent Class: T01; W01
International Patent Class (Main): G06F-013/00; **H04L-012/24**
International Patent Class (Additional): G06F-015/177
File Segment: EPI

13/5/18 (Item 18 from file: 350)
DIALOG(R)File 350:Derwent WPIX
(c) 2003 Thomson Derwent. All rts. reserv.

013595977 **Image available**
WPI Acc No: 2001-080184/200109
XRPX Acc No: N01-061120
Network-based mail **attachment storage system transmits appended electronic** mail **item including uniform resource locator but excluding stored attachment, based on forwarding specification**
Patent Assignee: THINMAIL INC (THIN-N)
Inventor: POLLACK J
Number of Countries: 090 Number of Patents: 003
Patent Family:

Patent No	Kind	Date	Applicat No	Kind	Date	Week	
WO 200067133	A1	20001109	WO 2000US9561	A	20000411	200109	B
AU 200043384	A	20001117	AU 200043384	A	20000411	200111	
US 6505236	B1	20030107	US 99302877	A	19990430	200306	

Priority Applications (No Type Date): US 99302877 A 19990430
Patent Details:

Patent No	Kind	Lan	Pg	Main IPC	Filing Notes
WO 200067133	A1	E	31	G06F-013/00	

Designated States (National): AE AL AM AT AU AZ BA BB BG BR BY CA CH CN CR CU CZ DE DK DM 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 NO NZ PL PT RO RU SD SE SG SI SK SL TJ TM TR TT TZ UA UG UZ VN YU ZA ZW
Designated States (Regional): AT BE CH CY DE DK EA ES FI FR GB GH GM GR IE IT KE LS LU MC MW NL OA PT SD SE SL SZ TZ UG ZW

AU 200043384	A	G06F-013/00	Based on patent WO 200067133
US 6505236	B1	G06F-015/16	

Abstract (Basic): WO 200067133 A1
NOVELTY - A storage device (26) stores stripped attachment (20') at preset address (40) with specific file name (38). Generator (42) generates uniform resource locator (URL) (44) related to preset address and file name. Appender (46) appends URL to electronic **mail** item (14). A portal (48) transmits the appended e- **mail** including URL but excluding the stored attachment (20), based on forwarding specification (18).
DETAILED DESCRIPTION - A portal (12) receives the electronic **mail** item (14) containing forwarding specification (18) and an attachment (20). An attachment stripper (24) detaches the attachment from electronic **mail** item. A parser (41) extracts a recipient address (19) from forwarding specification. An attachment retriever (50) enables recipient (22) to retrieve the stored data attachment (20') from the storage device. A policy interpreter (52) determines if recipient is to be charged a fee for retrieving stored attachments. A timer (54) calculates a deletion time after which stored attachment is to be deleted. An attachment deleter (56) deletes stored attachment upon expiration of deletion time. A sender notifier (58) notifies sender (16) when recipient retrieved stored attachment. A comparator (60) compares stored attachment to previously stored attachments, to determine if any attachment are identical. A redundancy deleter (62) deletes stored attachment when it is identical to previously stored attachment. A redirector (64) redirects the uniform resource locator pointing to deleted attachment so that it points to identical previously stored attachment. The storage device which stores stripped attachment is chosen from the group consisting of hard drives (28), optical drives (30), random access **memories** (32), tape drives (34)

and **RAID** arrays (36). DEPENDENT CLAIMS are also included for the following:
(a) network-based **mail** attachment storage method;
(b) network-based **mail** attachment storage program
USE - Network-based **mail** attachment storage system for detaching and storing electronic **mail** attachments.
ADVANTAGE - Since e- **mail** attachments are detached from user's e- **mail** , the content of e- **mail** can be downloaded quickly and easily by user. Since detached e- **mail** attachment is stored and content of e- **mail** is appended to include uniform resource locator, the user can retrieve the e- **mail** attachment at a later time.
DESCRIPTION OF DRAWING(S) - The figure shows the diagrammatic view of the network-based e- **mail** attachment storage system.
Portal (12,48)
Electronic **mail** item (14)
Sender (16)
Specification (18)
Recipient address (19)
Attachments (20,20')
Recipient (22)
Attachment stripper (24)
Storage device (26)
Hard drives (28)
Optical drives (30)
Random access memories (32)
Tape drives (34)
RAID arrays (36)
File name (38)
Present address (40)
Parser (41)
Generator (42)
URL (44)
Appender (46)
Retriever (50)
Policy interpreter (52)
Timer (54)
Deleter (56)
Sender notifier (58)
Comparator (60)
Redundancy deleter (62)
Redirector (64)
pp; 31 DwgNo 1/4
Title Terms: NETWORK; BASED; **MAIL** ; ATTACH; STORAGE; SYSTEM; TRANSMIT; APPENDAGE; ELECTRONIC; **MAIL** ; ITEM; UNIFORM; RESOURCE; LOCATE; EXCLUDE; STORAGE; ATTACH; BASED; FORWARDING; SPECIFICATION
Derwent Class: T01; W01
International Patent Class (Main): G06F-013/00; G06F-015/16
International Patent Class (Additional): G06F-015/167; G06F-017/30; **H04L-012/00**
File Segment: EPI

13/5/19 (Item 19 from file: 350)
DIALOG(R)File 350:Derwent WPIX
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013131421 **Image available**
WPI Acc No: 2000-303292/200026
XRPX Acc No: N00-226651
Fiber channel address resolution protocol broadcast **responding method in fiber channel network, involves sending reply to** broadcast , **when storage devices are determined to be not FAR protocol compatible**
Patent Assignee: CROSSROADS SYSTEMS INC (CROS-N)
Inventor: WILSON S K
Number of Countries: 022 Number of Patents: 004
Patent Family:

Patent No	Kind	Date	Applicat No	Kind	Date	Week	
WO 200018049	A1	20000330	WO 99US22132	A	19990923	200026	B

US 6151331	A	20001121	US 98159163	A	19980923	200101
EP 1119931	A1	20010801	EP 99969555	A	19990923	200144
			WO 99US22132	A	19990923	
JP 2002525968	W	20020813	WO 99US22132	A	19990923	200267
			JP 2000571595	A	19990923	

Priority Applications (No Type Date): US 98159163 A 19980923
Patent Details:

Patent No	Kind	Lan	Pg	Main IPC	Filing Notes
WO 200018049	A1	E	28	H04J-003/02	
	Designated States (National): CA JP				
	Designated States (Regional): AT BE CH CY DE DK ES FI FR GB GR IE IT LU MC NL PT SE				
US 6151331	A			H04J-003/16	
EP 1119931	A1	E		H04J-003/02	Based on patent WO 200018049
	Designated States (Regional): AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE				
JP 2002525968	W		26	H04L-012/28	Based on patent WO 200018049

Abstract (Basic): WO 200018049 A1

NOVELTY - The fiber channel address resolution protocol (FARP) **broadcast** is received at storage router (18) connected to storage devices (20,30). When the storage devices are determined to be not FARP compatible, a reply containing physical address of storage device is transmitted to the FARP **broadcast** from the storage router.

DETAILED DESCRIPTION - The storage devices are connected to the storage router via an arbitrated loop (16). The FARP **broadcast** is sent from a client application resident on the host (14). An INDEPENDENT CLAIM is also included for fiber channel address resolution protocol **broadcast** responding system.

USE - For responding fiber channel address resolution protocol (FARP) **broadcast** in fiber channel network.

ADVANTAGE - Allows the use and discovery of legacy SCSI devices on a **storage area network** , using FARP and FARP address discovery.

DESCRIPTION OF DRAWING(S) - The figure shows exemplary **storage area network** for which FARP **broadcast** responding method is materialized.

Host (14)
Arbitrated loop (16)
Storage router (18)
Storage devices (20,30)
pp; 28 DwgNo 1/4

Title Terms: CHANNEL; ADDRESS; RESOLUTION; PROTOCOL; **BROADCAST** ; RESPOND; METHOD; CHANNEL; NETWORK; SEND; REPLY; **BROADCAST** ; STORAGE; DEVICE; DETERMINE; PROTOCOL; COMPATIBLE
Derwent Class: T01; W01
International Patent Class (Main): H04J-003/02; H04J-003/16; **H04L-012/28**
International Patent Class (Additional): H04J-013/00; **H04L-012/42** ; H04Q-011/00
File Segment: EPI

13/5/20 (Item 20 from file: 350)
DIALOG(R)File 350:Derwent WPIX
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012564474 **Image available**
WPI Acc No: 1999-370580/199931
XRPX Acc No: N99-276309
Redundant memory cell array for semiconductor memory such as dynamic random access memory (DRAM)
Patent Assignee: MITSUBISHI ELECTRIC CORP (MITQ); MITSUBISHI DENKI KK (MITQ)
Inventor: AMANO T; ARIMOTO K; FUJINO T; KINOSHITA M; KOBAYASHI M; MORISHITA F; TANIZAKI T; TSURUDA T
Number of Countries: 002 Number of Patents: 002
Patent Family:

Patent No	Kind	Date	Applicat No	Kind	Date	Week

US 5914907 A 19990622 US 98122760 A 19980727 199931 B
JP 11219598 A 19990810 JP 9821806 A 19980203 199942

Priority Applications (No Type Date): JP 9821806 A 19980203
Patent Details:
Patent No Kind Lan Pg Main IPC Filing Notes
US 5914907 A 23 G11C-008/00
JP 11219598 A 17 G11C-029/00
Abstract (Basic): US 5914907 A
NOVELTY - A redundant memory cell array is arranged at the intersection of a second row and column, which is further divided into subblocks having a predetermined number of memory cell rows and columns. The defective subblock of a memory cell array is replaced with a corresponding subblock of the redundant array based on an external setting.
DETAILED DESCRIPTION - Eight memory cell arrays are arranged by dividing the mounting surface into three rows and columns, except the region located at the intersection of the second row and the second column. Each array includes intersecting word and bit lines. Several memory cells are provided corresponding to the intersection of a word line and a bit line.
USE - For e.g. a DRAM.
ADVANTAGE - Minimizes delays in **data transmission** and accessing time and thus provides efficient error detection and a **highly reliable memory** . Allows the number of subblocks for redundancy operation to be minimized and chip area to be reduced since a redundant circuit is not required for each regular memory cell array.
DESCRIPTION OF DRAWING(S) - The figure shows a configuration of a plan view of the semiconductor memory device.
pp; 23 DwgNo 1/17
Title Terms: REDUNDANT; MEMORY; CELL; ARRAY; SEMICONDUCTOR; MEMORY; DYNAMIC ; RANDOM; ACCESS; MEMORY; DRAM
Derwent Class: U13; U14
International Patent Class (Main): G11C-008/00; G11C-029/00
International Patent Class (Additional): G11C-007/00
File Segment: EPI

13/5/21 (Item 21 from file: 350)
DIALOG(R)File 350:Derwent WPIX
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012526442 **Image available**
WPI Acc No: 1999-332548/199928
XRPX Acc No: N99-250183
Video cassette tape with memory, for signal recording-reproducing apparatus e.g. digital video tape recorder (VTR) - has power supply that produces DC power from power supply signal of power supply signal receiving coil, and supplies DC power as drive power to required location in cassette tape body
Patent Assignee: HITACHI LTD (HITA)
Number of Countries: 001 Number of Patents: 001
Patent Family:
Patent No Kind Date Applicat No Kind Date Week
JP 11120741 A 19990430 JP 97280509 A 19971014 199928 B

Priority Applications (No Type Date): JP 97280509 A 19971014
Patent Details:
Patent No Kind Lan Pg Main IPC Filing Notes
JP 11120741 A 9 G11B-023/30

Abstract (Basic): JP 11120741 A
NOVELTY - A power supply (1e4) produces DC power from power supply signal from a power supply signal receiving coil (1g), and to supply the DC power as a drive power to a required location in a cassette tape body (1a). The coil receives the power signal from the power signal transmission coil (35) of a power supply circuit (37) in a non-contact state. DETAILED DESCRIPTION - A **data transmission** -receiving coil

(1f) performs the non-contact transmission and reception of data to and from the data transmitting-receiving coil (34) a data interface (36). A data interface circuit (1e1) forwards and receives data to and from the data interface (36) via the **data transmission** -receiving coil (1f) and the coil (34). The data from the data interface circuit are written in a memory (1e). A microcomputer (1e3) reads the data from the memory and forwards the read data to the data interface circuit.An INDEPENDENT CLAIMS is included for a signal recording-reproducing apparatus.

USE - For e.g. digital VTR.

ADVANTAGE - Prevents e.g. contact failure, destruction of circuit elements e.g. **memory** due to static charge, thus ensuring **highly reliable** video cassette tape. DESCRIPTION OF DRAWING(S) - The figure shows the block diagram of the video cassette tape. (1a) Cassette tape body; (1e) Memory; (1e3) Microcomputer; (1e4) Power supply; (1f) **Data transmission** -receiving coil; (1g) Power supply signal receiving coil; (34) Data transmitting-receiving coil; (35) Power signal transmission coil; (36) Data interface; (37) Power supply circuit.

Dwg.1/5

Title Terms: VIDEO; CASSETTE; TAPE; MEMORY; SIGNAL; RECORD; REPRODUCE; APPARATUS; DIGITAL; VIDEO; TAPE; RECORD; VTR; POWER; SUPPLY; PRODUCE; DC; POWER; POWER; SUPPLY; SIGNAL; POWER; SUPPLY; SIGNAL; RECEIVE; COIL; SUPPLY; DC; POWER; DRIVE; POWER; REQUIRE; LOCATE; CASSETTE; TAPE; BODY

Derwent Class: T03; W04

International Patent Class (Main): G11B-023/30

International Patent Class (Additional): G11B-015/07

File Segment: EPI

13/5/22 (Item 22 from file: 350)

DIALOG(R)File 350:Derwent WPIX

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011272233 **Image available**

WPI Acc No: 1997-250136/199723

XRPX Acc No: N97-206565

Memory accessing method for information processor - in which notification of access end signal is output to information processor when data judged by first and second judging unit, contain no error

Patent Assignee: FUJI ELECTRIC CO LTD (FJIE); FUJIFACON CORP (FUJX)

Number of Countries: 001 Number of Patents: 001

Patent Family:

Patent No	Kind	Date	Applicat No	Kind	Date	Week	
JP 9081463	A	19970328	JP 95236420	A	19950914	199723	B

Priority Applications (No Type Date): JP 95236420 A 19950914

Patent Details:

Patent No	Kind	Lan	Pg	Main IPC	Filing Notes
JP 9081463	A		30	G06F-012/16	

Abstract (Basic): JP 9081463 A

The method is applicable for reading/writing of data between an information processor (101) and a data memory device (102). When a memory access demand is output then the output of information processor is **connected** to a **transmission cable** (8). A first latch unit (105) latches the data and a second error detecting code output through a second bus (7) from the data memory device, is input through a first bus (6). A first error detecting code generation/judging unit judges error in latched data by first latch unit, using the received second error detecting code. Based on the demand from the first judging unit, data latch operation and data latch release operation are performed repeatedly at regular intervals.

When the next memory access demand is output, then the output of data memory device is **connected** through **transmission cable** . A second latch unit (106) latches the received data and a first error detecting code output through the first bus of information processor is input through the second bus. A second error detecting code generation/judging unit judges error in the latched data using the error detecting code. Based on the demand from the second judging unit,

data latch operation and data latch release operation is repeatedly performed at regular intervals. But, when the data judged by the first and second judging units contain no error, then a notification of access end signal is output to the information processor.

ADVANTAGE - Realizes **highly reliable memory** accessing method. Avoids exclusive mechanism for retry operation, thereby reduces cost of appts.

Dwg.1/20

Title Terms: MEMORY; ACCESS; METHOD; INFORMATION; PROCESSOR; NOTIFICATION; ACCESS; END; SIGNAL; OUTPUT; INFORMATION; PROCESSOR; DATA; JUDGEMENT; FIRST; SECOND; JUDGEMENT; UNIT; CONTAIN; NO; ERROR
Derwent Class: T01
International Patent Class (Main): G06F-012/16
File Segment: EPI

13/5/23 (Item 23 from file: 350)

DIALOG(R)File 350:Derwent WPIX
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010374219 **Image available**
WPI Acc No: 1995-275581/199536
XRPX Acc No: N95-210604

Networking module for fault-tolerant transmission **of system management information - has primary** transmission **and secondary back-up** transmission **using two system management buses with microprocessor controllers**

Patent Assignee: CABLETRON SYSTEMS INC (CABL-N); FEE B (FEEB-I); OLIVER C (OLIV-I)
Inventor: FEE B; OLIVER C
Number of Countries: 020 Number of Patents: 005
Patent Family:

Patent No	Kind	Date	Applicat No	Kind	Date	Week	
WO 9520853	A1	19950803	WO 95US1177	A	19950126	199536	B
AU 9516950	A	19950815	AU 9516950	A	19950126	199546	
US 5485576	A	19960116	US 94188033	A	19940128	199609	
EP 741939	A1	19961113	EP 95908729	A	19950126	199650	
			WO 95US1177	A	19950126		
JP 9508483	W	19970826	JP 95520220	A	19950126	199744	
			WO 95US1177	A	19950126		

Priority Applications (No Type Date): US 94188033 A 19940128
Cited Patents: 2.Jnl.Ref
Patent Details:

Patent No	Kind	Lan	Pg	Main IPC	Filing Notes
WO 9520853	A1	E	23	H04L-029/14	
Designated States (National): AU JP					
Designated States (Regional): AT BE CH DE DK ES FR GB GR IE IT LU MC NL PT SE					
AU 9516950	A			H04L-029/14	Based on patent WO 9520853
US 5485576	A		11	G06F-011/20	
EP 741939	A1	E	1	H04L-029/14	Based on patent WO 9520853
Designated States (Regional): AT BE CH DE DK ES FR GB GR IE IT LI LU MC NL PT SE					
JP 9508483	W		32	G06F-013/00	Based on patent WO 9520853

Abstract (Basic): WO 9520853 A

The networking module (10) is positionable in a chassis and has several modules connected by two (20,26) system management buses. Each module has a processor. A fault-tolerant communication and control system on each module has a microprocessor controller (22), coupled between the first system management bus and a processor (CPU) located on the networking module.

The secondary path includes a second microprocessor controller and a dual-port memory. The second controller system is coupled to the second system management bus and to a first port of the memory, and a second port of the memory is coupled to the CPU. The dual-port memory provides an interface between the CPU and the second microprocessor controller system to provide isolation and allow the memory to be

accessible by either processor.
USE/ADVANTAGE - **Fault tolerant system** management buses. Information **storage** accessed and transmitted over backup **transmission** path in event of failure of primary path.
Dwg.1/7
Title Terms: MODULE; FAULT; TOLERATE; **TRANSMISSION** ; SYSTEM; MANAGEMENT; INFORMATION; PRIMARY; **TRANSMISSION** ; SECONDARY; BACK; UP; **TRANSMISSION** ; TWO; SYSTEM; MANAGEMENT; BUS; MICROPROCESSOR; CONTROL
Derwent Class: T01; W01
International Patent Class (Main): G06F-011/20; G06F-013/00; H04L-029/14
International Patent Class (Additional): **H04L-012/40**
File Segment: EPI

13/5/24 (Item 24 from file: 350)
DIALOG(R)File 350:Derwent WPIX
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009214467 **Image available**
WPI Acc No: 1992-341887/199242
XRPX Acc No: N92-260755
Raid storage **system for host computer - uses controller with number of array channels between host and disc drives which can be reconfigured into different raid levels**
Patent Assignee: HYUNDAI ELECTRONICS AMERICA (HYUN-N); NCR INT INC (NATC) ; SYMBIOS INC (SYMB-N); AT & T GLOBAL INFORMATION SOLUTIONS INT INC (AMTT); SYMBIOS LOGIC INC (SYMB-N); NCR CORP (NATC)
Inventor: JIBBE M K; MCCOMBS C C; THOMPSON K J
Number of Countries: 005 Number of Patents: 006
Patent Family:

Patent No	Kind	Date	Applicat No	Kind	Date	Week	
EP 508604	A2	19921014	EP 92302098	A	19920311	199242	B
US 5345565	A	19940906	US 91668660	A	19910313	199435	
EP 508604	A3	19930922	EP 92302098	A	19920311	199509	
EP 508604	B1	19991117	EP 92302098	A	19920311	199953	
DE 69230299	E	19991223	DE 630299	A	19920311	200006	
			EP 92302098	A	19920311		
JP 3159768	B2	20010423	JP 9286576	A	19920311	200125	

Priority Applications (No Type Date): US 91668660 A 19910313
Cited Patents: No-SR.Pub; EP 294287; EP 320107; EP 369707; US 4899342; US 4914656
Patent Details:

Patent No	Kind	Lan	Pg	Main IPC	Filing Notes
EP 508604	A2	E	32	G06F-003/06	
Designated States (Regional): DE FR GB					
US 5345565	A		31	G06F-011/10	
EP 508604	A3			G06F-003/06	
EP 508604	B1	E		G06F-003/06	
Designated States (Regional): DE FR GB					
DE 69230299	E			G06F-003/06	Based on patent EP 508604
JP 3159768	B2		32	G06F-003/06	Previous Publ. patent JP 6180623

Abstract (Basic): EP 508604 A
The disc array controller system provides data transfer between a host (12) and various disc drives. The discs can be organised to perform as a RAID level 1, 3, 4 or 5 disc array. The controller system includes a number of array channels (21-25) to couple selected disc drives with the hose bus (16). Circuitry generates parity information during write operations.
Each array channel has a data **bus connected** between the host **bus** and its associated disc drive, and also the input and output of the parity generation circuitry. Bus drivers control the configuration of the disc array.
ADVANTAGE - System can be readily reconfigured to provide different styles of RAID system.
Dwg.1/18
Title Terms: RAID; STORAGE; SYSTEM; HOST; COMPUTER; CONTROL; NUMBER; ARRAY; CHANNEL; HOST; DISC; DRIVE; CAN; RECONFIGURE; RAID; LEVEL

Derwent Class: T01; T03
International Patent Class (Main): G06F-003/06; G06F-011/10
International Patent Class (Additional): G06F-013/42
File Segment: EPI

13/5/25 (Item 25 from file: 350)
DIALOG(R)File 350:Derwent WPIX
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008612298 **Image available**
WPI Acc No: 1991-116328/199116
XRPX Acc No: N91-089495
Data storage processing code series error detector - has data and clock input rails connected to LSB and shift permit inputs of shift register
Patent Assignee: VASILENKO V S (VASI-I)
Inventor: VADYTKO A B; VASILENKO V S; VERESENKO V A
Number of Countries: 001 Number of Patents: 001
Patent Family:

Patent No	Kind	Date	Applicat No	Kind	Date	Week	
SU 1569996	A	19900607	SU 4462594	A	19880720	199116	B

Priority Applications (No Type Date): SU 4462594 A 19880720

Abstract (Basic): SU 1569996 A
The error detector has shift register (3), registers (4.1, 4.2,7), memory (5), adder (6), counters (8,13), decoders (9,14), NOT-gate (10), AND-gates (11.1,11.2,15,17), OR-gate (12) and recording pulse shaper (16). With any error occurrence in one of remainders, a received number exceeds the range limits and in the sign bit of the adder (6) a unity is formed, otherwise it is zero.
USE/ADVANTAGE - In computer engineering, in digital devices for data processing, **storage** and transmission and **highly reliable data transmission** systems. Reduced hardware. Bul.21/7.6.90. (4pp Dwg.No.1/1)
Title Terms: DATA; STORAGE; PROCESS; CODE; SERIES; ERROR; DETECT; DATA; CLOCK; INPUT; RAIL; CONNECT; LSB; SHIFT; PERMIT; INPUT; SHIFT; REGISTER
Derwent Class: U21
International Patent Class (Additional): H03M-013/00
File Segment: EPI

13/5/26 (Item 26 from file: 350)
DIALOG(R)File 350:Derwent WPIX
(c) 2003 Thomson Derwent. All rts. reserv.

008432276 **Image available**
WPI Acc No: 1990-319276/199042
XRPX Acc No: N90-244647
Codes monitor for computer and data transmission **engineering - has data input rail connected to data input of reception permit flip-flop**
Patent Assignee: KLYUCHKO V I (KLYU-I)
Inventor: KLYUCHKO V I; PETUKHOV V E; TKACHENKO A V
Number of Countries: 001 Number of Patents: 001
Patent Family:

Patent No	Kind	Date	Applicat No	Kind	Date	Week	
SU 1552382	A	19900323	SU 4329949	A	19871117	199042	B

Priority Applications (No Type Date): SU 4329949 A 19871117

Abstract (Basic): SU 1552382 A
The codes monitor includes counter (1), flip flop (9), first comparison-to-constant comparator (10) and OR-gate (15). Now it incorporates AND-gates (3,12,13) and second comparison-to-constant comparator (11). The counter (1) is for counting a number of zeroes and resetting on arrival of a unity signal at the input (4). With arrival a unity signal at the input (7) the counter (1) is loaded by a constant t. When more than (2.t+1) zero signal arrival it is then cleared.

USE/ADVANTAGE - For monitoring the min. and optimal Fibonacci codes and also monitoring t-count system. The design allows ALU devices to be tested, for **highly reliable storage** devices etc.
Bul.11/23.3.90.
Dwg.1/2
Title Terms: CODE; MONITOR; COMPUTER; DATA; TRANSMISSION; ENGINEERING; DATA ; INPUT; RAIL; CONNECT; DATA; INPUT; RECEPTION; PERMIT; FLIP-FLOP
Derwent Class: T01; U21; W01
International Patent Class (Additional): H03M-013/00
File Segment: EPI

13/5/27 (Item 27 from file: 347)
DIALOG(R)File 347:JAPIO
(c) 2003 JPO & JAPIO. All rts. reserv.

07419595 **Image available**
STORAGE AREA NETWORK SYSTEM, METHOD FOR ITS OPERATION, **STORAGE** , AND DATA TRANSFERRING QUANTITY MONITORING DEVICE

PUB. NO.: 2002-288105 [JP 2002288105 A]
PUBLISHED: October 04, 2002 (20021004)
INVENTOR(s): MIYAZAWA YOSHIHIKO
MURAKAMI MASAHARU
WATANABE TAKESHI
APPLICANT(s): HITACHI LTD
APPL. NO.: 2001-087233 [JP 20011087233]
FILED: March 26, 2001 (20010326)
INTL CLASS: G06F-013/10; G06F-003/06

ABSTRACT

PROBLEM TO BE SOLVED: To guarantee the access performance of a user terminal to an **SAN (storage area network**) system.

SOLUTION: In the **storage area network** system, each user server has a prescribed data transferring quantity regulated to each in **data transmission** and reception through an I/F port with a magnetic disk device, the data transferring quantity between each user server and the magnetic disk device is obtained and monitored (4200), the regulated data transferring quantity of the user server is compared with an obtained actual data transferring quantity (4300) and the I/F port of a storage is selected according to this comparing result to give an instruction of connection to this port to a corresponding server (4700). Thus, in the **SAN** system to be applied to SSP(**storage** server provider), IDC(Internet data center), etc., a line capacity which a user serve can transfer in a fixed period is restricted, thereby it is possible to secure keeping of response performance as the whole system.

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13/5/28 (Item 28 from file: 347)
DIALOG(R)File 347:JAPIO
(c) 2003 JPO & JAPIO. All rts. reserv.

06762134 **Image available**
COMPUTER SYSTEM

PUB. NO.: 2000-348005 [JP 2000348005 A]
PUBLISHED: December 15, 2000 (20001215)
INVENTOR(s): KAMIMAKI HIDEKI
MATSUNAMI NAOTO
MATSUMOTO JUN
ICHIKAWA MASATOSHI
YAMAMOTO AKIRA
KOHIYAMA TOMOHISA
APPLICANT(s): HITACHI LTD
APPL. NO.: 11-160555 [JP 99160555]

FILED: June 08, 1999 (19990608)
INTL CLASS: G06F-015/177; G06F-013/00

ABSTRACT

PROBLEM TO BE SOLVED: To improve the reliability of a system to which clients systems are connected, to make its performance and functions high, and to facilitate the operation management by providing a means for system control at the time of multiplication, a means for operation in the case of fault occurrence, and a means for the selective switching of a **transmission** line.

SOLUTION: A network is constituted so that a storage system 5 being a disk array device transferring data via plural client systems 1, a server system 3 constituting a computer system and SAN, is doubled by a LAN 2 which makes a communication by the IP protocol and a **storage** network **SAN** 4 which is **connected** by an optical **fiber** performing **storage** data transfer by the SCSI protocol. This constitution can improve the performance of access to a storage of the storage system without mounting a local disk on the client system 1 and enables the batch management of storage, so that the system having high operation performance can be obtained.

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13/5/29 (Item 29 from file: 347)
DIALOG(R)File 347:JAPIO
(c) 2003 JPO & JAPIO. All rts. reserv.

06497366 **Image available**
DIGITAL SIGNAL **TRANSMISSION** CIRCUIT OF SEMICONDUCTOR DEVICE, SMALL SIGNAL SENSE CIRCUIT AND SEMICONDUCTOR DEVICE USING DIGITAL SIGNAL **TRANSMISSION** CIRCUIT OR SMALL SIGNAL SENSE CIRCUIT

PUB. NO.: 2000-083069 [JP 2000083069 A]
PUBLISHED: March 21, 2000 (20000321)
INVENTOR(s): TAKEUCHI MIKI
NAKAGOME YOSHINOBU
TANAKA TOSHIHIRO
SHINAGAWA YUTAKA
SUZUKAWA KAZUFUMI
FUJITO MASAMICHI
APPLICANT(s): HITACHI LTD
APPL. NO.: 11-133455 [JP 99133455]
FILED: May 14, 1999 (19990514)
PRIORITY: 10-195269 [JP 98195269], JP (Japan), July 10, 1998 (19980710)
INTL CLASS: H04L-025/02; G11C-011/417; G11C-011/409; H03K-019/0175

ABSTRACT

PROBLEM TO BE SOLVED: To provide a semiconductor device that realizes a signal **transmission** system whose noise and power consumption alike are small and which is suitable for high speed signal **transmission** between physically separated blocks or a small sense circuit which is suitable to read **memory storage** information and is high in speed and **highly reliable** .

SOLUTION: In this signal **transmission** circuit where a preceding stage logic circuit 10 and an output circuit 20 on a transmitting side and an input circuit 30 and a next stage logic circuit 40 on a receiving side exist on different semiconductor chips or are arranged at separate positions on the same chip and they are connected by a pair of complementary signal lines, digital signal **transmission** is performed by the complementary signal line pair that symmetrically shifts from almost middle potential between high potential and low potential and the input circuit 30 where one of the complementary signal **line** pair is **connected** to the source of a 1st field effect transistor M1T and the gate of a 2nd field effect transistor M1B, the other is connected to the gate of the M1T and the source of the M1B and the drains of the M1T and M1B are connected to a transistor conduction detection circuit 310 is provided.

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13/5/30 (Item 30 from file: 347)
DIALOG(R)File 347:JAPIO
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05993104 **Image available**
ATM BEST EFFORT SERVICE SUPPLY METHOD USING PRELIMINARY BAND

PUB. NO.: 10-276204 [JP 10276204 A]
PUBLISHED: October 13, 1998 (19981013)
INVENTOR(s): UEMATSU HITOSHI
HARADA KAZUYUKI
KONDO AKIHIKO
YASUSHI TETSUJIROU
WATANABE SHIGERU
KANAYAMA YUKIHARU
KAWAMURA RYUTARO
APPLICANT(s): NIPPON TELEGR & TELEPH CORP <NTT> [000422] (A Japanese Company or Corporation), JP (Japan)
APPL. NO.: 09-077843 [JP 9777843]
FILED: March 28, 1997 (19970328)
INTL CLASS: [6] **H04L-012/28** ; H04Q-003/00
JAPIO CLASS: 44.3 (COMMUNICATION -- Telegraphy); 44.4 (COMMUNICATION -- Telephone)

ABSTRACT

PROBLEM TO BE SOLVED: To improve best effort service by permitting a path or a line executing **highly reliable** communication to duplex routes between facing devices, **storing** the path or the line executing best effort service in one route and switching the routes in accordance with the fault situation of the route.

SOLUTION: The path (highly reliable VP.VC) supplying highly reliable communication by an asynchronous transfer mode communication system is duplexes in the **transmission** lines 21-24 of the facing devices 11 and 12 and the path (best effort VP.VC) supplying best effort service is not duplexed and is stored in the **transmission** lines 22 and 24. In the devices 11-14, the priority of highly reliable VP is made to be the highest and that of best effort VP is made to be lowest. When a fault does not occur in the **transmission** line, highly reliable VP.VC selects the **transmission** lines 22 and 24. When the fault occurs in the **transmission** line, highly reliable VP.VC detects the fault and switches the lines to the **transmission** lines 21 and 23. When the fault is restored, highly reliable VP.VC is returned to the **transmission** lines 22 and 24.

```
Set     Items   Description
S1      18274   FTSS OR RAID? OR HIGHLY()RELIABLE OR (FAULT? OR FAILURE? OR
             ERROR?)()TOLERAN?()SYSTEM? OR  REDUNDANT?()ARRAY?
S2       1504   S1(10N)(MEMOR? OR STORAGE? OR STORING)
S3     402308   MESSAG? OR TRANSMISS? OR MAIL? OR EMAIL? OR BROADCAST? OR(-
            COMMUNICATION OR SUBSCRIPTION)()(MANAG? OR AGENT?)
S4     184577   (CONNECT? OR INTERCONNECT?)(3N)(CABLING OR FABRIC? OR HARD-
            WAR? OR BUS? ? OR LINE? OR WIRE? OR CABLE? OR FIBRE? OR FIBER-
            ?) OR PHYSICAL()LAYER?
S5      32013   (DATA OR NETWORK?)()TRANSMISS?
S6     102493   (MULTIPLE OR MULTIPLICITY OR PLURAL OR PLURALITY OR MANY OR
             SEVERAL OR SECOND OR ADDITIONAL OR NEXT)(2N)(NODE? OR SERVER?
             OR WORKSTATION? OR MEMBER?)
S7         12   S2(S)S3(S)S4
S8          5   S2(S)S3(S)S6
S9          7   S1(S)S3(S)S4(S)S6
S10      1154   S1(S)S3
S11        82   S10(S)(S4 OR S6)
S12        16   S11 AND IC=(H04L-012? OR H04L-001?)
S13        38   (S7 OR S8 OR S9 OR S12)
S14        26   S13 AND IC=(G06F? OR H04L?)
S15        26   IDPAT (sorted in duplicate/non-duplicate order)
S16        26   IDPAT (primary/non-duplicate records only)
File 348:EUROPEAN PATENTS 1978-2003/Jun W03
        (c) 2003 European Patent Office
File 349:PCT FULLTEXT 1979-2002/UB=20030619,UT=20030612
        (c) 2003 WIPO/Univentio
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European + PCT Files

16/5,K/6 (Item 6 from file: 348)
DIALOG(R)File 348:EUROPEAN PATENTS
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00959017
Hierarchical storage management from a mirrored file system on a storage network segmented by a bridge
Hierarchische Speicherverwaltung eines gespiegelten Dateiensystems in einem durch eine Brucke segmentierten Speichernetzwerk
Gestion de memoire hierarchique d'un systeme de fichiers miroirs dans un reseau segmente par un pont
PATENT ASSIGNEE:
Gadzoox Networks, Inc., (2452040), 6840 Via Del Oro, Suite 290, San Jose, Ca. 95119, (US), (applicant designated states: AT;BE;CH;CY;DE;DK;ES;FI;FR;GB;GR;IE;IT;LI;LU;MC;NL;PT;SE)
INVENTOR:
Chin, Howey Q., 1804 Schooldale Drive, San Jose, CA 95124, (US)
Chan, Kurt, 6595 Pueblo Court, Roseville, CA 95746, (US)
LEGAL REPRESENTATIVE:
Brax, Matti Juhani (85201), Berggren Oy Ab, P.O. Box 16, 00101 Helsinki, (FI)
PATENT (CC, No, Kind, Date): EP 869439 A1 981007 (Basic)
APPLICATION (CC, No, Date): EP 98660029 980401;
PRIORITY (CC, No, Date): US 825683 970401
DESIGNATED STATES: AT; BE; CH; CY; DE; DK; ES; FI; FR; GB; GR; IE; IT; LI; LU; MC; NL; PT; SE
INTERNATIONAL PATENT CLASS: **G06F-011/14**

ABSTRACT EP 869439 A1
A system for hierarchical data storage management and transparent data backup in a high speed, high volume Fibre Channel Arbitrated Loop environment comprising first (10) and second (26) Fibre Channel Arbitrated Loops, each coupling a Transaction Server (16) and backup HSM server (30) to high speed disk drives (12,14) and mirrored high speed disk drives (32,34) respectively. The two loops are coupled by a Bridge (28) compatible with the Fibre Channel Arbitrated Loop protocol which forwards write transactions directed to the mirrored disk drives (32,34) from the first loop (10) to the second (26) but keeps read transaction from the Transaction Server (16) to the high speed disk drives (12,14) on the first loop (10) isolated from backup and HSM transactions occurring on the second loop (26) between the backup HSM server (30), the mirrored disk drives (32,34) and backup storage devices (38,40) coupled to the backup HSM server (30).
ABSTRACT WORD COUNT: 151

LEGAL STATUS (Type, Pub Date, Kind, Text):

Withdrawal:	000531	A1	Date application deemed withdrawn: 19991207
Application:	981007	A1	Published application (A1with Search Report ;A2without Search Report)
Examination:	981007	A1	Date of filing of request for examination: 980409
Examination:	981111	A1	Date of despatch of first examination report: 980924
Change:	990609	A1	Title of invention (English) (change)
Change:	990609	A1	Title of invention (French) (change)
Change:	990616	A1	Designated Contracting States (change)
Change:	990616	A1	Title of invention (English) (change)
Change:	990616	A1	Title of invention (French) (change)
Change:	990714	A1	Title of invention (English) (change)
Change:	990714	A1	Title of invention (French) (change)

LANGUAGE (Publication,Procedural,Application): English; English; English
FULLTEXT AVAILABILITY:

Available Text	Language	Update	Word Count
CLAIMS A	(English)	9841	1707
SPEC A	(English)	9841	30022
Total word count - document A			31729
Total word count - document B			0
Total word count - documents A + B			31729

INTERNATIONAL PATENT CLASS: [redacted]06F-011/14

...SPECIFICATION another server. The second server is connected by another SCSI bus to a mirrored JBOD, **RAID** or other hard disk arrangement. In this arrangement, each time the Transaction Server writes data...

...hard drive array, the same data needs to be converted from SCSI format, packetized for **transmission** over the proprietary high speed link and transmitted to the **second server** using whatever protocol is in use on the proprietary high speed link. When the **second server** receives the packets, it must depacketize them and convert the payload data to SCSI format...

...SCSI write transaction to write the data to the hard disk array coupled to the **second server** . Thus, the overhead of two SCSI write transactions, packetizing and depacketizing to/from the packet format on the proprietary high speed link and a **transmission** over the proprietary high speed link must be made to get the data mirrored. The...

16/5,K/21 (Item 21 from file: 349)
DIALOG(R)File 349:PCT FULLTEXT
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00766397 **Image available**
SIGNALING GATEWAY
PASSERELLE DE SIGNALISATION
Patent Applicant/Assignee:
NORTEL NETWORKS CORPORATION, World Trade Center of Montreal, 8th floor, 280 St. Antoine Street West, Montreal, Quebec H2Y 3Y4, CA, CA (Residence), CA (Nationality)
Inventor(s):
LIAO Monling, 11201 Trescott Court, Raleigh, NC 27614, US
Patent and Priority Information (Country, Number, Date):
Patent: WO 200079807 A1 20001228 (WO 0079807)
Application: WO 2000IB1236 20000616 (PCT/WO IB0001236)
Priority Application: US 99334961 19990617
Designated States: CA
(EP) AT BE CH CY DE DK ES FI FR GB GR IE IT LU MC NL PT SE
Main International Patent Class: H04Q-003/00
International Patent Class: **H04L-012/66**
Publication Language: English
Filing Language: English
Fulltext Availability:
Detailed Description
Claims
Fulltext Word Count: 19169

English Abstract
An apparatus, system, and method are provided for interworking reliable signaling and services between a public telephone (PTN) network and an internet protocol (IP) network. The public telephone network transports an ISUP and/or TCAP message in a first format, while the internet protocol network transports an encapsulated ISUP and/or TCAP message in a second format. A first interface exchanges messages in the first format with the public telephone network, and a second interface exchanges encapsulated ISUP and/or TCAP messages in the second format with the internet protocol network. A processor translates ISUP and/or TCAP messages in the first format to/from the encapsulated ISUP and/or TCAP messages in the second format. The processor forwards messages in either format to the respective network. The first format can be the SS7 protocol format used in a public telephone network, while the second format can be the IP protocol format used in an internet protocol network. Network interconnection addressing and routing remapping functions are included. Network load sharing and fail-over switching functions are provided. An apparatus for exchanging encapsulated ISUP and/or TCAP messages with the internet protocol network is included. A system for interworking a public telephone network and an internet protocol network is provided. The system comprises a first network node, a second network node, and at least one interworking apparatus having a processor adapted for exchanging ISUP and/or TCAP messages in either format with the respective networks, as described. Related methods for interworking and translating messages between networks are provided.

French Abstract
L'invention concerne un appareil, un systeme et un procede permettant l'interconnexion d'une signalisation fiable et de services entre un reseau telephonique public et un reseau IP. Le reseau telephonique public achemine un message SSUR RNIS (ISUP) et/ou SSGT dans un premier format, tandis que le reseau IP achemine un message SSUR RNIS (ISUP) et/ou SSGT encapsule, dans un second format. Une premiere interface echange des messages dans le premier format avec le reseau telephonique public, et une seconde interface echange les messages SSUR RNIS (ISUP) et/ou SSGT encapsules, dans le second format avec le reseau IP. Un processeur traduit les messages SSUR RNIS (ISUP) et/ou SSGT dans le premier format en messages SSUR RNIS (ISUP) et/ou SSGT encapsules, dans le second format ou inversement. Le processeur transmet les messages dans un des deux

formats au reseau respectif. Le premier format peut etre le format de protocole SS7 utilise dans un reseau telephonique public, et le second format peut etre le format de protocole internet utilise dans un reseau IP. L'invention concerne egalement des fonctions de remappage de routage et d'addressage d'interconnexions reseau, ainsi que des fonctions de commutation de secours et de repartition des charges du reseau. L'invention concerne en outre un appareil servant a echanger des messages SSUR RNIS (ISUP) et/ou SSGT avec le reseau IP, ainsi qu'un systeme concu pour interconnecter un reseau telephonique public et un reseau IP. Le systeme comporte un premier noeud de reseau, un second noeud de reseau, et au moins un appareil d'interconnexion ayant un processeur concu pour echanger des messages SSUR RNIS (ISUP) et/ou SSGT, quel que soit le format, avec les reseaux respectifs, tel qu'il est decrit. L'invention concerne par ailleurs des procedes associes d'interconnexion et de traduction de messages entre les reseaux.

Legal Status (Type, Date, Text)
Publication 20001228 A1 With international search report.
Publication 20001228 A1 Before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments.
Examination 20010322 Request for preliminary examination prior to end of 19th month from priority date
International Patent Class: **H04L-012/66**
Fulltext Availability:
Detailed Description

Detailed Description
... therebetween. The first interworking apparatus and second interworking apparatus are connected to the first network **node** and **second** network **node** respectively, such that messages can be exchanged between the first and **second** network **nodes** through the operably connected interworking apparatuses. Further, the first and second interworking apparatuses can be...

...described above, so as to emulate the respective SS7 signaling link for interfacing with the **second** network **node** through the internet ... first network node and the first and second interworking apparatuses. Accordingly, the system can provide **highly** **reliable** signaling and services from IP network resources.

An embodiment of the present invention provides a...

```
Set     Items   Description
S1         23   AU=(GAITHER B? OR GAITHER, B?)
S2         37   AU=(MCKEE B? OR MCKEE, B?)
S3          6   S1 AND S2
S4         30   (S1 OR S2) AND IC=G06F?
S5         32   S3 OR S4
S6         32   IDPAT (sorted in duplicate/non-duplicate order)
S7         25   IDPAT (primary/non-duplicate records only)
File 344:Chinese Patents Abs Aug 1985-2003/Mar
         (c) 2003 European Patent Office
File 347:JAPIO Oct 1976-2003/Feb(Updated 030603)
         (c) 2003 JPO & JAPIO
File 350:Derwent WPIX 1963-2003/UD,UM &UP=200340
         (c) 2003  Thomson Derwent
File 348:EUROPEAN PATENTS 1978-2003/Jun W03
         (c) 2003 European Patent Office
File 349:PCT FULLTEXT 1979-2002/UB=20030619,UT=20030612
         (c) 2003 WIPO/Univentio
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7/5/1 (Item 1 from file: 350)
DIALOG(R)File 350:Derwent WPIX
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015301612 **Image available**
WPI Acc No: 2003-362546/200334
XRPX Acc No: N03-289577
Computer system has cache memories to store group of lines by single transaction, and processing system to maintain identity of bus that owns group of lines, and bus that owns each individual line within group of lines
Patent Assignee: HEWLETT-PACKARD CO (HEWP); GAITHER B D (GAIT-I)
Inventor: **GAITHER B D**
Number of Countries: 003 Number of Patents: 003
Patent Family:

Patent No	Kind	Date	Applicat No	Kind	Date	Week	
US 20030028730	A1	20030206	US 2001919309	A	20010731	200334	B
JP 2003067246	A	20030307	JP 2002195680	A	20020704	200334	
DE 10232926	A1	20030306	DE 1032926	A	20020719	200334	

Priority Applications (No Type Date): US 2001919309 A 20010731
Patent Details:

Patent No	Kind	Lan	Pg	Main IPC	Filing Notes
US 20030028730	A1		13	G06F-013/00	
JP 2003067246	A		11	G06F-012/08	
DE 10232926	A1			G06F-012/08	

Abstract (Basic): US 20030028730 A1
NOVELTY - The computer system comprises cache memories (C1) (110) for reading and storing group of lines by single memory transaction. A processing system maintains identity of bus that owns group of lines, and the bus (106) that owns each individual line within the group of lines.
DETAILED DESCRIPTION - INDEPENDENT CLAIMS are also included for the following:
(1) computer system coherency maintaining method; and
(2) memory lines transferring method.
USE - Computer system with multi-processors.
ADVANTAGE - Coherency states are maintained for group of lines and for individual lines stored in cache memory. The transfer of multiple data lines is performed by single coherency transaction and thereby overall latency is reduced. Prevents increased cache-to-cache copy activity caused by long lines.
DESCRIPTION OF DRAWING(S) - The figure shows a block diagram of the computer system.
bus (106)
cache memories (110)
pp; 13 DwgNo 1/5
Title Terms: COMPUTER; SYSTEM; CACHE; MEMORY; STORAGE; GROUP; LINE; SINGLE; TRANSACTION; PROCESS; SYSTEM; MAINTAIN; IDENTIFY; BUS; GROUP; LINE; BUS; INDIVIDUAL; LINE; GROUP; LINE
Derwent Class: T01; U14
International Patent Class (Main): **G06F-012/08 ; G06F-013/00**
International Patent Class (Additional): **G06F-015/16 ; G06F-015/177**
File Segment: EPI

7/5/2 (Item 2 from file: 350)
DIALOG(R)File 350:Derwent WPIX
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015015536 **Image available**
WPI Acc No: 2003-076053/200307
XRPX Acc No: N03-058906
Combined-hardware-and-software secure-platform interface for secure memory-management, object dispatching etc.; provides operational control of hardware resources without exposing privileged instructions and privileged registers

Patent Assignee: HEWLETT-PACKARD CO (HEWP); CHRISTIAN T (CHRI-I); GARDNER R (GARD-I); HYSER C D (HYSE-I); MAGENHEIMER D J (MAGE-I); MCKEE B (MCKE-I); WORLEY J S (WORL-I); WORLEY W S (WORL-I)
Inventor: CHRISTIAN T; GARDNER R; HYSER C D; MAGENHEIMER D J; **MCKEE B** ; WORLEY J S; WORLEY W S
Number of Countries: 004 Number of Patents: 003
Patent Family:

Patent No	Kind	Date	Applicat No	Kind	Date	Week
WO 2002101504	A2	20021219	WO 2002US18180	A	20020607	200307 B
US 20020194389	A1	20021219	US 2001296957	P	20010608	200315
			US 2001296958	P	20010608	
			US 2001297175	P	20010608	
			US 2002118646	A	20020408	
GB 2381630	A	20030507	WO 2002US18180	A	20020607	200331
			GB 20034527	A	20030227	

Priority Applications (No Type Date): US 2002118646 A 20020408; US 2001296957 P 20010608; US 2001296958 P 20010608; US 2001297175 P 20010608
Patent Details:

Patent No	Kind	Lan	Pg	Main IPC	Filing Notes
WO 2002101504	A2	E	85	G06F-000/00	
Designated States (National): DE GB JP					
US 20020194389	A1			G06F-009/00	Provisional application US 2001296957
					Provisional application US 2001296958
					Provisional application US 2001297175
GB 2381630	A			G06F-009/46	Based on patent WO 200201504

Abstract (Basic): WO 2002101504 A2
NOVELTY - Non-privileged instructions and non-privileged registers are provided by a hardware instruction-set architecture. A set of callable software services that may execute at a privilege level that is more privileged than the privilege levels of calling programs. An operational control of hardware resources does not expose their privileged instructions and privileged registers and without simulating privileged instructions and privileged registers.
DETAILED DESCRIPTION - INDEPENDENT CLAIMS are included for:
(a) computer instructions that implement a software portion of the combined-hardware-and-software secure platform interface
(b) a computer system that hosts a control program
(c) a method of securing a computer system
USE - In a secure machine and secure machine interface that provides secure memory-management, dispatchable object dispatching, exception handling, interrupt handling, debugging and performance monitoring, cryptographic services, and secure repository services to operating systems and customized control programs.
ADVANTAGE - Provides a set of secure-platform management services for operational control of hardware resources that neither expose privileged instructions and privileged registers of the hardware nor simulate privileged instructions and privileged registers. Provides the secure-repository, that employ internally generated secret data, each security-management service managing internal secret data.
DESCRIPTION OF DRAWING(S) - The drawing is a block diagram illustrating the secure platform (SP) interfaces within a computer system comprising a combined-hardware and software secure platform and one or more operating systems and customized control program.
pp; 85 DwgNo 15/19
Title Terms: COMBINATION; HARDWARE; SOFTWARE; SECURE; PLATFORM; INTERFACE; SECURE; MEMORY; MANAGEMENT; OBJECT; DISPATCH; OPERATE; CONTROL; HARDWARE; RESOURCE; EXPOSE; INSTRUCTION; REGISTER
Derwent Class: T01; W01
International Patent Class (Main): **G06F-000/00** ; **G06F-009/46**
International Patent Class (Additional): **G06F-009/00** ; **G06F-009/54** ; **G06F-015/163**
File Segment: EPI

7/5/3 (Item 3 from file: 350)

DIALOG(R)File 350:Derwent W
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014919124 **Image available**
WPI Acc No: 2002-739831/200280
XRPX Acc No: N02-582834
Stereoscopic image capture device for computer-aided design system, has timers that start counting when flash is fired, and independently stop counting, based on brightness of pixel sensors from flash, determined by comparators
Patent Assignee: GAITHER B D (GAIT-I); MAHON M J (MAHO-I); MCKEE B A (MCKE-I)
Inventor: **GAITHER B D** ; MAHON M J; **MCKEE B A**
Number of Countries: 001 Number of Patents: 001
Patent Family:

Patent No	Kind	Date	Applicat No	Kind	Date	Week	
US 20020096624	A1	20020725	US 2001768477	A	20010124	200280	B

Priority Applications (No Type Date): US 2001768477 A 20010124
Patent Details:

Patent No	Kind	Lan	Pg	Main IPC	Filing Notes
US 20020096624	A1		7	H01L-027/00	

Abstract (Basic): US 20020096624 A1
NOVELTY - The device has multiple intensity comparators (320) coupled with the timers (304) and pixel sensors (200). The timers start counting, when an infrared flash (302) coupled with the timers fires and independently stop counting, based on the brightness of the pixel sensors from the flash, determined by the intensity comparators.
DETAILED DESCRIPTION - An INDEPENDENT CLAIM is included for three-dimensional data capturing method.
USE - For computer-aided design (CAD) and computer aided manufacturing (CAM) systems where 3-dimensional data is required.
ADVANTAGE - The pixels are used to construct three-dimensional model of the object facing the image capture device. Since the speed of light is constant, the distance from the flash to the object imaged by the sensors can be calculated from the delay for the light from the flash efficiently.
DESCRIPTION OF DRAWING(S) - The figure shows the block diagram of the stereoscopic image capture system.
Pixel sensors (200)
Infrared flash (302)
Timers (304)
Intensity comparators (320)
pp; 7 DwgNo 3/4
Title Terms: STEREOSCOPIC; IMAGE; CAPTURE; DEVICE; COMPUTER; AID; DESIGN; SYSTEM; TIME; START; COUNT; FLASH; FIRE; INDEPENDENT; STOP; COUNT; BASED; BRIGHT; PIXEL; SENSE; FLASH; DETERMINE; COMPARATOR
Derwent Class: T01; T06; W04
International Patent Class (Main): H01L-027/00
File Segment: EPI

7/5/4 (Item 4 from file: 350)
DIALOG(R)File 350:Derwent WPIX
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014869870 **Image available**
WPI Acc No: 2002-690576/200274
XRPX Acc No: N02-544769
Operation resuming method of multiprocessor computer system, involves resuming execution of affected processes of affected processors on other processors
Patent Assignee: GAITHER B D (GAIT-I); OSECKY B D (OSEC-I)
Inventor: **GAITHER B D** ; OSECKY B D
Number of Countries: 001 Number of Patents: 001
Patent Family:

Patent No	Kind	Date	Applicat No	Kind	Date	Week

US 20020101715 A1 2002080[redacted] US 2001775404 A 20010131 [redacted]274 B

Priority Applications (No Type Date): US 2001775404 A 20010131
Patent Details:
Patent No Kind Lan Pg Main IPC Filing Notes
US 20020101715 A1 10 G06F-001/20

Abstract (Basic): US 20020101715 A1
NOVELTY - An impending failure of a cooling device coupled to an affected processor is detected and the execution of the affected processes is suspended. The execution of other processes by the affected processor is prohibited and execution of affected processes is resumed on other processors. The power consumption of the affected processor is reduced, to maintain the processor at a non-critical temperature.
DETAILED DESCRIPTION - An INDEPENDENT CLAIM is included for computer system.
USE - For providing continuous operation of low-cost high availability computer systems (claimed).
ADVANTAGE - Allows a multiprocessor computer system to be constructed with non-redundant, inexpensive, thermally and volumetrically efficient turbo cooler fans and hence ensures continuous operation of the computer system in the event of a failure of the fans.

DESCRIPTION OF DRAWING(S) - The figure shows the block diagram of multiprocessor computer system.
pp; 10 DwgNo 1/2
Title Terms: OPERATE; RESUME; METHOD; MULTIPROCESSOR; COMPUTER; SYSTEM; RESUME; EXECUTE; AFFECT; PROCESS; AFFECT; PROCESSOR; PROCESSOR
Derwent Class: T01; U14; V04
International Patent Class (Main): **G06F-001/20**
International Patent Class (Additional): H05K-005/00
File Segment: EPI

7/5/5 (Item 5 from file: 350)
DIALOG(R)File 350:Derwent WPIX
(c) 2003 Thomson Derwent. All rts. reserv.

014869869 **Image available**
WPI Acc No: 2002-690575/200274
XRPX Acc No: N02-544768
Obstruction clearing method from computer system fan, involves altering direction of rotation of fan when obstruction is detected based on change in rotational speed and current of fan
Patent Assignee: GAITHER B D (GAIT-I); OSECKY B D (OSEC-I); HEWLETT-PACKARD CO (HEWP)
Inventor: **GAITHER B D** ; OSECKY B D
Number of Countries: 001 Number of Patents: 002
Patent Family:
Patent No Kind Date Applicat No Kind Date Week
US 20020101714 A1 20020801 US 2001775164 A 20010131 200274 B
US 6532151 B2 20030311 US 2001775164 A 20010131 200321

Priority Applications (No Type Date): US 2001775164 A 20010131
Patent Details:
Patent No Kind Lan Pg Main IPC Filing Notes
US 20020101714 A1 8 G06F-001/20
US 6532151 B2 H05K-007/20
Abstract (Basic): US 20020101714 A1
NOVELTY - The fan obstruction corresponding to fans (20,22,24,26) are detected based on change in rotational speed and current of the fans. The direction of rotation of the fan is altered based on the detected obstructions. A warning signal is provided to system operator if the attempt failed.
DETAILED DESCRIPTION - An INDEPENDENT CLAIM is included for computer system.
USE - For clearing obstructions from cooling fans of computer

system (claimed).
ADVANTAGE - Increases system reliability and robustness at low additional cost by enabling implementation of the method in existing computer system just with little additional design effort. Prevents system crash by appropriately detecting and attempting to clear the obstruction from the fan or providing a warning signal when the attempt of clearing the obstruction failed.
DESCRIPTION OF DRAWING(S) - The figure shows a block diagram of the computer system.
Fans (20,22,24,26)
pp; 8 DwgNo 1/2
Title Terms: OBSTRUCT; CLEAR; METHOD; COMPUTER; SYSTEM; FAN; ALTER; DIRECTION; ROTATING; FAN; OBSTRUCT; DETECT; BASED; CHANGE; ROTATING; SPEED; CURRENT; FAN
Derwent Class: T01; V04; V06; W05; X25
International Patent Class (Main): **G06F-001/20** ; H05K-007/20
International Patent Class (Additional): **G06F-001/16**
File Segment: EPI

7/5/6 (Item 6 from file: 350)
DIALOG(R)File 350:Derwent WPIX
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014786578 **Image available**
WPI Acc No: 2002-607284/200265
XRPX Acc No: N02-480882
Virtual bus to physical bus translation mechanism for computer system, has intermediary inclusive caches connected to virtual buses and physically addressed interconnect
Patent Assignee: GAITHER B D (GAIT-I)
Inventor: **GAITHER B D**
Number of Countries: 001 Number of Patents: 001
Patent Family:

Patent No	Kind	Date	Applicat No	Kind	Date	Week	
US 20020073281	A1	20020613	US 2000733123	A	20001208	200265	B

Priority Applications (No Type Date): US 2000733123 A 20001208
Patent Details:

Patent No	Kind	Lan	Pg	Main IPC	Filing Notes
US 20020073281	A1		13	G06F-012/08	

Abstract (Basic): US 20020073281 A1
NOVELTY - Each of the processors (201,203,205,207), has local caches (202,204,206,208) that are connected to virtual buses. Several intermediary inclusive caches (ITC) (221-225) are connected to the virtual buses and a physically addressed interconnect (231). A main memory (241) is connected to the physically addressed interconnect.
DETAILED DESCRIPTION - An INDEPENDENT CLAIM is included for method for translating from a virtually addressed bus to a physically-addressed bus.
USE - For translating from a virtual bus to physical bus in computer system.
ADVANTAGE - The ITC eliminate unnecessary snooping, thereby reducing processing time and bus bandwidth. The ITC also protects upper buses from unnecessary bus traffic.
DESCRIPTION OF DRAWING(S) - The figure shows a block diagram of a computer architecture that allows use of a cache to translate from a virtual bus to a physical bus.
Processors (201,203,205,207)
Local caches (202,204,206,208)
Intermediary inclusive caches (221-225)
pp; 13 DwgNo 3/6
Title Terms: VIRTUAL; BUS; PHYSICAL; BUS; TRANSLATION; MECHANISM; COMPUTER; SYSTEM; INTERMEDIARY; INCLUSION; CONNECT; VIRTUAL; BUS; PHYSICAL; ADDRESS ; INTERCONNECT
Derwent Class: T01
International Patent Class (Main): **G06F-012/08**

File Segment: EPI

7/5/7 (Item 7 from file: 350)
DIALOG(R)File 350:Derwent WPIX
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014739456 **Image available**
WPI Acc No: 2002-560161/200260
XRPX Acc No: N02-443489
Data interconnection system has FTSS architecture combines internal and network transmission
Patent Assignee: HEWLETT-PACKARD CO (HEWP)
Inventor: **GAITHER B D ; MCKEE B A**
Number of Countries: 001 Number of Patents: 001
Patent Family:

Patent No	Kind	Date	Applicat No	Kind	Date	Week	
FR 2818849	A1	20020628	FR 200113950	A	20011029	200260	B

Priority Applications (No Type Date): US 2000703428 A 20001031
Patent Details:

Patent No	Kind	Lan	Pg	Main IPC	Filing Notes
FR 2818849	A1		51	H04L-012/46	

Abstract (Basic): FR 2818849 A1
NOVELTY - A data interconnection system couples servers (80, 82, 84, 86, 88, 90) to an FTSS system through FTSS architecture (94) and stores packets on arrival in reliable permanent memory (92) with packet receipts sent to an external network (96) on arrival at the correct server system.
USE - Fault tolerant interconnection system for data transmission.
ADVANTAGE - Ensures reliable handling of packets. Combines internal file input output and external transmission functions.
DESCRIPTION OF DRAWING(S) - The drawing is a system block diagram.
(Drawing includes non English language text)
Servers (80, 82, 84, 86, 88, 90)
Fault Tolerant Server System (FTSS) architecture (94)
External network (96)
pp; 51 DwgNo 4/8
Title Terms: DATA; INTERCONNECT; SYSTEM; ARCHITECTURE; COMBINATION; INTERNAL; NETWORK; TRANSMISSION
Derwent Class: W01
International Patent Class (Main): H04L-012/46
International Patent Class (Additional): H04L-001/00
File Segment: EPI

7/5/8 (Item 8 from file: 350)
DIALOG(R)File 350:Derwent WPIX
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014503954 **Image available**
WPI Acc No: 2002-324657/200236
XRPX Acc No: N02-254963
Computer cache memory system has lower order caches having memories which stores address of data output by higher order caches
Patent Assignee: HEWLETT-PACKARD CO (HEWP); HEWLETT-PACKARD DEV CO LP (HEWP)
Inventor: **GAITHER B D** ; HERRELL R W
Number of Countries: 002 Number of Patents: 002
Patent Family:

Patent No	Kind	Date	Applicat No	Kind	Date	Week	
JP 2002073415	A	20020312	JP 2001211630	A	20010712	200236	B
US 6574710	B1	20030603	US 2000629128	A	20000731	200339	

Priority Applications (No Type Date): US 2000629128 A 20000731
Patent Details:

Patent No	Kind	Lan	Pg	Main IPC	Filing Notes

JP 2002073415 A 7 G06F 12/08
US 6574710 B1 G06F-012/00

Abstract (Basic): JP 2002073415 A
NOVELTY - Higher order caches (104,106,108,110) and caches (114,116) which is in the lower order level in the cache hierarchy are provided. Memories (120,122) of caches (114,116), store address of the data output by caches (104,106,108,110).
USE - Computer cache memory system.
ADVANTAGE - The overhead generation is minimized.
DESCRIPTION OF DRAWING(S) - The figure shows the block diagram of the computer system. (Drawing includes non-English language text).
Higher order caches (104,106,108,110)
Lower order caches (114,116)
Memories (120,122)
pp; 7 DwgNo 1/3
Title Terms: COMPUTER; CACHE; MEMORY; SYSTEM; LOWER; ORDER; MEMORY; STORAGE ; ADDRESS; DATA; OUTPUT; HIGH; ORDER
Derwent Class: T01
International Patent Class (Main): **G06F-012/00 ; G06F-012/08**
International Patent Class (Additional): **G06F-015/16 ; G06F-015/177**
File Segment: EPI

7/5/9 (Item 9 from file: 350)
DIALOG(R)File 350:Derwent WPIX
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014357960 **Image available**
WPI Acc No: 2002-178661/200223
XRPX Acc No: N02-135831
Specifying and applying rules to classification-based decision points in an application system, involves using classifier rules to classify application state and associating decision rules with control points
Patent Assignee: INT BUSINESS MACHINES CORP (IBMC)
Inventor: DEGENARO L R; EHNEBUSKE D L; **MCKEE B J A** ; RASMUS K P; ROUVELLOU I M C
Number of Countries: 001 Number of Patents: 001
Patent Family:

Patent No	Kind	Date	Applicat No	Kind	Date	Week	
US 6341369	B1	20020122	US 98204970	A	19981203	200223	B

Priority Applications (No Type Date): US 98204970 A 19981203
Patent Details:

Patent No	Kind	Lan	Pg	Main IPC	Filing Notes
US 6341369	B1		11	G06F-009/44	

Abstract (Basic): US 6341369 B1
NOVELTY - The method involves associating classifier rules (122-132) to classify the state of an application (100) with a category within several categories. Decision rules (134-146) are then associated with the created controls points (102-104) in the application. The decision rules are applied based on the assessment of the state of the application according to the category.
DETAILED DESCRIPTION - Classification categories (106-108) are associated with the control points created in the application.
INDEPENDENT CLAIMS are also included for the following:
(a) the application used in the data processing system;
(b) the data processing system;
(c) and the computer program product using the data processing system.
USE - Used in a data processing system.
ADVANTAGE - Used in managing business system that relies on a large number of business rules. Ensures improved method for specifying and enforcing business rules in a business system.
DESCRIPTION OF DRAWING(S) - The figure shows the application incorporating the processes for specifying the control points and selecting rules in a data processing system.

Application (100)
Controls points (102-104)
Classification categories (106-108)
Classifier rules (122-132)
Decision rules (134-146)
pp; 11 DwgNo 1/4
Title Terms: SPECIFIED; APPLY; RULE; CLASSIFY; BASED; DECIDE; POINT; APPLY; SYSTEM; CLASSIFY; RULE; CLASSIFY; APPLY; STATE; ASSOCIATE; DECIDE; RULE; CONTROL; POINT
Derwent Class: T01
International Patent Class (Main): **G06F-009/44**
File Segment: EPI

7/5/10 (Item 10 from file: 350)
DIALOG(R)File 350:Derwent WPIX
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014214159 **Image available**
WPI Acc No: 2002-034857/200205
XRPX Acc No: N02-026810
Caching method for sets of data objects with explicit lifetime specifications using a manager to maintain and update objects stored in the cache as lifetimes expire
Patent Assignee: INT BUSINESS MACHINES CORP (IBMC)
Inventor: DEGENARO L R; EHNEBUSKE D L; IYENGAR A K; **MCKEE B J A ;** ROUVELLOU I M; ALSPACH MCKEE B J; EHNESBUSKE D L
Number of Countries: 027 Number of Patents: 002
Patent Family:

Patent No	Kind	Date	Applicat No	Kind	Date	Week	
CA 2338915	A1	20011004	CA 2338915	A	20010228	200205	B
EP 1160672	A2	20011205	EP 2001480016	A	20010227	200205	

Priority Applications (No Type Date): US 2000542269 A 20000404
Patent Details:

Patent No	Kind	Lan	Pg	Main IPC	Filing Notes
CA 2338915	A1	E	35	G06F-012/02	
EP 1160672	A2	E		G06F-012/12	

Designated States (Regional): AL AT BE CH CY DE DK ES FI FR GB GR IE IT LI LT LU LV MC MK NL PT RO SE SI TR

Abstract (Basic): CA 2338915 A1
NOVELTY - The cache manager (140) assigns a start time to objects loaded into the cache (150) from the database (160). Objects within the cache with a loaded lifetime longer than the specified time are updated or removed. The manager also determine wether individual objects should be refreshed or the entire object set.
DETAILED DESCRIPTION - INDEPENDENT CLAIMS are included for
(1) a method for managing a cache in a system.
(2) a system for managing a cache.
USE - Managing cached data objects within a computer system e.g. a database system.
ADVANTAGE - Eliminating obsolete cached data at a client request time.
DESCRIPTION OF DRAWING(S) - The drawing is a block diagram of the system
Cache manager (140)
Cache (150)
Database (160)
pp; 35 DwgNo 1/7
Title Terms: METHOD; SET; DATA; OBJECT; LIFETIME; SPECIFICATION; MANAGE; MAINTAIN; UPDATE; OBJECT; STORAGE; CACHE; EXPIRE
Derwent Class: T01
International Patent Class (Main): **G06F-012/02 ; G06F-012/12**
International Patent Class (Additional): **G06F-017/30**
File Segment: EPI

7/5/11 (Item 11 from file: 350)
DIALOG(R)File 350:Derwent WPIX
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014159124 **Image available**
WPI Acc No: 2001-643352/200174
XRPX Acc No: N01-481340
Computer system has share cache memory to which read data from main memory can be written through bus according to bus protocol such that data transaction to bus is not started
Patent Assignee: HEWLETT-PACKARD CO (HEWP)
Inventor: **GAITHER B D**
Number of Countries: 002 Number of Patents: 002
Patent Family:

Patent No	Kind	Date	Applicat No	Kind	Date	Week	
JP 2001256110	A	20010921	JP 200153874	A	20010228	200174	B
US 6434672	B1	20020813	US 2000515727	A	20000229	200255	

Priority Applications (No Type Date): US 2000515727 A 20000229
Patent Details:

Patent No	Kind	Lan	Pg	Main IPC	Filing Notes
JP 2001256110	A		8	G06F-012/08	
US 6434672	B1			G06F-012/12	

Abstract (Basic): JP 2001256110 A
NOVELTY - The computer system (100) includes a share cache memory (160) and the processors (110A,110B) with the level cache memories (120A,120B) which are connected in parallel to the main memory (190) of a memory subsystem (170) via a bus (140). The data in the main memory are read and written in the share cache memory through the bus according a bus protocol such that a data transaction on the bus is not started.
DETAILED DESCRIPTION - INDEPENDENT CLAIMS are also included for the following:
(a) a computer system performance improvement method using share cache memory;
(b) and a computer system performance improving apparatus.
USE - Computer system.
ADVANTAGE - Predetermined delay due to bus access to main memory can be eliminated.
DESCRIPTION OF DRAWING(S) - The figure shows the block diagram of computer system.
Computer system (100)
Processors (110A,110B)
Level cache memories (120A,120B)
Bus (140)
Share cache memory (160)
Memory subsystem (170)
Main memory (190)
pp; 8 DwgNo 2/3
Title Terms: COMPUTER; SYSTEM; SHARE; CACHE; MEMORY; READ; DATA; MAIN; MEMORY; CAN; WRITING; THROUGH; BUS; ACCORD; BUS; PROTOCOL; DATA; TRANSACTION; BUS; START
Derwent Class: T01
International Patent Class (Main): **G06F-012/08 ; G06F-012/12**
File Segment: EPI

7/5/12 (Item 12 from file: 350)
DIALOG(R)File 350:Derwent WPIX
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014095745 **Image available**
WPI Acc No: 2001-579959/200165
Related WPI Acc No: 2001-512921
XRPX Acc No: N01-431769
File access request processing method in computer system, involves translating physical file path to virtual file path, to process file

access request
Patent Assignee: HEWLETT-PACKARD CO (HEWP); GAITHER B D (GAIT-I); MCKEE B A (MCKE-I); THELEN G W (THEL-I)
Inventor: **GAITHER B D ; MCKEE B A** ; THELEN G W
Number of Countries: 002 Number of Patents: 003
Patent Family:

Patent No	Kind	Date	Applicat No	Kind	Date	Week	
US 20010014892	A1	20010816	US 2000498798	A	20000202	200165	B
			US 2000729131	A	20001201		
JP 2001229056	A	20010824	JP 2000386790	A	20001220	200165	
US 6381615	B2	20020430	US 2000498798	A	20000202	200235	
			US 2000729131	A	20001201		

Priority Applications (No Type Date): US 2000498798 A 20000202; US 2000729131 A 20001201
Patent Details:

Patent No	Kind	Lan	Pg	Main IPC	Filing Notes
US 20010014892	A1		17	G06F-017/30	Cont of application US 2000498798 Cont of patent US 6195650
JP 2001229056	A		16	G06F-012/00	
US 6381615	B2			G06F-017/30	Cont of application US 2000498798 Cont of patent US 6195650

Abstract (Basic): US 20010014892 A1
NOVELTY - A file access request containing a virtual file path, is received from an application and the virtual file path is translated to a physical file path. The file access request is processed using the physical file path which is translated back to the virtual file path. The access request to the application is then completed using virtual file path.
USE - For virtualizing file access request in operating system of computer system and also in workstations, network servers and other computing devices.
ADVANTAGE - Files can be moved between storage devices and processed efficiently by translation of the file paths.
DESCRIPTION OF DRAWING(S) - The figure shows the computer system comprising virtual file system translation driver.
pp; 17 DwgNo 2/7
Title Terms: FILE; ACCESS; REQUEST; PROCESS; METHOD; COMPUTER; SYSTEM; TRANSLATION; PHYSICAL; FILE; PATH; VIRTUAL; FILE; PATH; PROCESS; FILE; ACCESS; REQUEST
Derwent Class: T01
International Patent Class (Main): **G06F-012/00 ; G06F-017/30**
File Segment: EPI

7/5/13 (Item 13 from file: 350)
DIALOG(R)File 350:Derwent WPIX
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014044484 **Image available**
WPI Acc No: 2001-528697/200158
XRPX Acc No: N01-392331
Business rules management method in object oriented rules-based expert computer system, involves assigning priority values to each jurisdiction and modifying decision outcome resulted from lower priority jurisdiction
Patent Assignee: INT BUSINESS MACHINES CORP (IBMC)
Inventor: EHNEBUSKE D L; **MCKEE B J A**
Number of Countries: 001 Number of Patents: 001
Patent Family:

Patent No	Kind	Date	Applicat No	Kind	Date	Week	
US 6272482	B1	20010807	US 98134341	A	19980814	200158	B

Priority Applications (No Type Date): US 98134341 A 19980814
Patent Details:

Patent No	Kind	Lan	Pg	Main IPC	Filing Notes
US 6272482	B1		11	G06F-017/00	

Abstract (Basic): US 627248[redacted]1

NOVELTY - Jurisdictions that are adapted to exert authority over a decision of an application program are defined. Control points for the decision are created and business rules are mapped from the jurisdictions to the respective control points. Priority values are assigned to each jurisdiction and a decision outcome resulted from a lower priority jurisdiction is modified by a higher priority jurisdiction.

DETAILED DESCRIPTION - An INDEPENDENT CLAIM is also included for a rules management system.

USE - For business rules management in object-oriented, rules-based expert computer systems.

ADVANTAGE - By assigning business rules to jurisdictions through respective control points, the size of the rule space in the business information system is reduced drastically.

DESCRIPTION OF DRAWING(S) - The figure shows the logical flow chart depicting business rules management method.

pp; 11 DwgNo 3/5

Title Terms: BUSINESS; RULE; MANAGEMENT; METHOD; OBJECT; ORIENT; RULE; BASED; EXPERT; COMPUTER; SYSTEM; ASSIGN; PRIORITY; VALUE; MODIFIED; DECIDE; LOWER; PRIORITY

Derwent Class: T01

International Patent Class (Main): **G06F-017/00**

International Patent Class (Additional): **G06F-017/60**

File Segment: EPI

7/5/14 (Item 14 from file: 350)

DIALOG(R)File 350:Derwent WPIX

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014028707 **Image available**

WPI Acc No: 2001-512921/200156

XRPX Acc No: N01-379776

File access request processing method in computer operating systems, involves translating virtual file path to physical file path for processing file access request

Patent Assignee: HEWLETT-PACKARD CO (HEWP)

Inventor: **GAITHER B D** ; **MCKEE B A** ; THELEN G W

Number of Countries: 027 Number of Patents: 002

Patent Family:

Patent No	Kind	Date	Applicat No	Kind	Date	Week	
US 6195650	B1	20010227	US 2000498798	A	20000202	200156	B
EP 1122647	A2	20010808	EP 2000125824	A	20001124	200156	

Priority Applications (No Type Date): US 2000498798 A 20000202

Patent Details:

Patent No	Kind	Lan	Pg	Main IPC	Filing Notes
US 6195650	B1		17	G06F-012/00	
EP 1122647	A2	E		G06F-012/10	

Designated States (Regional): AL AT BE CH CY DE DK ES FI FR GB GR IE IT LI LT LU LV MC MK NL PT RO SE SI TR

Abstract (Basic): US 6195650 B1

NOVELTY - Virtual file system translation driver (42) receives a file access request containing virtual file path from an application and system utilities (16) and translates the virtual file path to physical file path for processing file access request. The physical file path is translated back to virtual file path for completing the file access request to the application.

USE - In operating systems, workstations, network servers and other computing devices for virtualizing file access operations and other input-output operations in operating system.

ADVANTAGE - The existing physical file system is completely virtualized by simply installing virtual system translation driver. The files within the file system are stored on storage devices having different attributes. The process of re-mapping directories is done on-the-fly without rebooting the computer.

DESCRIPTION OF DRAWING(S) - The figure shows the computer system having virtual file system translation driver.
Application and system utility (16)
Virtual file system translation driver (42)
pp; 17 DwgNo 2/7
Title Terms: FILE; ACCESS; REQUEST; PROCESS; METHOD; COMPUTER; OPERATE; SYSTEM; TRANSLATION; VIRTUAL; FILE; PATH; PHYSICAL; FILE; PATH; PROCESS; FILE; ACCESS; REQUEST
Derwent Class: T01
International Patent Class (Main): **G06F-012/00 ; G06F-012/10**
International Patent Class (Additional): **G06F-017/30**
File Segment: EPI

7/5/15 (Item 15 from file: 350)
DIALOG(R)File 350:Derwent WPIX
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013619591 **Image available**
WPI Acc No: 2001-103799/200112
XRPX Acc No: N01-076846
Method for adhering to coherence protocol for data storage system especially computer cache, includes switching of first status of entry in first cache through first cache into second status, so that entry of first cache can be cleared
Patent Assignee: HEWLETT-PACKARD CO (HEWP)
Inventor: **GAITHER B D** ; RENTSCHLER E M
Number of Countries: 003 Number of Patents: 003
Patent Family:

Patent No	Kind	Date	Applicat No	Kind	Date	Week	
DE 10006430	A1	20001026	DE 1006430	A	20000214	200112	B
JP 2000322318	A	20001124	JP 2000112465	A	20000413	200112	
US 6360301	B1	20020319	US 99290430	A	19990413	200224	

Priority Applications (No Type Date): US 99290430 A 19990413
Patent Details:

Patent No	Kind	Lan	Pg	Main IPC	Filing Notes
DE 10006430	A1		10	G06F-012/08	
JP 2000322318	A		6	G06F-012/08	
US 6360301	B1			G06F-012/12	

Abstract (Basic): DE 10006430 A1
NOVELTY - The method comprises inputting by means of a first cache (316) that an entry was cleared by a cache of a higher plane (304-308); and switching of a first status (406,504,602) of the entry in the first cache through the first cache in a second status (408,508,608), so that the entry of the first cache can be cleared without his having to be cancelled in the cache of a higher plane.
USE - In multiprocessor computer systems which use cache memories, and in particular to coherence protocol.
ADVANTAGE - Makes possible improved behavior of the cache memory.
DESCRIPTION OF DRAWING(S) - The drawing shows a block diagram of an example of a computer system suitable for use with the method.
Higher plane cache (304-308)
First cache (316)
First status (406,504,602)
Second status (408,508,608)
pp; 10 DwgNo 3/6
Title Terms: METHOD; ADHERE; COHERE; PROTOCOL; DATA; STORAGE; SYSTEM; COMPUTER; CACHE; SWITCH; FIRST; STATUS; ENTER; FIRST; CACHE; THROUGH; FIRST; CACHE; SECOND; STATUS; SO; ENTER; FIRST; CACHE; CAN; CLEAR
Derwent Class: T01
International Patent Class (Main): **G06F-012/08 ; G06F-012/12**
International Patent Class (Additional): **G06F-015/16 ; G06F-015/177**
File Segment: EPI

7/5/16 (Item 16 from file: 350)

DIALOG(R)File 350:Derwent W
(c) 2003 Thomson Derwent. All rts. reserv.

013592183 **Image available**
WPI Acc No: 2001-076390/200109
XRPX Acc No: N01-058271
Address error recovery procedure for computer, involves reading out corresponding coherent condition from cache and calling recovery route to rectify the error
Patent Assignee: HEWLETT-PACKARD CO (HEWP)
Inventor: FEEHRER J R; **GAITHER B D** ; MORRISON J A
Number of Countries: 002 Number of Patents: 002
Patent Family:

Patent No	Kind	Date	Applicat No	Kind	Date	Week	
JP 2000322317	A	20001124	JP 2000110434	A	20000412	200109	B
US 6405322	B1	20020611	US 99290942	A	19990413	200244	

Priority Applications (No Type Date): US 99290942 A 19990413
Patent Details:

Patent No	Kind	Lan	Pg	Main IPC	Filing Notes
JP 2000322317	A		11	G06F-012/08	
US 6405322	B1			G06F-012/16	

Abstract (Basic): JP 2000322317 A
NOVELTY - The address error which occurs in local channel (130) of computer system (100) is detected. The corresponding coherency condition is read from one or more address line specified from cache memory (120) and recovery routine is called for rectifying the address error.
DETAILED DESCRIPTION - An INDEPENDENT CLAIM is also included for address error recovery system.
USE - For recovering address error in computers and processors.
ADVANTAGE - The cache coherency information is utilized, hence address error is easily detected.
DESCRIPTION OF DRAWING(S) - The figure shows the block diagram of multiprocessor computing system.
Computer system (100)
Cache memory (120)
Local channel (130)
pp; 11 DwgNo 5/5
Title Terms: ADDRESS; ERROR; RECOVER; PROCEDURE; COMPUTER; READ; CORRESPOND ; COHERE; CONDITION; CACHE; CALL; RECOVER; ROUTE; RECTIFY; ERROR
Derwent Class: T01
International Patent Class (Main): **G06F-012/08 ; G06F-012/16**
International Patent Class (Additional): **G06F-015/16 ; G06F-015/177**
File Segment: EPI

7/5/17 (Item 17 from file: 350)
DIALOG(R)File 350:Derwent WPIX
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012998464 **Image available**
WPI Acc No: 2000-170316/200015
XRPX Acc No: N00-126573
Decision points identifying method in object oriented object for identifying applicable business rules, in computer system
Patent Assignee: INT BUSINESS MACHINES CORP (IBMC)
Inventor: EHNEBUSKE D L; **MCKEE B J A**
Number of Countries: 001 Number of Patents: 001
Patent Family:

Patent No	Kind	Date	Applicat No	Kind	Date	Week	
US 6016477	A	20000118	US 97993718	A	19971218	200015	B

Priority Applications (No Type Date): US 97993718 A 19971218
Patent Details:

Patent No	Kind	Lan	Pg	Main IPC	Filing Notes
US 6016477	A		8	G06F-017/60	

Abstract (Basic): US 6016477 A

NOVELTY - Decision point in business object (14) is selected and associated by name to a trigger point. Business rules selected to attachment points for business rules are assigned to decision point. The points object is executed until the trigger point is detected. The points of attachment for business rules and the selected business rules are then displayed to the user.

DETAILED DESCRIPTION - INDEPENDENT CLAIMS are also included for the following:

(a) apparatus for identifying decision points in object;

(b) program for identifying decision points in object.

USE - For identifying business rules applicable to decision points in object oriented business object in computer system for real time business.

ADVANTAGE - The business analysts are permitted to manually attach or detach business rule. The business rule are manipulated by business experts instead of programmer.

DESCRIPTION OF DRAWING(S) - The figure shows object introduction diagram illustrating attachment of business rules to business object.

Business object (14)

pp; 8 DwgNo 3/4

Title Terms: DECIDE; POINT; IDENTIFY; METHOD; OBJECT; ORIENT; OBJECT; IDENTIFY; APPLY; BUSINESS; RULE; COMPUTER; SYSTEM

Derwent Class: T01

International Patent Class (Main): **G06F-017/60**

File Segment: EPI

7/5/18 (Item 18 from file: 350)

DIALOG(R)File 350:Derwent WPIX

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012486633 **Image available**

WPI Acc No: 1999-292741/199925

XRPX Acc No: N99-219323

Computer system with dynamic exchange algorithm selection function - uses second exchange algorithm to arrange second item in cache memory when second item has related class attribute which has second value

Patent Assignee: HEWLETT-PACKARD CO (HEWP)

Inventor: **GAITHER B D**

Number of Countries: 002 Number of Patents: 002

Patent Family:

Patent No	Kind	Date	Applicat No	Kind	Date	Week	
JP 11096074	A	19990409	JP 98200576	A	19980715	199925	B
US 6223256	B1	20010424	US 97898637	A	19970722	200125	

Priority Applications (No Type Date): US 97898637 A 19970722

Patent Details:

Patent No	Kind	Lan	Pg	Main IPC	Filing Notes
JP 11096074	A		12	G06F-012/12	
US 6223256	B1			G06F-012/00	

Abstract (Basic): JP 11096074 A

NOVELTY - A first item is arranged in a cache memory (114) using a first exchange algorithm when the first item has a related class attribute (112) which has a first value. A second item is arranged in a cache memory using a second exchange algorithm when the second item has a related class attribute which has a second value. DETAILED DESCRIPTION - An item, which is to be input in a cache memory, has a related class attribute which has a first value or a second value.

USE - None given.

ADVANTAGE - Improves rate of hit in cache memory since proper exchange algorithm is used for deciding the item to be replaced in the cache memory. DESCRIPTION OF DRAWING(S) - The figure shows the block diagram of a 4-way set associative cache memory system. (112) Class attribute; (114) Cache memory.

Dwg.2/5

Title Terms: COMPUTER; SYST[redacted] DYNAMIC; EXCHANGE; ALGORITHM; [redacted]LECT;
FUNCTION; SECOND; EXCHANGE; ALGORITHM; ARRANGE; SECOND; ITEM; CACHE;
MEMORY; SECOND; ITEM; RELATED; CLASS; ATTRIBUTE; SECOND; VALUE
Derwent Class: T01
International Patent Class (Main): **G06F-012/00 ; G06F-012/12**
File Segment: EPI

7/5/19 (Item 19 from file: 350)
DIALOG(R)File 350:Derwent WPIX
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012130032 **Image available**
WPI Acc No: 1998-546944/199847
XRPX Acc No: N98-426174
Object code optimisation method during real time execution of program in RAM - involves optimising identified non-optimum instruction streams, based on which generated object code is optimised and substituted in program during program execution
Patent Assignee: HEWLETT-PACKARD CO (HEWP)
Inventor: **GAITHER B D ; MCKEE B A**
Number of Countries: 002 Number of Patents: 002
Patent Family:

Patent No	Kind	Date	Applicat No	Kind	Date	Week	
JP 10240543	A	19980911	JP 9831068	A	19980213	199847	B
US 5915114	A	19990622	US 97799950	A	19970214	199931	

Priority Applications (No Type Date): US 97799950 A 19970214
Patent Details:

Patent No	Kind	Lan	Pg	Main IPC	Filing Notes
JP 10240543	A		9	G06F-009/45	
US 5915114	A			G06F-011/00	

Abstract (Basic): JP 10240543 A
The method involves collecting execution traces of object code, during execution of program. The collected execution traces are analysed and one or more non-optimum instruction streams of the object code is identified.
An object code to be optimised is then generated. The non- optimum instruction streams are optimised for data assembly. Based on the optimised non-optimum instruction streams, the object code is optimised and is substituted in the program, during execution of program.
ADVANTAGE - Simplifies optimisation of object code.
Dwg.2/2
Title Terms: OBJECT; CODE; OPTIMUM; METHOD; REAL; TIME; EXECUTE; PROGRAM; RAM; OPTIMUM; IDENTIFY; NON; OPTIMUM; INSTRUCTION; STREAM; BASED; GENERATE; OBJECT; CODE; OPTIMUM; SUBSTITUTE; PROGRAM; PROGRAM; EXECUTE
Derwent Class: T01
International Patent Class (Main): **G06F-009/45 ; G06F-011/00**
File Segment: EPI

7/5/20 (Item 20 from file: 350)
DIALOG(R)File 350:Derwent WPIX
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010967594 **Image available**
WPI Acc No: 1996-464543/199646
Graphic user interface applications registering system processing - registering number of object classes and registration information which are associated with number of applications with graphic user interface
Patent Assignee: INT BUSINESS MACHINES CORP (IBMC)
Inventor: BELL L K; **MCKEE B** ; NGUYEN T; VARGA K A
Number of Countries: 001 Number of Patents: 001
Patent Family:

Patent No	Kind	Date	Applicat No	Kind	Date	Week	
US 5564003	A	19961008	US 92862703	A	19920403	199646	B
			US 94356830	A	19941215		

Priority Applications (No Type Date): US 92862703 A 19920403; US 94356830 A 19941215
Patent Details:

Patent No	Kind	Lan	Pg	Main IPC	Filing Notes
US 5564003	A		15	G06F-003/00	Cont of application US 92862703

Abstract (Basic): US 5564003 A

The method involves providing registration information for the number of applications. The registration information includes a number of class identifiers and a number of templates. The number of class identifiers identifies a number of object classes, each of identifiers and each of the number of templates correspond to a particular one of the number of applications. The method further entails registering the number of object classes and the registration information which are associated with the number of applications with the graphic user interface.

E.g. the graphic user interface recognizes the number of object classes and the registration information associated with the number of applications. The number of applications ia allowed to be initiated through templates presented as icons in the graphic user interface.

USE/ADVANTAGE - For batch registration of applications with graphic user interface. Increased number of information and reduced number of errors that may occurring during registration process of one or more applications.

Dwg.2/7

Title Terms: GRAPHIC; USER; INTERFACE; APPLY; REGISTER; SYSTEM; PROCESS; REGISTER; NUMBER; OBJECT; CLASS; REGISTER; INFORMATION; ASSOCIATE; NUMBER ; APPLY; GRAPHIC; USER; INTERFACE
Derwent Class: T01
International Patent Class (Main): **G06F-003/00**
File Segment: EPI

7/5/21 (Item 21 from file: 350)
DIALOG(R)File 350:Derwent WPIX
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003569050
WPI Acc No: 1983-B7240K/198305
XRPX Acc No: N83-022760

Address generator for data processing system - has index register containing override data, associated to adder supplying first portion of logical address register

Patent Assignee: BURROUGHS CORP (BURS)
Inventor: FARLEY W W; **GAITHER B D** ; JOHNSON A; PARKER B L
Number of Countries: 007 Number of Patents: 006
Patent Family:

Patent No	Kind	Date	Applicat No	Kind	Date	Week	
WO 8300241	A	19830120				198305	B
EP 82153	A	19830629	EP 82901671	A	19820415	198327	
JP 58501148	W	19830714				198334	
US 4432053	A	19840214	US 81278155	A	19810629	198409	
EP 82153	B	19890308				198910	
DE 3279514	G	19890413				198916	

Priority Applications (No Type Date): US 81278155 A 19810629
Cited Patents: US 3533075; US 3938096; US 4042911; US 4155119; US 4240139; US 4251860; US 4277826; US 4279014; US 4285040; US 4296468; US 4319322; US 4326248; US 3949378
Patent Details:

Patent No	Kind	Lan	Pg	Main IPC	Filing Notes
WO 8300241	A	E	19		
	Designated States (National): BE DE FR GB NL				
	Designated States (Regional): JP				
EP 82153	A	E			
	Designated States (Regional): BE DE FR GB NL				
EP 82153	B	E			
	Designated States (Regional): BE DE FR GB NL				

Abstract (Basic): WO 8300241 A

The system generates a logical address for use by a translator in accessing a memory. A store is provided for data indicative of a logical address, this data including index selection data and displacement data. Index registers each include index data and dimension override data. One of the index registers is selected in response to the index selection data. An adder is provided for summing the index data in a selected index register to the displacement data and the result is stored in a first portion of a logical address register. A store is provided for memorising a table containing address locating entries corresponding to a programme performable by the system, one of these entries being accessed in response to dimension override data in a selected index register. The accessed entry is stored in a second portion of the logical address register, and the contents of the two portions of the logical address register are applied to the translator.

Title Terms: ADDRESS; GENERATOR; DATA; PROCESS; SYSTEM; INDEX; REGISTER; CONTAIN; OVERRIDE; DATA; ASSOCIATE; ADDER; SUPPLY; FIRST; PORTION; LOGIC; ADDRESS; REGISTER

Derwent Class: T01

International Patent Class (Additional): **G06F-007/00** ; **G06F-009/36** ; **G06F-013/00** ; G11C-009/06

File Segment: EPI

7/5/22 (Item 22 from file: 350)

DIALOG(R)File 350:Derwent WPIX

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003569049

WPI Acc No: 1983-B7239K/198305

XRPX Acc No: N83-022759

Address generating system for data processor - has extended address generating apparatus using narrow data paths for generating wide logical address for translator

Patent Assignee: BURROUGHS CORP (BURS)

Inventor: FARLEY W W; **GAITHER B D** ; JOHNSON A; PARKER B

Number of Countries: 007 Number of Patents: 006

Patent Family:

Patent No	Kind	Date	Applicat No	Kind	Date	Week	
WO 8300240	A	19830120				198305	B
JP 58500731	W	19830506				198324	
EP 83343	A	19830713	EP 82901668	A	19820414	198329	
US 4453212	A	19840605	US 81282919	A	19810713	198425	
EP 83343	B	19880907				198836	
DE 3279008	G	19881013				198842	

Priority Applications (No Type Date): US 81282919 A 19810713

Cited Patents: 3.Jnl.Ref; US 3725874; US 3902163; US 4054945; US 4057848; US 4084227; US 4128875; US 4145738; US 4155119; US 4251860; US 4340139; US 3938096; US 3949378; US 4240139; WO 8300241

Patent Details:

Patent No	Kind	Lan	Pg	Main IPC	Filing Notes
WO 8300240	A	E	23		
	Designated States (National): JP				
	Designated States (Regional): BE DE FR GB NL				
EP 83343	A	E			
	Designated States (Regional): BE DE FR GB NL				
EP 83343	B	E			
	Designated States (Regional): BE DE FR GB NL				

Abstract (Basic): WO 8300240 A

The system generates a logical address for use by a translator in accessing a memory. A store is provided for data indicative of a logical address, the data including index selection data and displacement data. Index registers each include index data and one of these registers is selected in response to the index selection data. An

adder is provided for s[redacted]ing the index data in a select[redacted] index register to the displacement data and the result is stored in an extended address register. A predetermined number of the least significant digits of the sum in the extended address register is stored in a first portion of a logical address register.

A store is provided for a table containing address locating entries corresponding to a programme performable by the system and a corresponding one of these entries is accessed. The access is made in response to a predetermined number of the most significant digits of the number in the extended address register, the accessed entry being stored in a second portion of the logical address register. The contents of the latter register are applied to the translator.

Title Terms: ADDRESS; GENERATE; SYSTEM; DATA; PROCESSOR; EXTEND; ADDRESS; GENERATE; APPARATUS; NARROW; DATA; PATH; GENERATE; WIDE; LOGIC; ADDRESS; TRANSLATION
Derwent Class: T01
International Patent Class (Additional): **G06F-001/00** ; **G06F-007/00** ; **G06F-009/36** ; **G06F-012/08** ; **G06F-013/00** ; G11C-009/06
File Segment: EPI

7/5/23 (Item 23 from file: 347)
DIALOG(R)File 347:JAPIO
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07400413 **Image available**
SYSTEM AND METHOD FOR MONITORING UNALIGNED MEMORY ACCESS

PUB. NO.: 2002-268915 [JP 2002268915 A]
PUBLISHED: September 20, 2002 (20020920)
INVENTOR(s): **MCKEE BRET A**
KESSENICH JOHN M
APPLICANT(s): HEWLETT PACKARD CO (HP)
APPL. NO.: 2002-046398 [JP 20022046398]
FILED: February 22, 2002 (20020222)
PRIORITY: 01 800283 [US 2001800283], US (United States of America), March 06, 2001 (20010306)
INTL CLASS: **G06F-011/28** ; **G06F-012/06** ; **G06F-012/16**

ABSTRACT

PROBLEM TO BE SOLVED: To provide a simplified solution to monitor, count and trace unaligned memory accesses by an application program without building any complex software emulator.

SOLUTION: This system (30) monitors the unaligned memory access by a processor (32) of a computer system (30). The processor automatically generates a fault when attempting the misaligned memory access. Unaligned memory access faults are disabled in response to a fault generated by a first faulting instruction (228). The first faulting instruction is executed (204). A trap is generated by executing the first faulting instruction (206). Unaligned memory access faults are enabled in response to the trap.

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7/5/24 (Item 24 from file: 347)
DIALOG(R)File 347:JAPIO
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07400412 **Image available**
METHOD FOR MONITORING EXECUTION OF PRIVILEGED INSTRUCTION

PUB. NO.: 2002-268914 [JP 2002268914 A]
PUBLISHED: September 20, 2002 (20020920)
INVENTOR(s): **MCKEE BRET A**
APPLICANT(s): HEWLETT PACKARD CO (HP)

APPL. NO.: 2002-027962 [20022027962]
FILED: February 05, 2002 (20020205)
PRIORITY: 01 799999 [US 2001799999], US (United States of America), March 06, 2001 (20010306)
INTL CLASS: **G06F-011/28**

ABSTRACT

PROBLEM TO BE SOLVED: To provide a simplified solution to monitor, count and trace execution of a privileged instruction in privilege desiring application without building a complex software emulator.

SOLUTION: A processor includes a current privilege level, automatically generates a fault when attempting execution of an instruction requiring a higher privilege level than the current privilege level of the processor. This method includes a step (208) to raise the current privilege level of the processor in response to a fault generated by a first faulting instruction, a step (204) to execute the first faulting instruction, a step (206) to generate a trap by executing the first faulty instruction, and a step (210) to lower the current privilege level of the processor in response to the trap.

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7/5/25 (Item 25 from file: 347)
DIALOG(R)File 347:JAPIO
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07328559 **Image available**
COMPUTER SYSTEM HAVING INPUT/OUTPUT READ DATA ARRANGED DIRECTLY IN PROCESSOR LOCAL CACHE

PUB. NO.: 2002-197047 [JP 2002197047 A]
PUBLISHED: July 12, 2002 (20020712)
INVENTOR(s): **GAITHER BRAINE D**
APPLICANT(s): HEWLETT PACKARD CO (HP)
APPL. NO.: 2001-332148 [JP 20011332148]
FILED: October 30, 2001 (20011030)
PRIORITY: 00 703961 [US 2000703961], US (United States of America), October 31, 2000 (20001031)
INTL CLASS: **G06F-013/12** ; **G06F-012/08**

ABSTRACT

PROBLEM TO BE SOLVED: To shorten the I/O wait time of a large-scale multiprocessor system.

SOLUTION: Nodes (100, 200, and 300) of a multi-node system include shared cache memories (104, 204, and 304). Then I/O data are cached directly to the shared caches. Consequently, a processor readout instruction for the I/O data does not need a wait time for a memory transaction. An I/O communication between nodes may well be made by another I/O switch (314) or high-speed interconnection networks (112, 212, and 308).

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Set     Items   Description
S1         18   AU=(GAITHER B? OR GAITHER, B?)
S2       1215   AU=(MCKEE B? OR MCKEE, B?)
S3          0   S1 AND S2
S4         20   (S1 OR S2) AND ((FAULT OR FAILURE)()TOLERAN? OR REDUNDANT?
                  OR MIRROR?)
S5          1   (S2 OR S1) AND (RAID OR (RANDOM OR REDUNDANT)()ARRAY?)
S6         21   (S4 OR S5)
S7         10   RD (unique items)
File   8:Ei Compendex(R) 1970-2003/Jun W3
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File  35:Dissertation Abs Online 1861-2003/May
         (c) 2003 ProQuest Info&Learning
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         (c) 2003 Institution of Electrical Engineers
File  94:JICST-EPlus 1985-2003/Jun W4
         (c)2003 Japan Science and Tech Corp(JST)
File 233:Internet & Personal Comp. Abs. 1981-2003/May
         (c) 2003 Info. Today Inc.
File 144:Pascal 1973-2003/Jun W2
         (c) 2003 INIST/CNRS
File 434:SciSearch(R) Cited Ref Sci 1974-1989/Dec
         (c) 1998 Inst for Sci Info
File  34:SciSearch(R) Cited Ref Sci 1990-2003/Jun W4
         (c) 2003 Inst for Sci Info
File  62:SPIN(R) 1975-2003/May W3
         (c) 2003 American Institute of Physics
File  99:Wilson Appl. Sci & Tech Abs 1983-2003/May
         (c) 2003 The HW Wilson Co.
File  95:TEME-Technology & Management 1989-2003/Jun W2
         (c) 2003 FIZ TECHNIK
File 275:Gale Group Computer DB(TM) 1983-2003/Jun 25
         (c) 2003 The Gale Group
File  47:Gale Group Magazine DB(TM) 1959-2003/Jun 20
         (c) 2003 The Gale group
File 636:Gale Group Newsletter DB(TM) 1987-2003/Jun 23
         (c) 2003 The Gale Group
File  16:Gale Group PROMT(R) 1990-2003/Jun 24
         (c) 2003 The Gale Group
File 624:McGraw-Hill Publications 1985-2003/Jun 24
         (c) 2003 McGraw-Hill Co. Inc
File 484:Periodical Abs Plustext 1986-2003/Jun W4
         (c) 2003 ProQuest
File 813:PR Newswire 1987-1999/Apr 30
         (c) 1999 PR Newswire Association Inc
File 141:Readers Guide 1983-2003/May
         (c) 2003 The HW Wilson Co
File 239:Mathsci 1940-2003/Aug
         (c) 2003 American Mathematical Society
File 696:DIALOG Telecom. Newsletters 1995-2003/Jun 25
         (c) 2003 The Dialog Corp.
File 621:Gale Group New Prod.Annou.(R) 1985-2003/Jun 24
         (c) 2003 The Gale Group
File 674:Computer News Fulltext 1989-2003/Jun W4
         (c) 2003 IDG Communications
File  88:Gale Group Business A.R.T.S. 1976-2003/Jun 23
         (c) 2003 The Gale Group
File 369:New Scientist 1994-2003/Jun W3
         (c) 2003 Reed Business Information Ltd.
File 160:Gale Group PROMT(R) 1972-1989
         (c) 1999 The Gale Group
File 635:Business Dateline(R) 1985-2003/Jun 25
         (c) 2003 ProQuest Info&Learning
File  15:ABI/Inform(R) 1971-2003/Jun 25
         (c) 2003 ProQuest Info&Learning
File   9:Business & Industry(R) Jul/1994-2003/Jun 24
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(c) 2003 Resp. DB Svcs.
File 13:BAMP 2003/Jun W1
(c) 2003 Resp. DB Svcs.
File 810:Business Wire 1986-1999/Feb 28
(c) 1999 Business Wire
File 647:CMP Computer Fulltext 1988-2003/Jun W1
(c) 2003 CMP Media, LLC
File 98:General Sci Abs/Full-Text 1984-2003/May
(c) 2003 The HW Wilson Co.
File 148:Gale Group Trade & Industry DB 1976-2003/Jun 24
(c)2003 The Gale Group
File 256:SoftBase:Reviews,Companies&Prods. 82-2003/May
(c)2003 Info.Sources Inc

7/3,K/1 (Item 1 from file: 2)
DIALOG(R)File 2:INSPEC
(c) 2003 Institution of Electrical Engineers. All rts. reserv.

00654418 INSPEC Abstract Number: A74048649
Title: Positron trapping at dislocations in copper
Author(s): **McKee, B.T.A.** ; Saimoto, S.; Stewart, A.T.; Stott, M.J.
Author Affiliation: Queen's Univ., Kingston, Ont., Canada
Journal: Canadian Journal of Physics vol.52, no.9 p.759-65
Publication Date: 1 May 1974 Country of Publication: Canada
CODEN: CJPHAD ISSN: 0008-4204
Language: English
Subfile: A

Author(s): **McKee, B.T.A.** ; Saimoto, S.; Stewart, A.T.; Stott, M.J.
...Abstract: crystals were deformed under conditions that would lead to known densities of dislocations in near **random arrays** and were annealed to remove other defects associated with the deformation. Using a trapping model...

7/3,K/2 (Item 1 from file: 47)
DIALOG(R)File 47:Gale Group Magazine DB(TM)
(c) 2003 The Gale group. All rts. reserv.

03555668 SUPPLIER NUMBER: 10826071 (USE FORMAT 7 OR 9 FOR FULL TEXT)
Achieving access for the disabled. (Americans with Disabilities Act may require businesses to accommodate disabled job candidates; includes related article on information sources)
McKee, Bradford
Nation's Business, v79, n6, p31(4)
June, 1991
CODEN: NBUSA ISSN: 0028-047X LANGUAGE: ENGLISH RECORD TYPE: FULLTEXT
WORD COUNT: 3207 LINE COUNT: 00254

McKee, Bradford
... to all toilets is not possible, one unisex toilet for the disabled is allowed instead. **Mirrors** , urinals, and dispensers must conform to certain height standards.
Public phones on any floor must...

7/3,K/3 (Item 2 from file: 47)
DIALOG(R)File 47:Gale Group Magazine DB(TM)
(c) 2003 The Gale group. All rts. reserv.

03405586 SUPPLIER NUMBER: 08989899 (USE FORMAT 7 OR 9 FOR FULL TEXT)
A troubling bill for business. (Americans with Disabilities Act of 1989)
McKee, Bradford A.
Nation's Business, v78, n5, p58(2)
May, 1990
CODEN: NBUSA ISSN: 0028-047X LANGUAGE: ENGLISH RECORD TYPE: FULLTEXT
WORD COUNT: 1695 LINE COUNT: 00134

McKee, Bradford A.
... litigation."
Fulco says the administration plans to offer an amendment to the bill that would " **mirror** " current Title VII remedies, spelling them out and affixing them permanently. If the administration can...

7/3,K/4 (Item 1 from file: 484)
DIALOG(R)File 484:Periodical Abs Plustext
(c) 2003 ProQuest. All rts. reserv.

04978457 SUPPLIER NUMBER: 68554072 (USE FORMAT 7 OR 9 FOR FULLTEXT)

The green machine
McKee, Bradford
Architecture (IAIA), v90 n2, p46-50+, p.7
Feb 2001
ISSN: 0746-0554 JOURNAL CODE: IAIA
DOCUMENT TYPE: Feature
LANGUAGE: English RECORD TYPE: Fulltext; Abstract
WORD COUNT: 2281

McKee, Bradford

TEXT:
... radiant heating system considered for the floors. "It had a lot of benefits, but was **redundant** with the heating system," Harrison says. And though the building's south elevation is mostly...

7/3,K/5 (Item 2 from file: 484)
DIALOG(R)File 484:Periodical Abs Plustext
(c) 2003 ProQuest. All rts. reserv.

04915081 SUPPLIER NUMBER: 64874991 (USE FORMAT 7 OR 9 FOR FULLTEXT)
Off the wall
McKee, Bradford
Harper's Bazaar (GHAB), n3469, p230-233+, p.5
Dec 2000
ISSN: 0017-7873 JOURNAL CODE: GHAB
DOCUMENT TYPE: Feature
LANGUAGE: English RECORD TYPE: Fulltext; Abstract
WORD COUNT: 2391

McKee, Bradford

TEXT:
... will be concerned with dressing the future, speculating, anticipating coming events, and holding up a **mirror** to the world."
Fashion design and architecture have engaged in a kind of mutual thievery...

7/3,K/6 (Item 3 from file: 484)
DIALOG(R)File 484:Periodical Abs Plustext
(c) 2003 ProQuest. All rts. reserv.

04765382 SUPPLIER NUMBER: 54527571 (USE FORMAT 7 OR 9 FOR FULLTEXT)
Paige Rense: The shelter queen
McKee, Bradford
Architecture (IAIA), v89 n5, p121, p.1
May 2000
ISSN: 0746-0554 JOURNAL CODE: IAIA
DOCUMENT TYPE: Feature
LANGUAGE: English RECORD TYPE: Fulltext; Abstract
WORD COUNT: 483

McKee, Bradford

TEXT:
... a corollary, "only the poor murder for love." In no small way, the propulsive plot **mirrors** the unsolved slaughter of her predecessor, former AD editor Bradley Little. The New York Observer...

7/3,K/7 (Item 1 from file: 88)
DIALOG(R)File 88:Gale Group Business A.R.T.S.
(c) 2003 The Gale Group. All rts. reserv.

04372756 SUPPLIER NUMBER: 19768676
Autodesk's upgrade.

McKee, Bradford
Architecture, v86, n6, p112(4)
June, 1997
ISSN: 0746-0554 LANGUAGE: English RECORD TYPE: Fulltext
WORD COUNT: 2905 LINE COUNT: 00239

McKee, Bradford
... customer contact for the new release by taking early prototypes to customers in two-way **mirrored** rooms for "usability sessions." As the new software incubated, one-third of the 225-member...

7/3,K/8 (Item 2 from file: 88)
DIALOG(R)File 88:Gale Group Business A.R.T.S.
(c) 2003 The Gale Group. All rts. reserv.

03614756 SUPPLIER NUMBER: 16762821
The tricks to fast track. (architectural design)(includes related articles)
McKee, Bradford
Architecture, v84, n3, p135(3)
March, 1995
ISSN: 0746-0554 LANGUAGE: English RECORD TYPE: Fulltext
WORD COUNT: 1897 LINE COUNT: 00163

McKee, Bradford
... principal of Graeber, Simmons & Cowan Architects (GS&C) of Austin, Texas. The inefficiency of often **redundant** documentation in addition to the coordination of multiple contracts extends the time each phase takes...

7/3,K/9 (Item 1 from file: 15)
DIALOG(R)File 15:ABI/Inform(R)
(c) 2003 ProQuest Info&Learning. All rts. reserv.

02483303 217764271
Growth markets analysis: Emerging markets: The way to diversity?
McKee, Bob
Euromoney v33n401 PP: 218-223 Sep 2002
ISSN: 0014-2433 JRNL CODE: ERM
WORD COUNT: 2485

McKee, Bob
...TEXT: to Asia as it takes root.

This story of renewed structural strength in Asia is **mirrored** in reverse in high-debt, low-productivity South America. Structurally, Brazil remains at the bottom...

7/3,K/10 (Item 2 from file: 15)
DIALOG(R)File 15:ABI/Inform(R)
(c) 2003 ProQuest Info&Learning. All rts. reserv.

00584529 91-58876
What You Must Do for the Disabled
McKee, Bradford
Nation's Business v79n12 PP: 36, 38-40 Dec 1991
ISSN: 0028-047X JRNL CODE: NAB
WORD COUNT: 3884

McKee, Bradford
...TEXT: 1,220 mm) must be in front of the lavatory.

The bottom edge of a **mirror** 's reflecting pane should be no more than 40 inches (1,015 mm) above the...at 17 to 19 inches (430 by 485 mm) above the floor. Accessible dressing-room **mirrors** should be at least 18 inches wide and 54 inches high (460 by 1,370.

Note from WO1

US006430177B1

(12) **United States Patent**
Luzeski et al.

(10) **Patent No.: US 6,430,177 B1**
(45) **Date of Patent: Aug. 6, 2002**

(54) **UNIVERSAL MESSAGING SYSTEM PROVIDING INTEGRATED VOICE, DATA AND FAX MESSAGING SERVICES TO PC/WEB-BASED CLIENTS, INCLUDING A CONTENT MANAGER FOR RECEIVING INFORMATION FROM CONTENT PROVIDERS AND FORMATTING THE SAME INTO MULTIMEDIA CONTAINERS FOR DISTRIBUTION TO WEB-BASED CLIENTS**

(75) Inventors: **Nicholas M. Luzeski**, Paoli; **Daniel P. Meyer**, Downingtown, both of PA (US); **Curt Raddatz**, Willingboro, NJ (US)

(73) Assignee: **Unisys Corporation**, Blue Bell, PA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/093,593**

(22) Filed: **Jun. 9, 1998**

(51) **Int. Cl.**[7] **H04L 12/66**; H04M 1/64
(52) **U.S. Cl.** **370/356**; 379/88.11; 379/88.17
(58) **Field of Search** ..... 370/350, 354, 370/355.04, 356; 709/206, 200, 217; 364/DIG. 1, DIG. 2; 379/900, 67.1, 88.1, 88.11, 88.12, 88.13, 88.14, 88.17, 88.22, 88.23, 88.25

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WO	WO 97/32256	9/1997
WO	WO 97/40612	10/1997

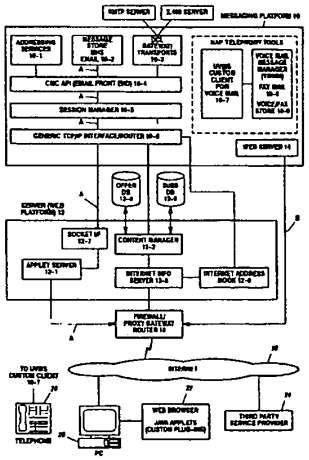
(List continued on next page.)

Primary Examiner—Willie Luther
(74) *Attorney, Agent, or Firm*—Lise A. Rode; Michael B. Atlass; Mark T. Starr

(57) **ABSTRACT**

A Universal Messaging system provides e-mail, voice-mail and fax-mail services to subscribers that may utilize the Internet to access their messages. The system integrates an e-mail messaging system with a voice/fax messaging system on a messaging platform computer. E-mail messages are stored in an e-mail message store, and voice and/or fax messages are stored in a separate store controlled, e.g., by a Voice Mail Message Manager (VMMM). Subscribers can access messages from a personal computer via the Internet using a standard Web browser with an applet that present each subscriber with a "universal inbox" that displays all of that subscriber's voice, fax, and e-mail messages. A Web platform controls the Web browser interface to the messaging platform, accepting requests from the Web browser (such as a request to read an e-mail or listen to a voice mail) and passing prescribed types of information back to the Web browser. The Web platform interfaces with the messaging platform via a generic TCP/IP interface/router. A Session Manager application manages the Web browser's "session" with the messaging system. A CMC layer in the messaging platform provides the "glue" to enable communication and control between and among the different message stores. The CMC layer provides an industry standard mechanism for providing a standard API through which access to proprietary message stores can be made.

19 Claims, 15 Drawing Sheets



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6,317,485	B1 *	11/2001	Homan et al.	

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SAP - Exhibit 1102
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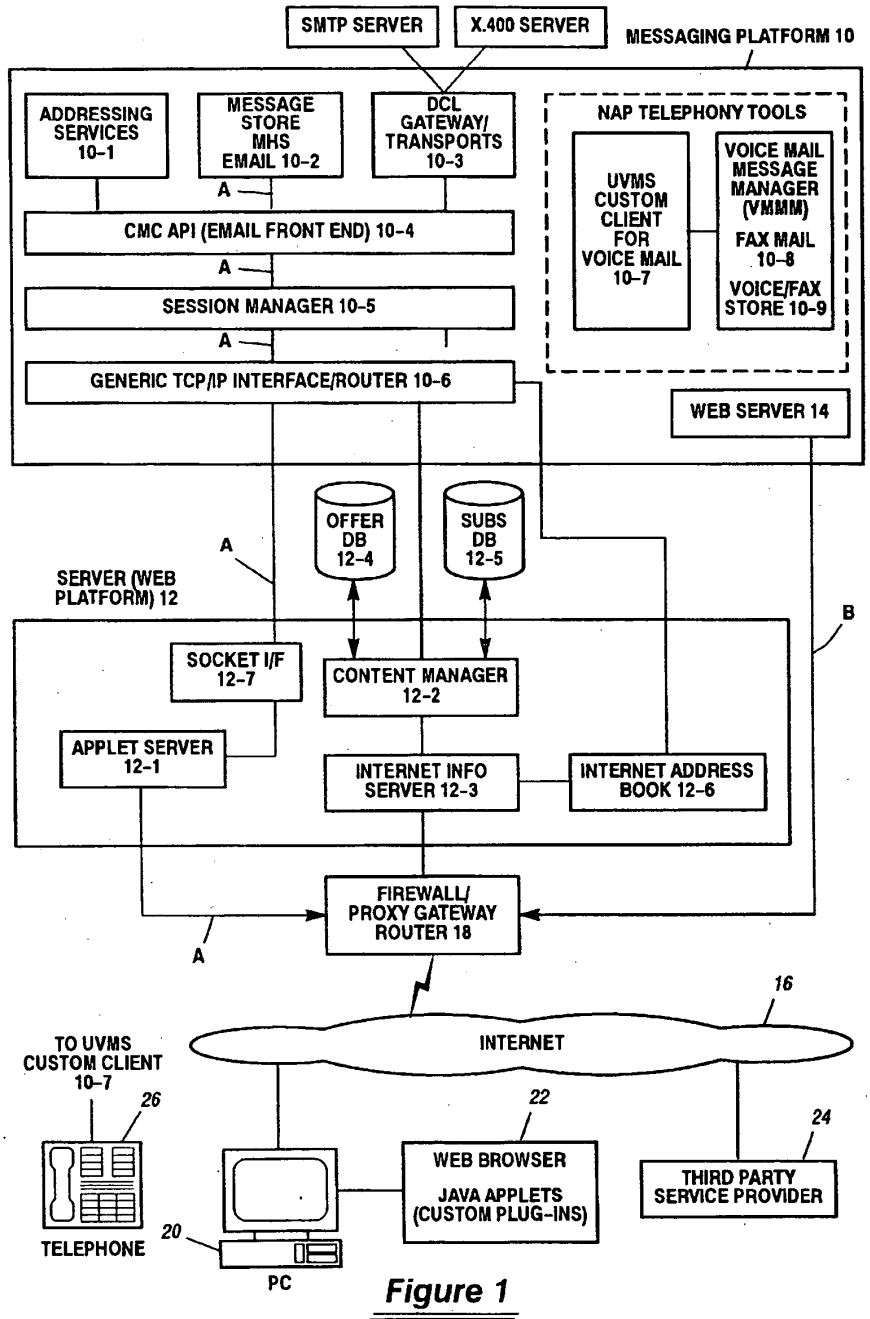


Figure 1

SAP - Exhibit 1102
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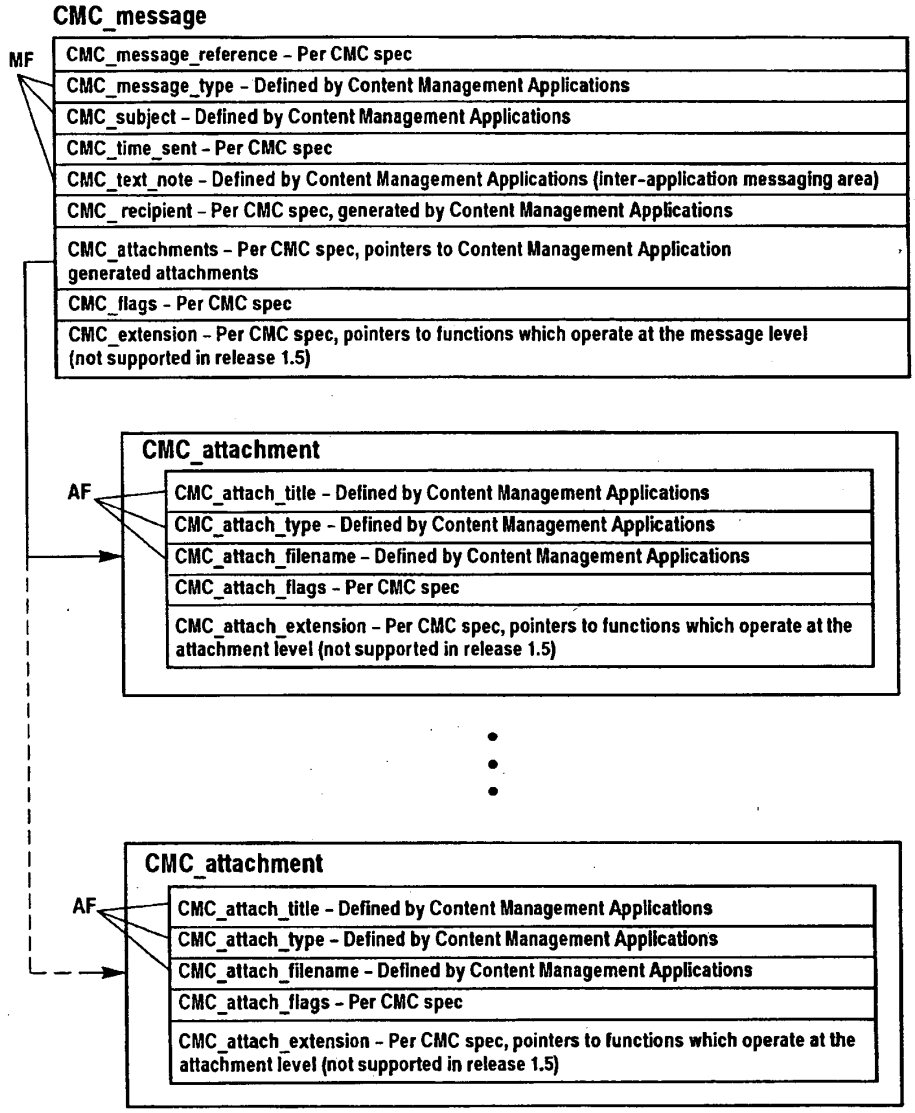


Figure 2

SAP - Exhibit 1102
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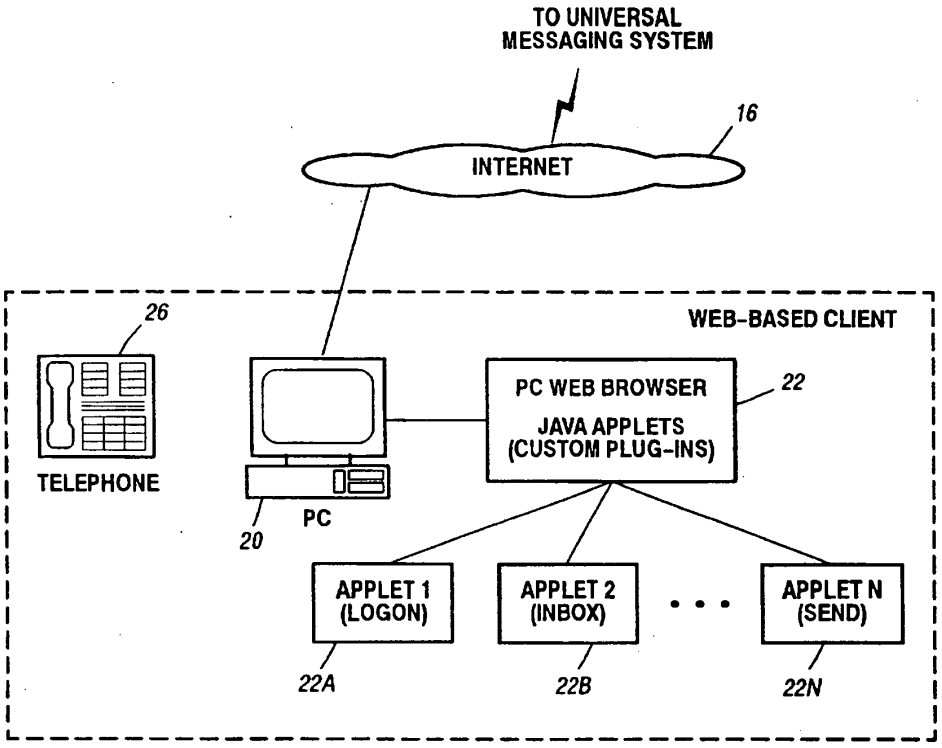


Figure 3

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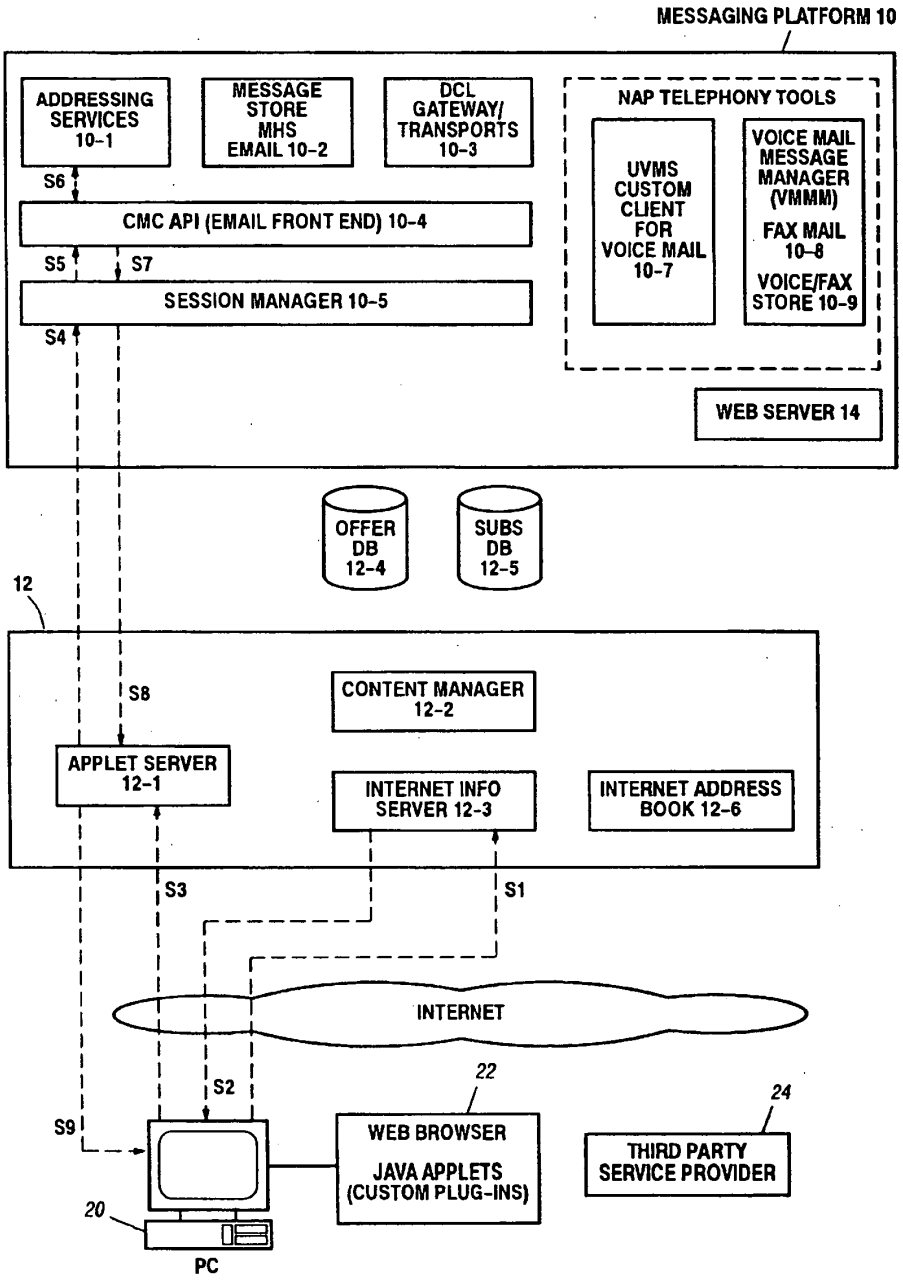


Figure 4A

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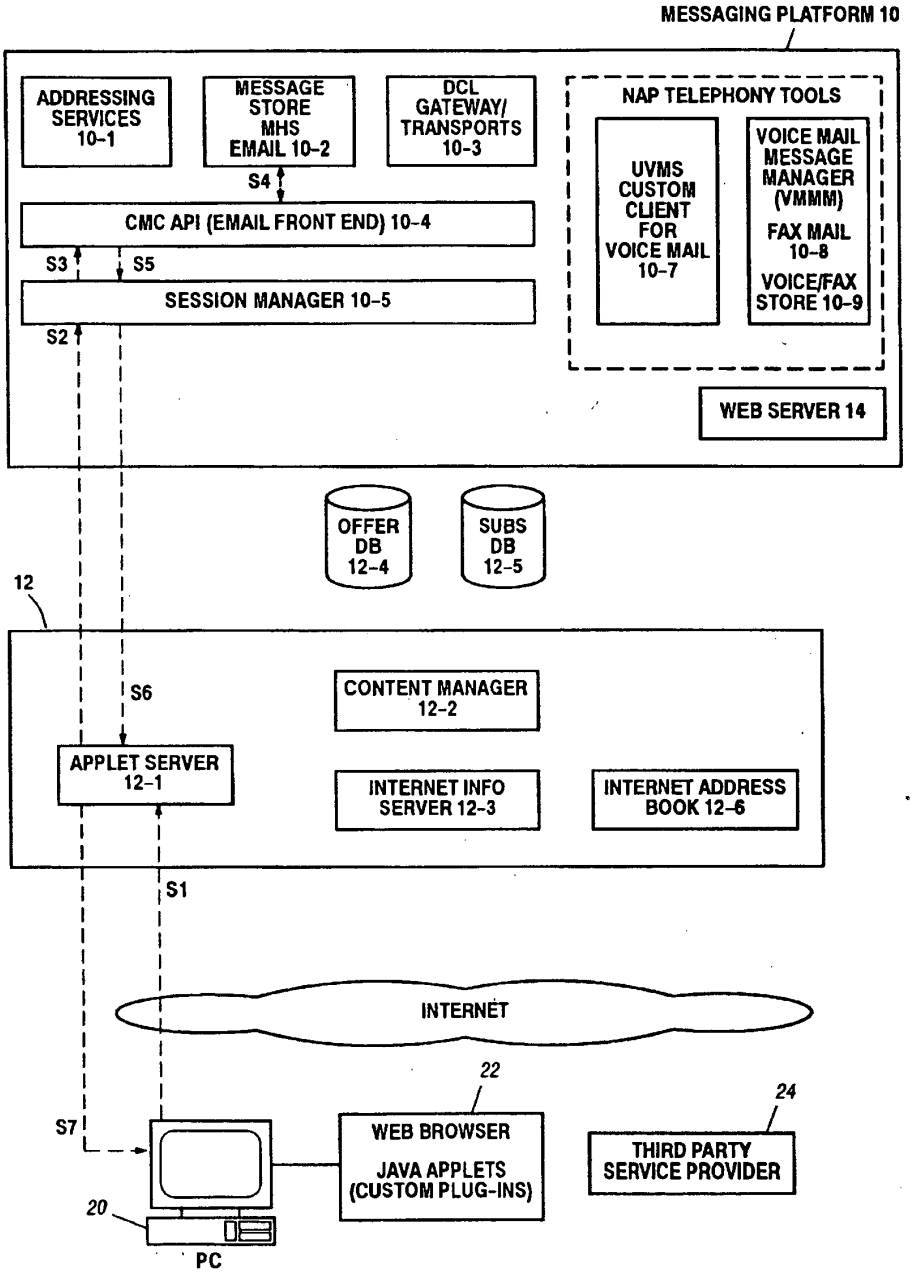


Figure 4B

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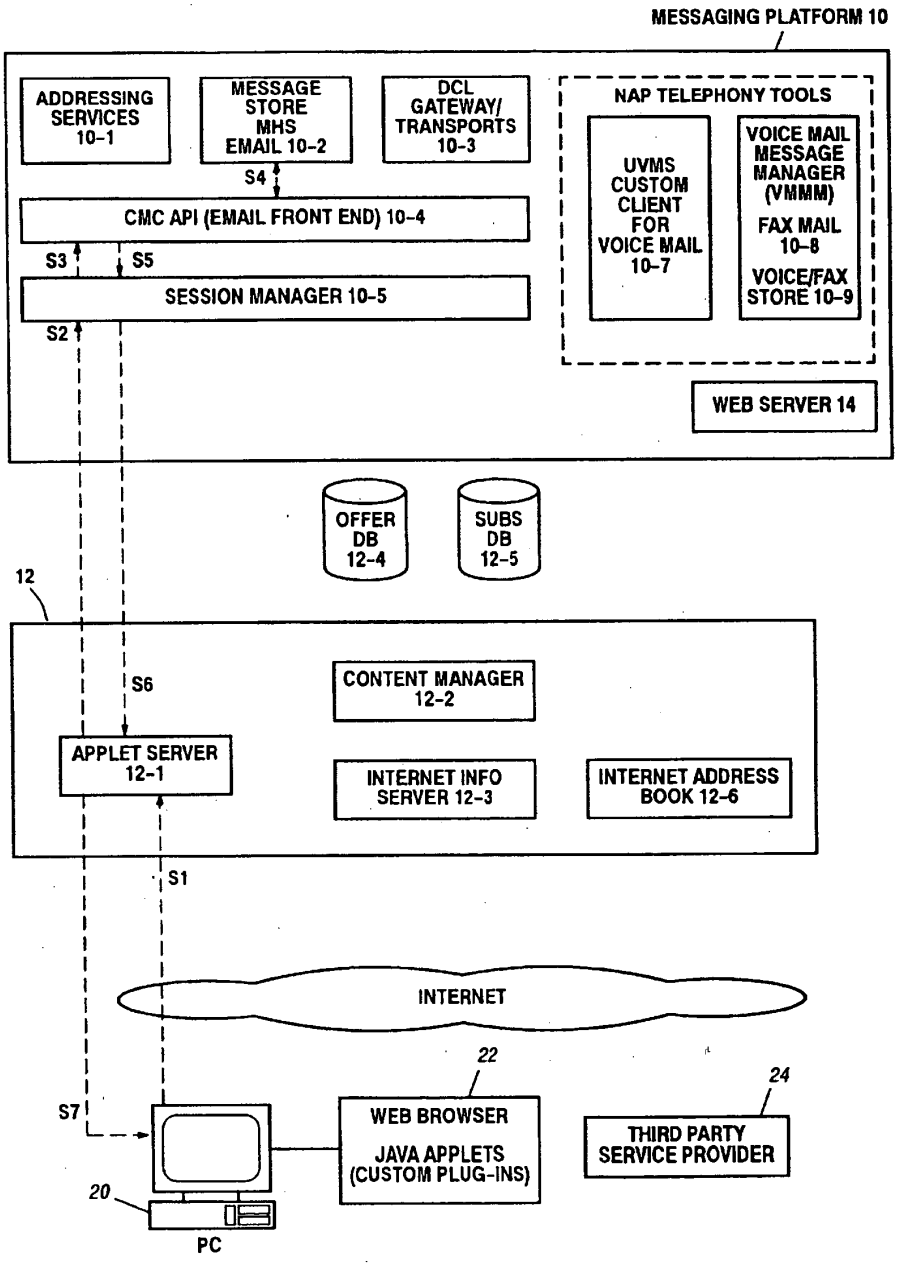


Figure 4C

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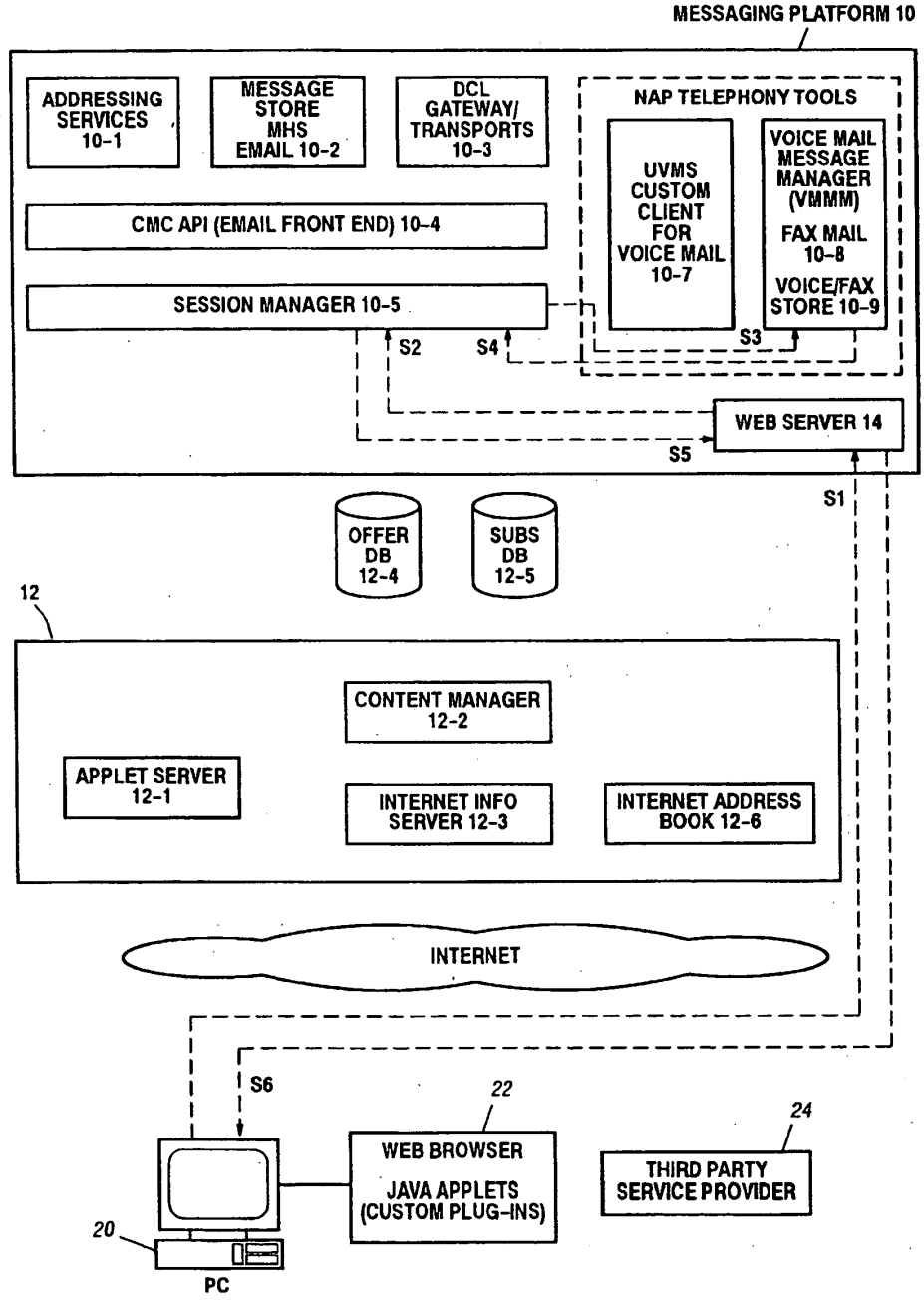


Figure 4D

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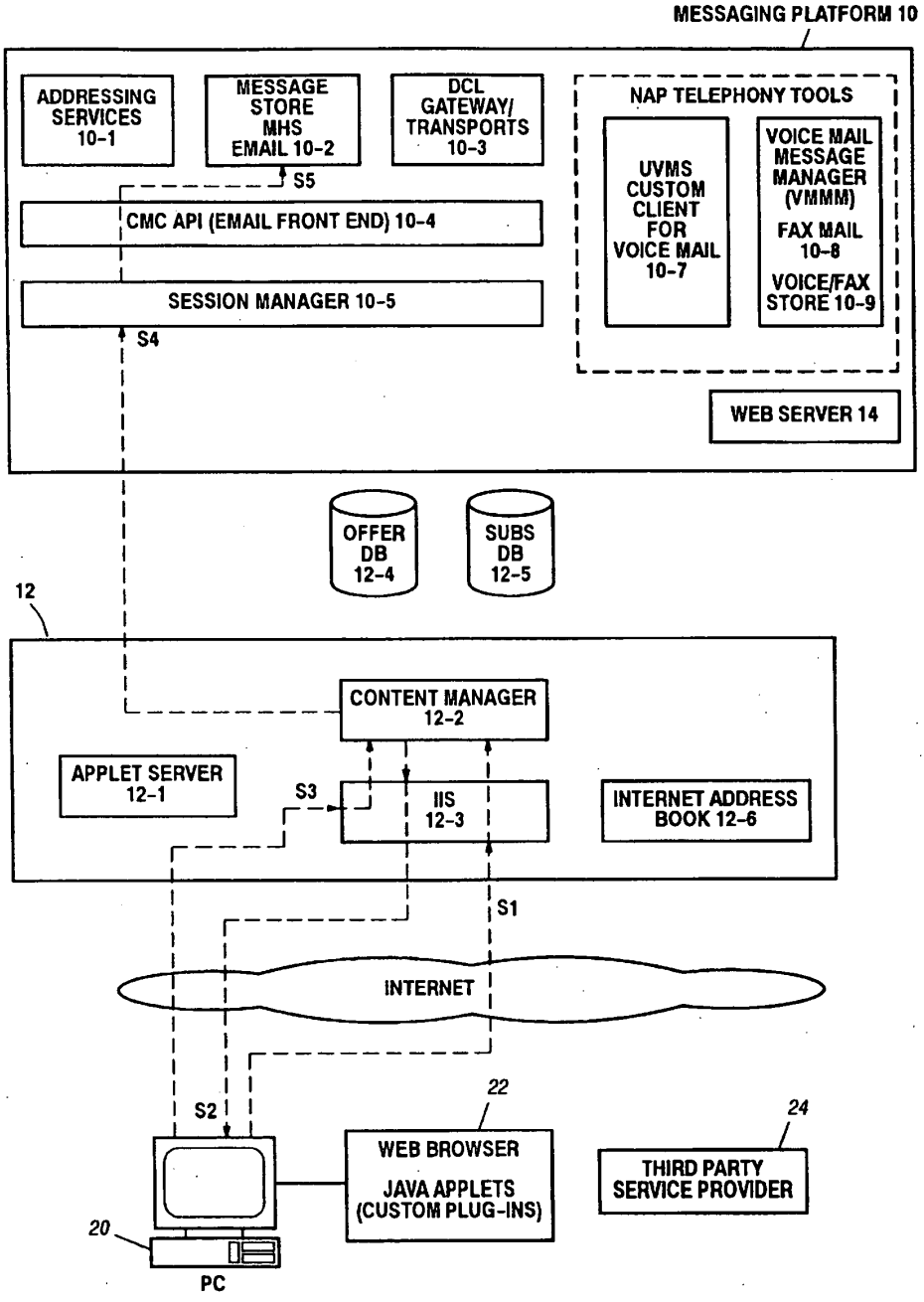


Figure 4E

SAP - Exhibit 1102
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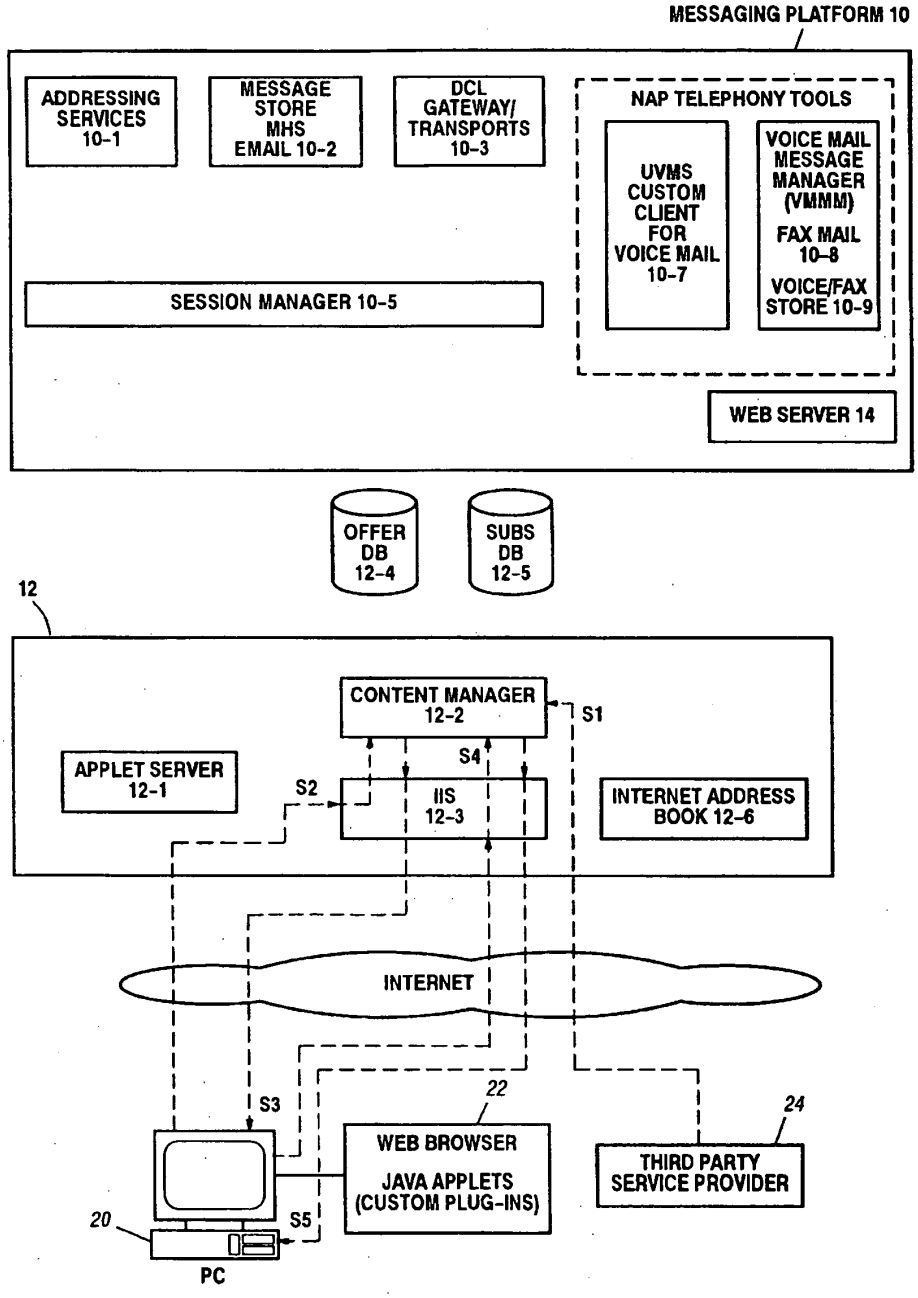


Figure 4F

SAP - Exhibit 1102
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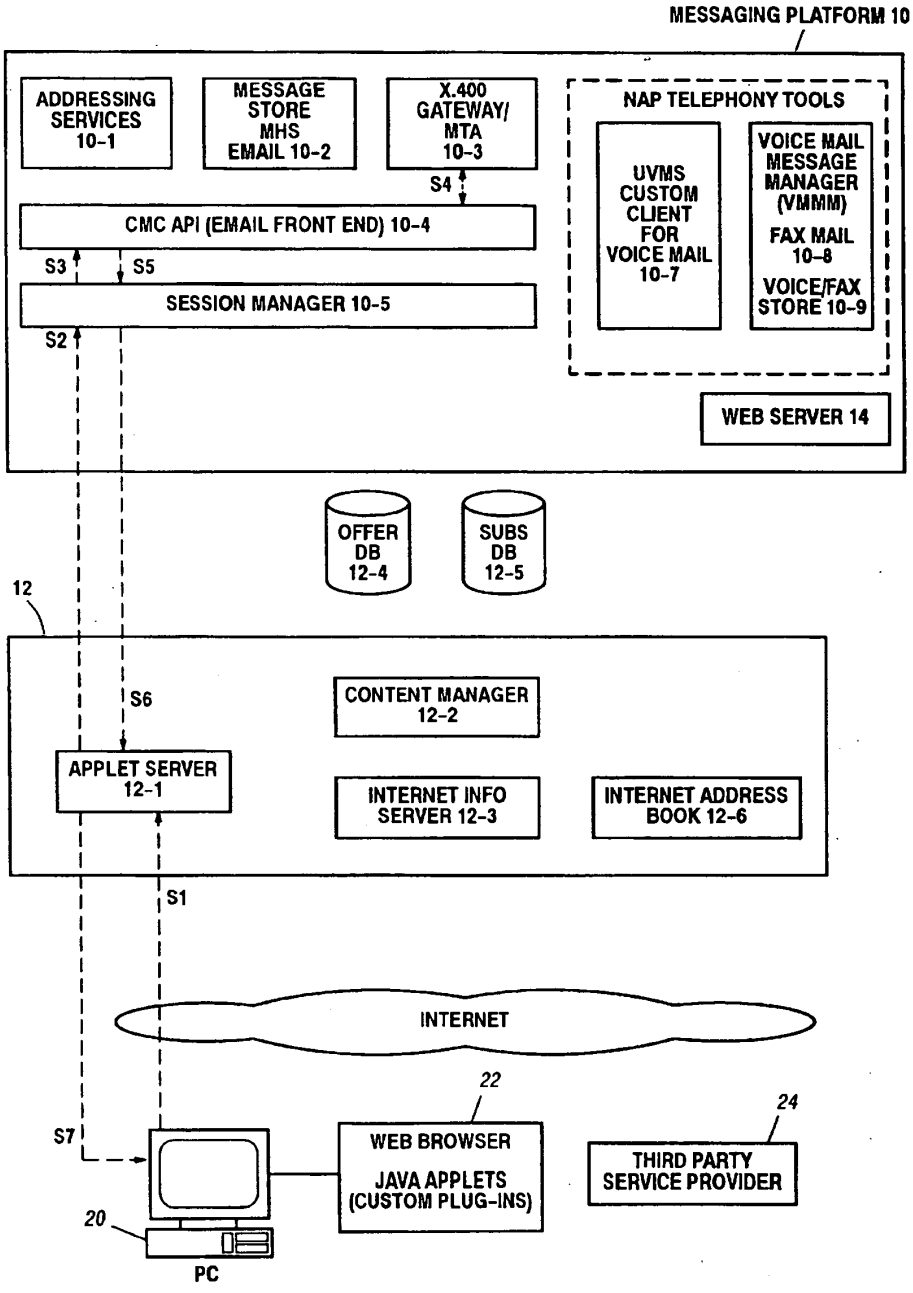


Figure 4G

SAP - Exhibit 1102
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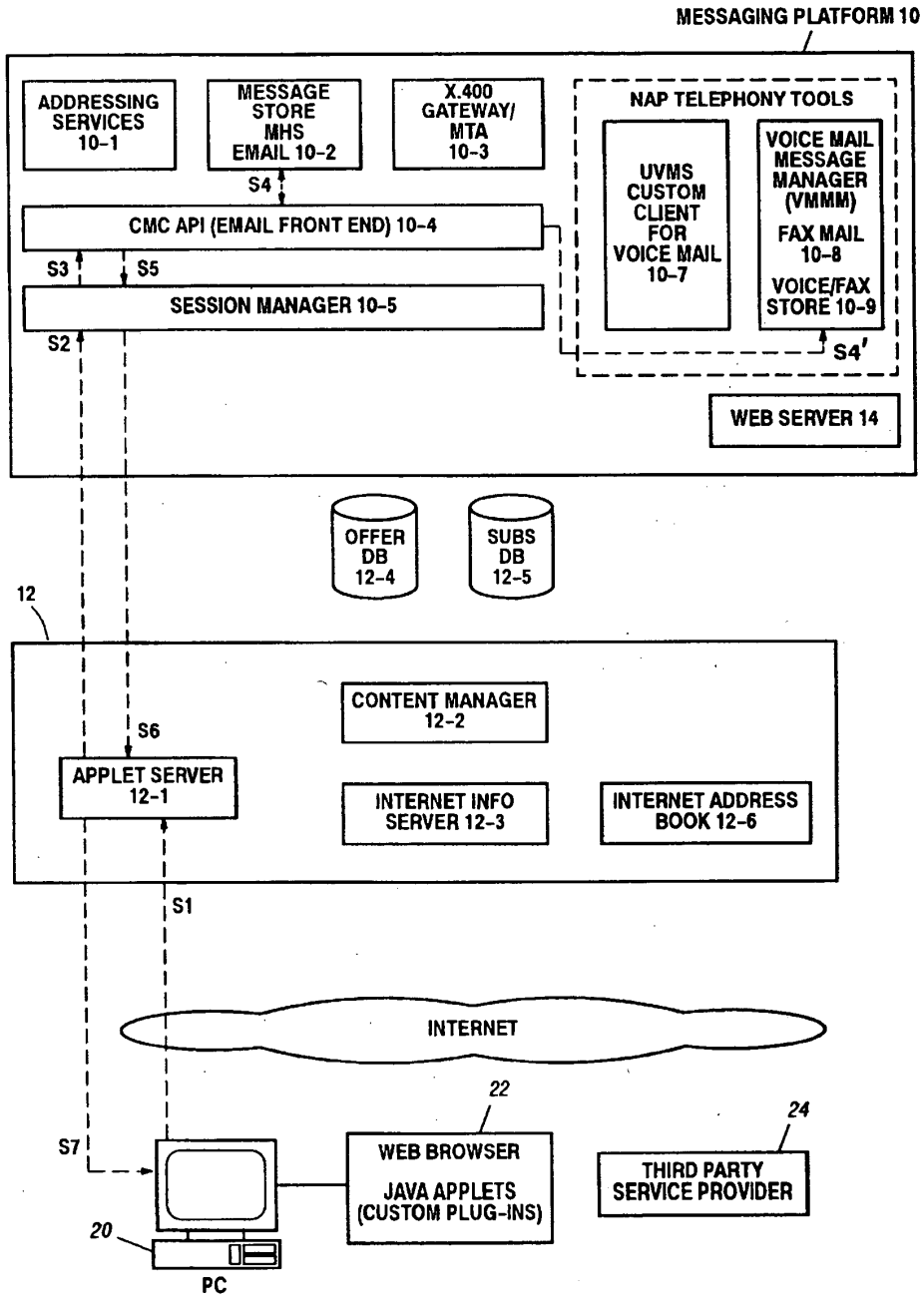


Figure 4H

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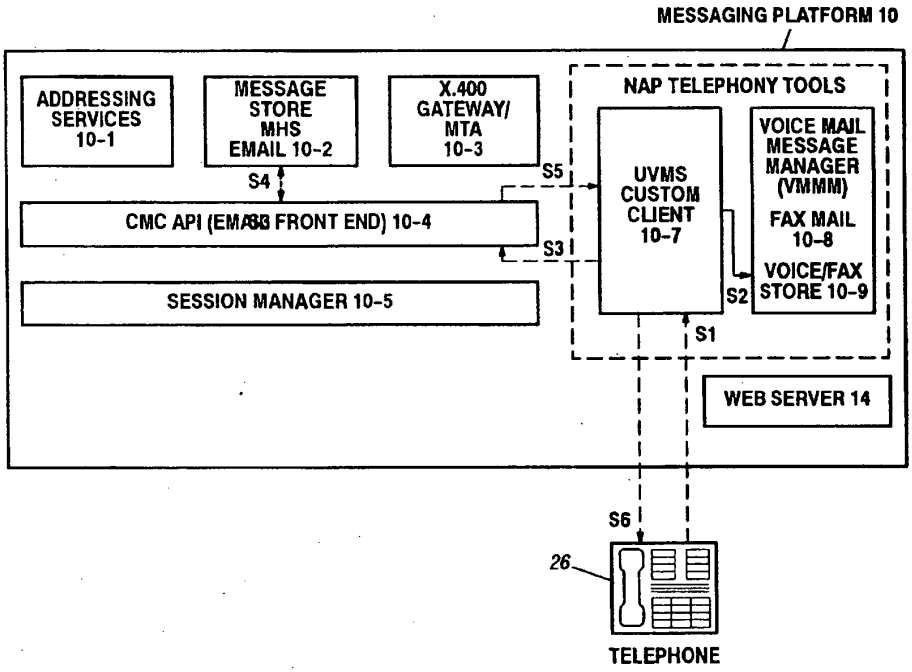


Figure 4I

SAP - Exhibit 1102
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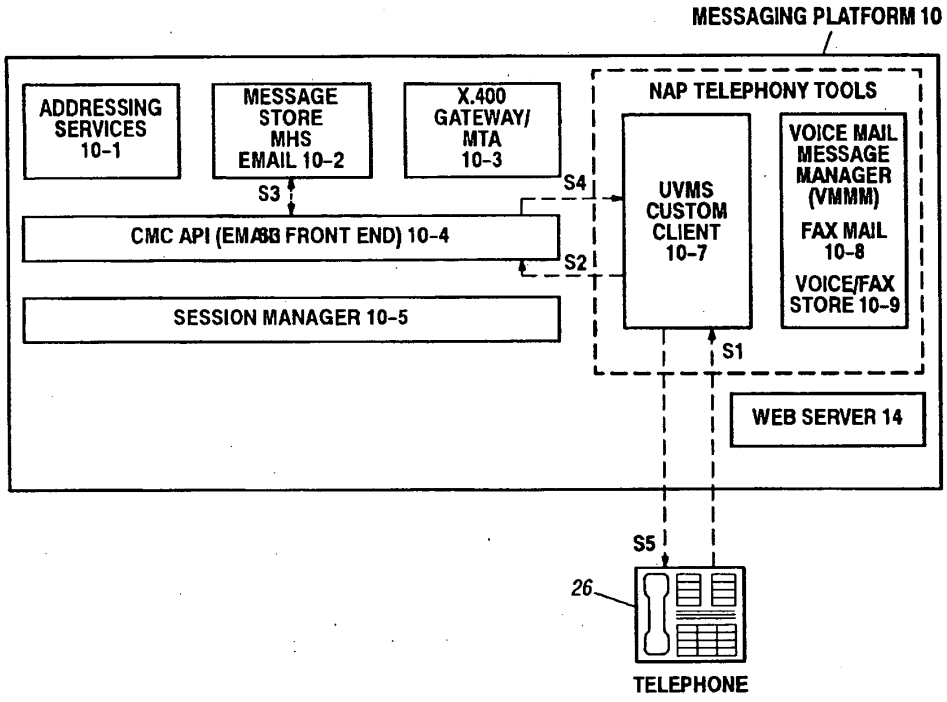


Figure 4J

SAP - Exhibit 1102
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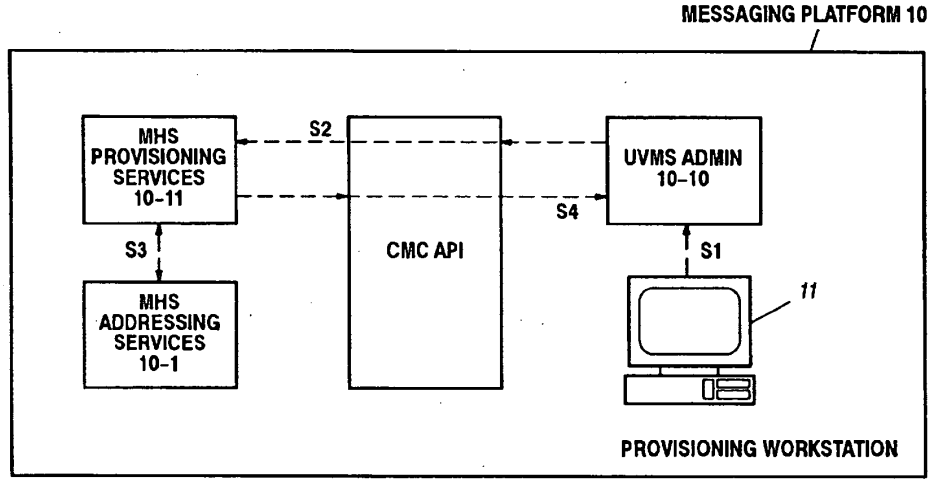


Figure 4K

SAP - Exhibit 1102
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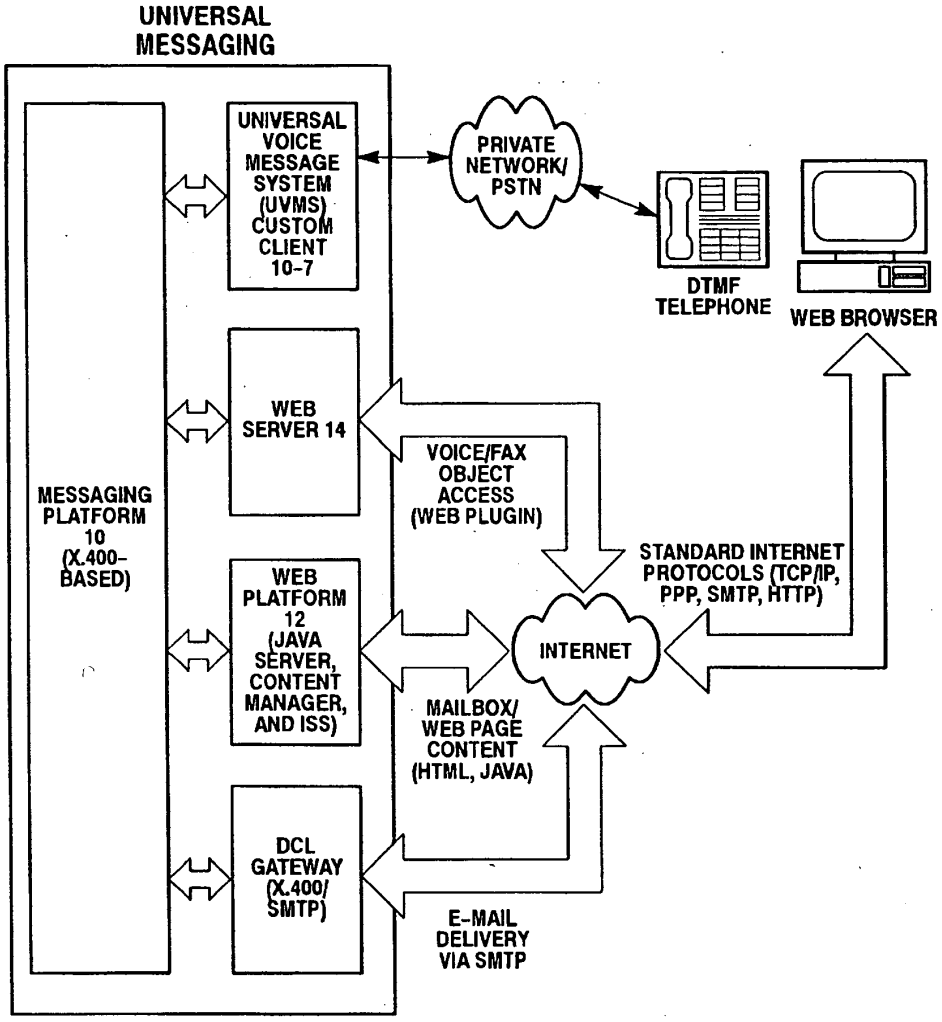


Figure 5

SAP - Exhibit 1102
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UNIVERSAL MESSAGING SYSTEM PROVIDING INTEGRATED VOICE, DATA AND FAX MESSAGING SERVICES TO PC/WEB-BASED CLIENTS, INCLUDING A CONTENT MANAGER FOR RECEIVING INFORMATION FROM CONTENT PROVIDERS AND FORMATTING THE SAME INTO MULTIMEDIA CONTAINERS FOR DISTRIBUTION TO WEB-BASED CLIENTS

CROSS REFERENCE TO RELATED APPLICATIONS

The subject matter disclosed herein is related to the subject matter disclosed in co-pending U.S. patent application Ser. No. 09/094,126, filed on even date herewith, titled "Universal Messaging System Providing Integrated Voice, Data and Fax Messaging Services to PC/Web-based Clients, Including a Session Manager for Maintaining a Session Between a Messaging Platform and the Web-based Clients"; and U.S. patent application Ser. No. 09/094,266, filed on even date herewith, titled "Universal Messaging System Providing Integrated Voice, Data and Fax Messaging Services to PC/Web-based Clients, Including a Large Object Server for Efficiently Distributing Voice/Fax Messages to Web-based Clients".

FIELD OF THE INVENTION

The present invention relates generally to messaging systems, e.g., voice-mail and e-mail systems, and more particularly to a Universal Messaging system providing integrated voice, data and fax messaging services to PC-based, including Web-based, clients.

BACKGROUND OF THE INVENTION

Universal Messaging enables subscribers to realize the benefits of unified messaging, which consolidates the notification, presentation and management of voice, fax and e-mail messages. With Universal Messaging, a subscriber need only check a single notification device for new messages. Such notification may be provided, e.g., by an e-mail message, message waiting indicator light, stutter dial tone, pager and/or an automatic outdial phone call.

Universal Messaging may also include consolidated message presentation. For example, instead of using a telephone handset to pick up voice messages, a fax machine to pick up fax messages, and a PC to pick up e-mail messages, a subscriber could process all his or her messages with a telephone handset or a multimedia PC, or the like.

A first aspect of the invention disclosed herein relates to the "session-based" character of many messaging systems, including systems providing combined e-mail and voice/fax mail services. In a session-based system, the user enters his or her password and is logged into a "session," i.e., an active communications connection between computers or applications over a network. A session is basically a data conversation between two devices, such as a dumb terminal and a mainframe. If the session is terminated for any reason, the user must log back in. In contrast, the Internet (e.g., World Wide Web, or simply Web) may be considered sessionless, since it is based on a request-response paradigm that uses the HTTP protocol. No actual session is created when a Web browser accesses a "page" of the Web. What occurs is that the browser issues an HTTP request to a Web server hosting that page, and the Web server transfers the HTML code for the page to the browser; but no session is maintained. Any subsequent access of that Web page or to links within that page are performed using another HTTP request/response sequence.

To make a Universal Messaging system compatible with a "sessionless" Web browser interface, it would be advantageous to provide a way to initiate and maintain a session with respect to the voice/fax messaging components of the system. Since a voice messaging system typically handles interactions with callers or subscribers via a telephone, a very session-based connection, there would be a benefit in making interactions with PC-based clients, including those utilizing a sessionless Web connection, appear to the voice/fax messaging component as if coming from a session-based interface, such as a telephone handset. Consider, for example, the case of a very large messaging system having thousand or hundreds of thousands of subscribers. If such a system were to provide access to PC or Web-based clients, a great strain would be placed on the system if such clients were required to "log on" (i.e., enter a user name and password) each and every time an HTTP request were sent to the messaging system. One aspect of the present invention addresses this problem.

A second aspect of the present invention concerns the need to provide support for new message types specifically targeted for the delivery of multimedia content. Such message types will preferably be ignored by normal e-mail clients but will be visible to clients specifically adapted to recognize them. The present invention provides a solution to this challenge by providing a novel approach to controlling access to different types of content in a messaging system. This aspect of the invention permits the use of existing Universal Messaging platform capabilities to address, store, transport, and deliver multimedia content packaged as attachments to uniquely identified e-mail messages.

A third aspect of the present invention concerns the use of TCP/IP (Transmission Control Protocol/Internet Protocol) for the transmission of messages in a Universal Messaging system. TCP/IP is a well known networking protocol that provides communications across interconnected networks and between computers with diverse hardware architectures and operating systems. TCP is a connection-oriented protocol. It first establishes a connection between the two systems that intend to exchange data. When an application sends a message to TCP for transmission, TCP breaks the message into packets and sends them over the network. Because a single message is often broken into many packets, TCP marks these packets with sequence numbers before sending them. The sequence numbers allow the receiving system to properly reassemble the packets into the original message. The IP subset of TCP/IP is the messenger protocol that addresses and sends packets. TCP/IP divides networking functionality into the following four layers: (1) a Network Interface Layer that corresponds to the OSI Physical and Data Link Layers; (2) an Internet Layer that corresponds to the OSI network layer; (3) a Transport Layer, which corresponds to the OSI Transport Layer; and (4) an Application Layer corresponding to the session, presentation and application layers of the OSI model. The Application Layer manages the functions required by user programs, including protocols for remote log-in (Telnet), file transfer (FTP) and electronic mail (SMTP).

The third aspect of the present invention addresses the need for improved speed in transferring large data objects in a Universal Messaging system. Particularly, the problem is that data passing through the CMC interface, session management, and TCP/IP stacks of a Universal Messaging system necessarily cross a number of software process

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boundaries with substantial overhead. For example, having to cross at least two TCP/IP stacks (such as, e.g., in the system described below, in communicating messages from messaging platform **10** to server complex (Web platform) **12** and from server complex **12** to PC Client **20**) adds significant overhead alone. While this may not be a problem for smaller files, such as e-mail messages and control information, it can be a significant problem for larger data objects, such as audio, graphics (fax images), and video. The overhead and protocols that the data must traverse can be too great to deliver such large data objects to the subscriber efficiently. The present invention addresses this problem as well.

Further background information concerning the construction and operation of messaging systems, and particularly one employing a Network Applications Platform (NAP) for interfacing a telephone network and network applications running on an enterprise server, may be found in: U.S. Pat. No. 5,133,004, Jul. 21, 1992, "Digital Computer Platform for Supporting Telephone Network Applications"; U.S. Pat. No. 5,138,710, Aug. 11, 1992, "Apparatus and Method for Providing Recoverability in Mass Storage Data Base Systems Without Audit Trail Mechanisms"; U.S. Pat. No. 5,384,829, Jan. 24, 1995, "Digital Computer Platform for Supporting Telephone Network Applications"; U.S. Pat. No. 5,323,450, Jun. 21, 1994, "Telephone Network Applications Platform for Supporting Facsimile Applications"; U.S. Pat. No. 5,494,606, Feb. 20, 1996, "Multi-Lingual Prompt Management System for a Network Applications Platform"; U.S. Pat. No. 5,633,916, May 27, 1997, "Universal Messaging Service Using Single Voice Grade Telephone Line Within a Client/Server Architecture"; U.S. patent application Ser. No. 08/944,924, filed Oct. 6, 1997, "Enhanced Multi-Lingual Prompt Management in a Voice Messaging System With Support for Speech Recognition"); U.S. patent application Ser. No. 08/964,744, filed Nov. 5, 1997, "Methods and Apparatus for Providing External Access to Executable Call Flows of a Network Application"; U.S. patent application Ser. No. 08/987,571, filed Dec. 11, 1997, "Multiple Language Electronic Mail Notification of Received Voice and/or Fax Messages"; and U.S. patent application Ser. No. 09/094,026, filed on even date herewith, "System and Method for Integrating Notification Functions of Two Messaging Systems in a Universal Messaging Solution".

SUMMARY OF THE INVENTION

The present invention provides Universal Messaging services to subscribers that may utilize the Internet to access their messages. The invention integrates an e-mail messaging system with a voice/fax messaging system on a messaging platform computer. E-mail messages are stored in an e-mail message store, and voice and/or fax messages are stored in a separate store controlled, e.g., by a Voice Mail Message Manager (VMMM). Subscribers can access messages from a personal computer via the Internet using a standard Web browser with a Java applet that present each subscriber with a "universal inbox" that displays all of that subscriber's voice, fax, and e-mail messages. A Web platform controls the Web browser interface to the messaging platform, accepting requests from the Web browser (such as a request to read an e-mail or listen to a voice mail) and passing prescribed types of information back to the Web browser. The Web platform interfaces with the messaging platform via a generic TCP/IP interface/router. A Session Manager application manages the Web browser's "session" with the messaging system. A CMC layer in the messaging platform provides the "glue" to enable communication and control between and among the different message stores. The CMC layer provides an industry standard mechanism for providing a standard API through which access to proprietary message stores can be made.

Thus, a Universal Messaging system in accordance with the present invention comprises a messaging platform supporting an e-mail messaging system and a voice/fax messaging system, and content manager means for receiving information from a content provider and formatting the information into "multimedia containers" for distribution to remote clients via a wide area communications network such as the Internet.

One presently preferred embodiment of the invention further comprises a Web platform supporting the content manager means. In this embodiment, the Web platform includes or is operatively coupled to a first database containing e-mail advertisements and a second database containing news-type information from the content provider. In addition, in the preferred embodiment, the Web platform further supports an applet server for providing software applets to the remote client(s), and an Internet server. Moreover, the content manager means provides multimedia containers for delivering multimedia content to one or more clients.

According to the present invention, each of the inventive multimedia containers comprises a message portion and an attachment portion having associated title, type and filename fields, each of which is used in a predefined manner. The message portion, for example, is preferably characterized by a message type field and a corresponding predefined set of message type definitions; a predefined use of the subject field; and a predefined structure for the text-note field. The text-note field is preferably used for communication between the content manager means and the client(s). Further, all content is preferably carried in the attachment portion via a pointer in the filename field. Preferably, only one type of content, either audio, text, HTML, or graphics, is used per attachment; and the filename field is used to contain pointers to objects, including a Uniform Resource Locator (URL). Finally, the text-note field of the message portion is preferably used to carry instructions relating to presentation and management of the content, and the actual content is referenced by pointers using attachment structures.

Accordingly, the present invention provides support for new message types specifically targeted for the delivery of multimedia content. Such message types may be ignored by normal e-mail clients but will be visible to custom clients specifically adapted to recognize them. Thus, the invention provides a novel approach to controlling access to different types of content in a messaging system while permitting the use of existing Universal Messaging platform capabilities to address, store, transport, and deliver multimedia content.

Other features and advantages of the present invention are described below.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** schematically depicts one preferred embodiment of a Universal Messaging system in accordance with the present invention.

FIG. **2** depicts an exemplary multimedia container in accordance with the present invention.

FIG. **3** depicts an expanded view of a Web-based client in accordance with the present invention.

FIGS. **4**A through **4**K depict exemplary process flows for various transactions.

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FIG. 5 illustrates how the different components of the inventive Universal Messaging system use standard interfaces and protocols to provide unified messaging services.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

A. Overview

FIG. 1 schematically depicts one presently preferred embodiment of a Universal Messaging system in accordance with the present invention. As shown, the system includes a messaging platform **10** (e.g., Unisys Corporation's Clearpath NX™ mainframe computer); a server complex **12** (e.g., an NT server), also referred to herein as a "Web platform"; a "Web server" **14** (e.g., Unisys's Atlas™ software), which is sometimes referred to herein as a "large object server" and which is preferably a software component running on the messaging platform/mainframe **10** (i.e., it need not be a separate hardware component); a wide area communications network (such as the Internet) **16**; a gateway/firewall **18**; and a Web-based client comprising a remote PC-based client **20** and an associated Web browser **22**. (As used herein, the term "PC" refers generically to a personal computer or like screen based client, and is not restricted any particular platform.) A third party service provider **24** may also be considered part of the overall system. The structure and operation of each of these components is explained below in connection with the detailed description of preferred embodiments.

As shown in FIG. **1**, the messaging platform **10** includes the following elements: addressing services object **10-1**; message store for e-mail **10-2**; transports service provider **10-3** (including a gateway for interfacing to SMTP and X.400 servers); Common Messaging Calls (CMC) application programming interface (API) layer **10-4**; Session Manager **10-5**; generic TCP/IP interface/router **10-6**; Universal Voice Messaging System Custom Client **10-7** and Voice Mail Message Manager (VMMM) (for voice and fax mail) **10-8**; and voice/fax store **10-9**. (Note that CMC the CMC standard is defined by the X.400 API Association. CMC 1.0 defines a basic set of calls to inject and extract messages and files, and to access address information. CMC's major "competition" is MAPI—Messaging Application Programming Interface, though simple MAPI is almost identical to CMC.)

The Web platform **12** includes an applet server **12-1** (e.g., for providing Java applets to the Web-based client); a Content Manager Application **12-2** (i.e., an application designed to receive information from content providers, format information into multimedia containers and distribute these containers to the Universal Messaging system via CMC calls); and an NT based Internet server **12-3**, such as, e.g., an IIS server. (IIS is Microsoft Windows NT's Internet Information Server. IIS permits one to set up a Web site and control and manage it remotely through the Internet.) Web platform **12** also includes or is operatively coupled to a first database (Offer Database) **12-4** and a second database (Subscription Database) **12-5**, where "offer" refers to an e-mail based advertisement and "subscription" refers to "news" from a content provider. In addition, Web server **12** includes a communications object/address book **12-6** and a Sockets Interface **12-7**.

As shown, the firewall/gateway **18** interfaces the applet server **12-1**, Internet server **12-3** and Web server **14** to the Internet **16**. Moreover, the applet server **12-1** is responsible for downloading and interface with the Universal Messaging desktop located on the client's Web browser **22**. The applet server downloads (to the client PC **20**) the Java applets required to provide an active desktop, and then communicates with the applets to provide the look and feel of the messaging desktop. FIGS. **4A**, **4B** and **4C** (discussed below) show exemplary flows for logon and messaging.

The CMC API layer **10-4** and its supporting components provides a messaging interface library. The present invention does not require the use of any specific messaging interface library.

As mentioned, the present invention provides methods and apparatus for use in a session-based messaging system to manage sessions initiated through a sessionless interface. This aspect of the present invention is described in detail below in connection with the discussion of the Session Manager **10-5**, which is responsible for maintaining a "session" between the Web client **20** and the CMC API **10-4** even though the session is connectionless. For example, the Session Manager preferably retains a session record for each logged-on user to obviate the need for a CMC logon for each and every service request.

Another aspect of the present invention concerns an inventive method and apparatus for controlling access to different types of content in a messaging system. The present invention permits the use of existing Universal Messaging platform capabilities to address, store, transport, and deliver multimedia content packaged as attachments to uniquely identified e-mail messages. These specialized multimedia "containers" can be operated on by custom messaging clients in the same way as normal e-mail, and custom clients can be created to manipulate and present the contents of the containers in any way desired. A "custom client" is a Web-based messaging client that is custom built to manage and display multimedia containers. A "multimedia container" is a specifically designed type of message to store various kinds of multimedia information. Such a container may be filled by the Content Manager Application **12-2** (FIG. **1**), distributed by the messaging system and displayed by a custom client. This aspect of the present invention is described below in connection with the discussion of the Content Manager **12-2**.

In addition, the Web-based client **20** is permitted to access "small" messages, such as e-mail messages stored in message store **10-2**, via the Internet **16**. Such messages traverse the path denoted "A" in FIG. **1**. The Web-based client **20** is permitted to access "large" objects, such as fax mail and voice mail messages stored in the voice/fax store **10-9**, via the Internet and the path denoted "B". As explained below, Web platform **12** is "optimized" to handle the relatively smaller e-mail messages whereas Web server **14** is optimized to handle the relatively larger voice and fax mail messages. Such optimization is deemed necessary and advantageous in view of the relatively complex protocols, or large overhead, required by the TCP/IP interface/router **10-6**. In accordance with another aspect of the present invention, such large overhead is avoided with respect to the relatively larger voice/fax message objects, where it is most problematic, by transmitting messages directly from the voice/fax store **10-9** through Session Manager **10-5** and then through Web server **14**, thus bypassing the TCP/IP interface/router **10-6** employed to pass messages between the messaging platform **10** and the Web platform (NT server) **112**.

B. Session Manager

Messaging systems, such as the UVMS system shown in FIG. **1**, are typically session-based. That is, a user enters his/her user code and password and is logged into a session.

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If the session is terminated for any reason, the user must log back in. The CMC API **10-4** is also session-based in that user access to messages via the CMC requires a log-on procedure to be performed. In contrast, the Internet is sessionless. Specifically, the Internet, and the World Wide Web in particular, is based on a request/response paradigm that uses the HTTP protocol. When a Web browser (such as browser **22**) "connects" to a "page" of the Web, no actual session is created. All that occurs is that the browser issues an HTTP request to the Web server (such as server **12**) that hosts that page, and the Web server transfers the HTML code comprising the page to the browser—no connection is maintained between separate user requests. Any subsequent accesses to that Web page or to links within that page are performed using another HTTP request/response which requires another connection.

Since the primary client interface, the CMC layer **10-4**, to Universal Messaging is session based, it is advantageous to provide some way to initiate and maintain a session for the Web browser client. The primary advantage is that during a session for a client, the CMC layer **10-4** maintains various user and messaging data. This data is lost when a session is terminated. The Web browser interface to the Universal Messaging system could follow the usual request/response paradigm of the World Wide Web, however, it would be highly inefficient to do so because each request would require a logon-request-logoff sequence. Therefore, it is the function of the Session Manager **10-5** to establish and maintain sessions on behalf of the Web browser client.

For example, when a user first requests access to voice, fax, or e-mail message services (such as reading or sending messages) via the Web browser interface **22**, the user is required to enter a mail profile identifier (e.g., a user name) and password. The Session Manager **10-5** then establishes a session with the CMC layer **10-4** on behalf of the user and associates a session ID with the session. The Session Manager saves the profile identifier, password, and session in a session record.

Every subsequent request from the Web browser interface **22** is automatically accompanied by the user's mail profile identifier, password and session ID, although the user is not made aware of this. The Session Manager **10-5** attempts to validate each such call against the session records to verify that the user requesting service is already logged in. A new CMC session will be established if the Session Manager **10-5** cannot locate the identifier/password combination in its session log.

A timeout function of the Session Manager **10-5** automatically logs a user off the CMC layer **10-4**, deleting his/her session record, if no activity is detected within a predetermined period of time.

Session Manager Implementation Details

The presently preferred functions performed by the Session Manager **10-5** include:

Associating requests originating in the network, which are forwarded by the router **10-6** with the Universal mailbox;

Instituting a timeout process for these sessions;

Converting message-based Web extension calls to procedural CMC calls and UM service library calls, and converting any responses to these calls to a response message format; and

Constructing session-related URLs and embedding them in responses to the Web server **14**.

These and other aspects of the Session Manager **10-5** are described below in connection with the following topics:

a. Relationship to other entities

b. Memory management

c. Session establishment

d. Library entry points

e. Mapping Remote Interface messages to the CMC API

f. Router Interface

g. Web Server Interface

h. Debugging options

a. Entity Relationships

The Session Manager **10-5** is implemented as a server library whose primary clients are the applet server **12-1** and Content Manager **12-2** running on one or more Internet servers **12-3** and interfacing via the Router **10-6**, and Web Server **14**. In turn, the Session Manager links to the CMC layer **10-4** using a single connection.

Also linked to by the Session Manager **10-5** are UVMS **10-7** and Voice Mail Message Manager (VMMM) **10-8**. The Session Manager **10-5** is also linked to the Web server **14**.

The services provided by the CMC layer **10-4** can be considered low-level when compared with the requirements of the Web client **20**. The Session Manager **10-5** typically converts each client request into multiple calls on the CMC layer **10-4**. For example, the client may request a list of message headers to present to the user as the contents of an "inbox". The Session Manager **10-5** then has to call the CMC layer **10-4** to construct a summary structure. Additional calls are made for each member of the summary structure to extract the required information, such as sender, subject, priority, date/time, etc. This data is consolidated by the Session Manager **10-5** and returned to the client in a convenient form. Most e-mail functions (e.g. read, send) result in multiple calls on the CMC layer **10-4**.

Parameters are passed to the Session Manager **10-5** in message form using an XDR format (a format whereby integers are represented by a four byte binary value with the most significant bit representing the sign). The Session Manager **10-5** decodes these parameters so they are compatible with CMC requirements.

The Session Manager **10-5** is also responsible for checking the result of each CMC function and returns an appropriate result code to its client.

b. Memory Management

The router **10-6** allocates the arrays needed to pass requests to and receive data from the Session Manager **10-5**. Within the Session Manager **10-5** there will be a pool of arrays used for temporary storage. The Session Manager **10-5** often needs to use more than one work area to service any given request. This approach should minimize the swapping of arrays in and out of memory on the mainframe **10**.

Two procedures, AllocateBuffer and FreeBuffer, control the allocation and deallocation of work areas. The procedure "AllocateBuffer" returns the index of an array row in a two-dimensional word array for the caller to use for temporary storage. The "FreeBuffer" procedure returns the designated array row to the available pool. Procedures requesting buffers should include an exception procedure to free the buffers to ensure that rows are not "lost" following a program fault.

c. Session Establishment

As discussed above, the Session Manager **10-5** is responsible for maintaining a session between the Web client **20** and the CMC layer **10-4** even though the session is connectionless. Every request for service from the Router **10-6** will include the user's mail profile identifier and password. The user's profile ID will be unique. Initially required for session

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establishment and the creation of a session record, the profile and password included in each request permits the Session Manager **10-5** to validate that each request pertains to an existing session. Where no matching session is located the Session Manager **10-5** automatically creates a new session on behalf of the user. This feature will also facilitate the future "hot" replacement capability of the library when it is fully implemented. The session record also stores the session number provided by the CMC during logon and this is used in subsequent CMC calls to uniquely identify the user session.

d. Library Entry Points

The Session Manager **10-5** provides two critical entry-points. The first is provided specifically for the use of the Router **10-6** and allows its users (applet server **12-1** and content manager **12-2**) to request various functions of the Session Manager **10-5** by passing parameters and receiving results in a message-based format.

The entry point for the router **10-6** is defined as:

```
Real Procedure Request(InRequest, Len, Response, Scratch,
Flags);
Value InRequest, Response, Flags;
Pointer InRequest, Response;
Real Len, Flags;
Array Scratch [0];
```

"InRequest" and "Response" are pointers to arrays allocated in the remote interface. "Scratch" is an array allocated by the Router **10-6** and passed to the Session Manager **10-5** to use as a work area.

A second entry point exists for the use of the Web Server **14** and is declared as:

```
Integer Procedure CGI_Session_Manager (req,
  content_length,
  receive, send,
  getenv, getargv,
  malloc, free,
  heaptoptr);
VALUE
  req, content_length
INTEGER
  req, content_length;
INTEGER PROCEDURE receive (len, req);
  VALUE req, len;
  INTEGER req, len;
  FORMAL;
INTEGER PROCEDURE send (buf_ptr, len, req);
  VALUE buf_ptr, len, req;
  INTEGER buf_ptr, len, req;
  FORMAL;
INTEGER PROCEDURE getenv (env_ptr);
  VALUE env_ptr;
  INTEGER env_ptr;
  FORMAL;
INTEGER PROCEDURE getargv (arg_no);
  VALUE arg_no;
  INTEGER arg_no;
  FORMAL;
INTEGER PROCEDURE malloc (bytes);
  VALUE bytes;
  INTEGER bytes;
  FORMAL;
INTEGER PROCEDURE free (cptr);
  VALUE cptr;
  INTEGER cptr;
  FORMAL;
INTEGER PROCEDURE heaptoptr (cptr, aptr);
  VALUE cptr;
  INTEGER cptr;
  POINTER aptr;
  FORMAL;
```

e. Mapping Remote Interface Messages to CMC API

The applet Server **12-1** and Content Manager **12-2** calls the Session Manager **10-5** using the "Request" entry point. The primary key for the message is the session ID. This is the end to end communication key between the Web client **22** and the Session Manager **10-5** and is composed of the user ID and password. On receipt of a message from the Router **10-6**, the Session Manager **10-5** derives the session ID and determines whether or not it identifies a valid session. If not, the Session Manager **10-5** attempts to log the user onto the CMC layer **10-4** and establishes a local session record. The requested function is then performed.

The structure of the request message passed to the Session Manager **10-5** is outlined below:

FunctionID	
User ID	Long Integer
User Password	String
	String
<Set of positional parameters based on FunctionID>	

A structure of the response message returned from the Session Manager **10-5** is:

Msg format indicator	
User ID	Long Integer
Password	String
ResultCode	String
	Long Integer
<Function-specific data>	

The above style of messaging allows for easy expansion of messages in the future while keeping network overheads to a minimum.

Only two basic types of parameter are permitted: An integer represented as a 4-byte hi-endian number; and "String" starting with a integer length followed by length bytes of ASCII data. A structure can be constructed out of the above two basic elementary types. A structure may take the form of <collection of elementary type>. A constructed parameter called "array" is also available. The form of "array" is <count of elements> <collection of elements>, where <count of elements> is a long integer and <collection of elements> is a collection of fixed length structures.

f. Router Interface

The functions available to clients calling the Session Manager via the router interface are listed below.

Logon (FunctionID=1): Logs the user on to the CMC layer **10-4** and creates a session record within the Session Manager **10-5**.

Logoff (FunctionID=2): Logs the user off the CMC layer **10-4** and destroys the Session Manager session record.

GetAllHeaders (FunctionID=3): This is the first example of the Session Manager providing additional intelligence by

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performing a number of CMC functions in response to a single request. The Session Manager **10-5** obtains the headers for all subscription records for the user by requesting all headers of a particular (content) BLT type, sorts them by subject field and ascending date/time, and then deletes all but the latest message where the subject fields are identical so that only the latest record for a given subscription remains. Next, all headers are requested and returned to the requester. An appropriate result value is returned. The Session Manager **10-5** returns the read/unread status of each message as well as an indication of the presence of attachments. CMC functions called include: CMC_Act_On, CMC_List, Clear_Extension, Set_Extension, Get_Summary, Get_Summary_Recipient, Get_Summgry_Extension, and Get_Display_Time.

GetNewHeaders (FunctionID=4): Having called GetAllHeaders, the client is expected to save the 128-bit reference of the last header received (assuming it did receive one or more headers). The client will periodically refresh its list of headers by calling this function passing the last received message reference. The Session Manager **10-5** will request all messages with a greater reference from the CMC layer **10-4** and process these in exactly the same way as the GetAllHeaders function.

SendMessage (FunctionID=5): Parameters are numerous and include such items as to, cc, bcc, subject, priority, message text, attachments, etc. An additional parameter determines whether or not the message is sent to the designated recipient(s) as well as being "saved" by sending the message to the originator with a specific BLT message type that allows foldering emulation. CMC functions called include, CMC_Send, Clear_Message, Set_Message, Set_Message_Recipient, Set_Message_Attach, and Get_Message. This function preferably involves the implementation of BCC recipients within the CMC layer **10-4**.

ReadMessage (FunctionID=6): The Session Manager **10-5** obtains the message referenced by the single 128-bit string parameter and returns the message header fields, the message body and details of attachments to the caller. Reading a message will cause the message to be marked as read. CMC functions called include CMC_Read, Clear_Extension, Set_Extension, Get_Message, Get_Message_Ext, Get_Message_Recipient, and Get_Message_Attach. BCC recipients are implemented within the CMC layer **10-4**.

DeleteMessage (FunctionID=7): The Session Manager **10-5** will delete the message referenced by the single 128-bit string parameter. The CMC function called is CMC_Act_On.

ValidUser (FunctionID=8): Content Manager **12-2** calls this function to determine whether or not the supplied mail profile ID represents a registered user. If so, a lookup is performed to get the user's full name and SMTP address. The Session Manager **10-5** also determines if a current session exists for the specified user.

GetAttachment (FunctionID=9): Parameters are (1) the 128-bit message identifier and (2) the relative attachment number. The Session Manager **10-5** determines the name of the attachment file, locates it and returns the file contents to the caller. The CMC layer **10-4** function called is Get_Message_Attach.

CreateOfferMessage (FunctionID=10): The Content Manager **12-2** calls this function to send a message to a list of recipients. The message text provides details of the offer and an attached URL points to the content being offered. The CMC functions called include, CMC_Send, Clear_Message, Set_Message, Set_Message_Recipient, Set_Message_Attach, and Get_Message.

CreateSubscriptionMessage (FunctionID=11): Similar to the previous function except there is no message text or return address. A URL points to the content. The CMC layer **(10-4)** functions called are the same as SendMessage.

GetVoiceFaxInfo (FunctionID=12): Having previously called ReadMessage and obtained an encrypted reference to a voice or fax message, the client next calls this function to obtain information relating to the voice/fax message. The Session Manager has to read the e-mail notification message to obtain a reference to the UVMS **10-7** message and information about the voice/fax message. One or more encrypted references to VMMM **10-8** messages are returned to the caller to be used by the Web Plugin to retrieve voice or fax data via the Web Server **14**. Each encrypted message reference includes a timestamp so they have a limited lifetime. The CMC layer **10-4** functions called are the same as SendMessage.

GetHeaderCount (FunctionID=13): This function returns the total count of messages in the user's mailbox and is used by the client to allocate appropriate resources.

ChangeProperty (FunctionID=14): This function allows the user to change user properties. The function is passed a name/value pair. Only one property can be changed per call. Currently the user may only change his or her CMC password. The CMC layer **10-4** function called is CMC_Password.

g. Web Server Interface

Streaming of voice and fax data both into and out of the VMMM Voice/Fax Store **10-9** is accomplished with the Web Server **14** which calls Session Manager **10-5** as a CGI library using the CGI_Session_Manager entry point. Two procedures, one for input and one for output, handle all streaming requirements.

The Session Manager's CGI interface has two responsibilities. Firstly, given an encrypted reference to a voice or fax message by the Web Plugin it must be able to locate the actual data and stream it back to the plugin to be "played" to the user. Secondly, it must be able to accept a data stream recorded by the plugin and representing a voice or fax message and process it appropriately.

When the Session Manager CGI interface receives a request it calls a procedure Stream_Voice_Fax_Data which extracts the encrypted VMMM message reference (previously obtained via a ReadMessage function call) from the incoming request. The reference is decoded and the timestamp checked for expiration. If the reference has not expired, the procedure GetVMMMBlob is called in the VMMM **10-8** interface library to stream the data back to the plugin via the Web Server.

After recording a voice message, the plugin streams data to the Session Manager which invokes a procedure called Accept_Voice_Fax. The Session Manager then calls the VMMM **10-8** interface library to store the data. The mailbox is checked and UVMS **10-7** is called to compose the message. After processing all the recipients an e-mail is generated (if one or more recipients failed) and sent to the originator to notify him or her of a problem. Finally, the user's browser is redirected to one of the two URLs supplied by the plugin to indicate the operation is complete and has succeeded or failed.

h. Debugging Options

Various debugging data including a trace of all data entering and leaving the Session Manager **10-5** is written to an optional trace file. The trace file is written in a comma-separated stream file format that is compatible with Microsoft Excel and other similar products.

Debugging can be initiated when the Session Manager **10-5** starts or during runtime. A new trace file is created each time tracing is initiated.

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C. Content Manager

As mentioned above, another aspect of the present invention concerns an inventive method and apparatus for controlling access to different types of content in a messaging system. The approach described herein permits the use of existing Universal Messaging platform capabilities to address, store, transport, and deliver multimedia content packaged as attachments to uniquely identified e-mail messages. These specialized multimedia "containers" can be operated on by custom messaging clients in the same way as normal e-mail. Save, delete, reply, forward, and other common e-mail functions continue to operate as expected. Customized clients can be created to manipulate and present the contents of the containers in any way desired. Some of the material referred to below can be found in the X.400 API Association's Common Messaging Call API Specification, Version 2.0, dated Jun. 28, 1995.

The Content Manager **12-2** is employed to serve as an interface to content providers, organize the content into the proper formats for receiving clients, provide address lists for the content containers, and set other desired content message parameters, such as priority. In addition, the Content Manager **12-2** acts as a client when receiving e-mail based replies to certain types of content messages.

The presentation and manipulation of the content messages is the responsibility of the custom messaging client(s), such as UVMS custom client **10-7**. The end user look and feel of these messages is completely under the control of the client. End user presentation issues such as displaying messages in separate folders, presenting custom icons for messages, enabling customized operations on messages or their contents is the responsibility of the client.

Content container messages preferably utilize the standard e-mail header constructs common to all messages. Standard headers contain "To:", "From:", "cc:", and "Subject:" fields as well as various flags for priority, return receipt, and other message status and delivery options. The "To:" and "From:" fields are filled in by the Content Manager **12-2**. The "To:" field will contain a list of all users targeted to receive a particular subscription or offer. The "From:" field will most likely contain the e-mail address of an inbox assigned to the Content Manager **12-2**; however, this is not a requirement and any "From:" address could be used.

Platform Services

A standard set of message maintenance and housekeeping functions are supplied by the Universal Messaging platform **10**. Mailbox attributes such as message count and size limits are supported. Attributes that apply to individual messages, such as delivery priority, return receipt, and expiration, are also handled by the platform. The concept of expiration of messages is especially important when using content delivery messages. The Content Manager **12-2** sets the message expiration attributes in the content message headers to ensure that outdated offers and subscriptions are automatically removed from the system.

The Universal Messaging platform **10** also ensures that the current state of all messages (including content containers) is accurately reflected no matter which access device is used. For example, if an offer is opened and saved at the handset **26**, the saved state of the offer is reflected in the users universal inbox. If the user then logs into the system using the Web interface, the custom Web application (e.g., browser **22**) can use the inbox information to display the offer header on the screen in a manner different from new offers. Other message operations (such as delete) are reflected in the universal inbox. Prohibiting or enabling certain operations on a message type or user basis (such as the deletion of subscription containers) is a custom client function.

Messaging Enabled Applications

The Content Manager **12-2** is preferably implemented as a messaging enabled application that is responsible for the generation and maintenance of the content messages flowing in and out of the Universal Messaging system. The Content Manager **12-2** has access to the Universal Messaging platform via CMC 1.0 client calls, VNMS support library calls, and the messaging platform file system.

The Universal Voice Messaging System (UVMS) **10-7** is also considered a messaging enabled application. UVMS handles client interface functions for the telephone handset user. All audio and fax content delivery functions involving an interface to telephone devices and fax machines are managed by the UVMS call flows.

The Web server **14** shown in FIG. **1** can either be a Unisys Clearpath™ based Atlas™ server (such as a server supplied with Umsg Release 1.0) or any other Web server to which the Content Manager **12-2** and custom Web application have access. The Web server **14** does not have access to the Content Manager **12-2**. The sole purpose of the Web server **14** is to fulfill requests from the Web-based client **22** for the retrieval and delivery of voice and fax messages. Client requests bound for the Content Manager are handled by the Internet Information Server **12-3**.

Content Container

FIG. **2** illustrates an exemplary multimedia container format. Message and attachment fields shown in bold, and indicated by reference characters "MF" and "AF", are defined by the Content Manager **12-2** and multimedia clients. The content of fields not in bold are defined by the CMC specification, and these fields are filled by applications in accordance with the specification.

The tasks involved in designing the container are as follows:

1. Develop a list of agreed upon message type definitions. The definitions should be sufficiently flexible to allow expansion in the future.

2. Define the use of the subject field.

3. Define a structure for the text-note field. We propose that the text-note field be used for communication between the Content Manager **12-2** and the multimedia clients.

4. Agree on the use of attachments. We propose that all content is carried in attachments via a pointer in the filename field. Only one type of content (e.g., audio, text, HTML, graphic) should be used per attachment.

5. Define the use of the attachment field's title, type, and filename. Produce a standard for using filename to contain pointers to objects (such as a URL).

The following sections describe each component of the CMC message structure depicted in FIG. **2** in more detail.

Message Types

As mentioned, the Universal Messaging platform may be enhanced to provide support for a new series of message types specifically targeted for the delivery of multimedia content. These message types will be ignored by normal e-mail clients but will be visible to the CMC layer **10-4** clients specifically coded to recognize the message type.

The following message types are defined in the CMC specification:

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Object Identifiers	type "OID", used for types identified by object identifiers as defined in CCITT Recommendation X.208.
CMC Registered Values	type "CMC", used for types defined in the CMC 2.0 specification.
"CMC:IPM.Note"	Interpersonal message. A memo-like message containing a recipient list, an optional subject, an optional text note, and zero or more attachments. The "Message" structure is optimized to accommodate a message of type IPM.
"CMC:Report.IPM.Note.IPRN"	Receipt notification for an interpersonal message. A receipt notification indicates that a message has been read by the recipient.
"CMC:Report.IPM.Note.IPNRN"	Non-receipt notification for an interpersonal message. A non-receipt notification indicates that a message has been removed from the recipient's mailbox without being read.
"CMC:Report.IPM.Note.DR"	Delivery report indicating that the service was able to deliver a message to the recipient.
"CMC:Report.IPM.Note.NDR"	Non-delivery report indicating that the service was not able to deliver a message to the recipient.
"CMC:Report.IPM.Note.CDR"	Both delivery and non-delivery reports when the original message is destined for multiple recipients, indicating that the messaging service is able to deliver the message to some recipients but not to the others.
Bilateral Defined Values	Type "BLT", used for types that are unregistered.

Because all message types other than CMC Registered Values are ignored by standard messaging clients, our choices are to use one of the defined object identifiers or to specify a new message type. The Universal Messaging platform has already declared message type "BLT:NAP" to be used to identify messages (currently voice and fax) that are handled by the UVMS messaging application. ("NAP" refers to Network Applications Platform.) Because the content delivery function does not seem to fit into any of the pre-declared message type categories, we suggest that one define a new message type class for the content containers. The message type takes the format: BLT:UMSCONTENT.<class>.<subclass> . . . <subclass>.

The hierarchy of the new message class for type "SUBSCRIPTION" is shown below:

```
"BLT:UMSCONTENT"
    "BLT:UMSCONTENT.SUBSCRIPTION"
        "BLT:UMSCONTENT.SUBSCRIPTION.NEWSPAPER"
        "BLT:UMSCONTENT.SUBSCRIPTION.MAGAZINE"
            .
            .
            .
        "BLT:UMSCONTENT.SUBSCRIPTION.xxx"
```

Similar message classes may be defined for type "OFFER" and "BILL". The class types are determined by the types of content to be offered. Subclasses are used to differentiate between different formats of content within a class. Appropriate subclass extensions can be defined within each class as required. In a presently preferred embodiment of the invention, extensions can be defined as required up to the message type data item limit of 255 characters.

Message Structure

The following is an exemplary type definition for a CMC message structure shown in C language syntax. A similar structure definition is provided in the ALGOL CMC support library.

```
typedef struct {
        CMC_message_reference   *message_reference;
        CMC_string              message_type;
        CMC_string              subject;
        CMC_time                time_sent;
        CMC_string              text_note;
        CMC_recipient           *recipients;
        CMC_attachment          *attachments;
        CMC_flags               message_flags;
        CMC_extension           *message_extensions;
        } CMC_message;
```

A data value of this type is a message. This data structure is included to provide support for CMC 1.0 implementations. A message has the following components:

message_reference	Identifies the message. The message reference is unique within a mailbox.
message_type	String that identifies the type of the message.
subject	Message's subject string. This is a free form string which can be used as desired by the content management application.
time sent	Date/time message was sent (submitted).
message_reference	Identifies the message. The message reference is unique within a mailbox.
text_note	Message's text note string. If the value is NULL, there is no text note. If the CMC_TEXT_NOTE_AS_FILE flag is set, the text note is in the first attachment. The format of the text note, regardless of whether it is passed in memory or in a file, is a sequence of paragraphs, with the appropriate line terminator for the platform (CR for Macintosh, LF for Unix, CR/LF for DOS and Windows, etc.) terminating each paragraph. Long lines (paragraphs) may be word wrapped by the CMC implementation. Note that there is no guaranteed fidelity (e.g., a long paragraph may be returned by the CMC read functions as a series of shorter paragraphs).
recipients	Pointer to first element in array of recipients of the message.
attachments	Pointer to first element in array of attachments for the message.
message_flags	Bits for Boolean attributes. Unused bits should be clear.
message_extensions	Pointer to first element in array of per-message extensions.

Attachments

Multimedia content can be placed directly in the content messages by using the text_note field of the message structure. Content can also be referenced by a pointer using the attach_filename field of the attachment structure. The latter approach allows the actual content to be stored directly

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in the appropriate message store instead of being carried along with the message. An example of this would be placing the audio portion of a subscription directly into the VNMS object store and including a pointer to the audio (NAP message ID) in the content message. Clients accessing the message would request the audio content directly from the VNMS object store using the supplied pointer.

We suggest that the text-note field be used to carry instructions relating to presentation and management of the content, and the actual content be referenced by pointers using attachment structures. Each attachment will only carry one type of multimedia data. For example, a content container (message) carrying the content for a Wall Street Journal subscription would have three attachments. One attachment would carry ASCII text content, one would carry HTML content, and one would carry audio content. The receiving client would use the attachment format appropriate to the access device the client is servicing.

In CMC, attachment structures contain information about an attachment. This information includes a user defined attachment title, a predefined object identifier (standard or user defined), the attachment filename (which could also be a pointer such as a URL), flags that determine the final ownership of the attachment, and an extension structure that can contain pointers to functions that operate on attachments.

The following is a type definition for a CMC attachment structure shown in C language syntax. A similar structure definition is provided in the ALGOL CMC support library.

```
typedet struct {
        CMC_string              attach_title;
        CMC_object_identifier   attach_type;
        CMC_string              attach_filename;
        CMC_flags               attach_flags;
        CMC_extension           *attach_extensions;
        } CMC_attachment;
```

This data structure is fully supported in CMC 1.0 implementations. An attachment has the following components:

attach_title	Optional title for attachment, e.g., original filename of attachment. This field is free format. It may be used to convey additional information about the attachment content.
attach_type	Object identifier that specifies type of attachment. A NULL value designates an undefined attachment type. Two general purpose Object Identifiers have been predefined for use by applications and CMC implementations.
attach_filename	Name of file where attachment content is located. The location of the file is implementation dependent, but should ensure access by the calling application. If the attach_type indicates a pointer based object identifier, the attach_filename will contain the pointer.
attach_flags	Flags boolean attributes. Unused flags should be clear.
attach_extensions	Pointer to first element in array of per-attachment extensions. A value of NULL indicates that no extensions are present.

A listing of exemplary predefined object content types is provided in the appendix below.

Custom Client for Multimedia Containers

Standard messaging clients (e.g., such as Microsoft Exchange and Lotus Notes cc:Mail) are only capable of acting on messages where the message type field is IPM:xxxx, where "xxxx" could be Note, NDN, Report, etc. The multimedia container concept disclosed herein relies on a messaging client that has the capability to recognize message types other than IPM. In the case of the Universal Messaging system, the message type used for multimedia containers is "BLT:UMSCONTENT.<content_type>" (where BLT stands for bilateral defined type). A custom messaging client for multimedia containers must have the capability to both create and interpret CMC messages of type BLT:UMSCONTENT.

A client of this type can be constructed by starting with a basic CMC client architecture (as used in the Universal Messaging e-mail client) and adding additional logic to handle the extended range of type fields required for the multimedia containers. In the case of message creation, this logic would include a table of supported content types indexed by a value known to the content provider. Content that is delivered to the custom client (through electronic data transfer or other means) will contain an identifying value that the custom client will use as an index into the content type table. Content messages are constructed by creating a standard CMC message (as for an e-mail), addressing the message to the recipient of the content, placing the content (or pointer to the content) into the body of the message, and setting the message type attribute equal to the string "BLT:UMSCONTENT<content type from the table>". The message is then submitted to the CMC API for normal handling in the manner of a standard e-mail.

The messaging platform delivers the multimedia content message to the addressed recipient. The message is ignored if the recipient does not have a custom multimedia container client. The standard client does not display the message or attempt to perform any action on it.

A custom client capable of recognizing and acting on the multimedia content message requires a change to the standard messaging client's message header handling logic that will cause the client to recognize message types beginning with BLT:UMSCONTENT. Upon discovering a message of type BLT:UMSCONTENT, the custom client proceeds to read the extended type information following the BLT:UMSCONTENT string. This information is used to provide customized presentation and handling of the content embedded in the message body. The custom client must should logic to handle all of the types of content that can be transported in the multimedia content container.

D. Web Server for Large Objects

Another aspect of the present invention concerns an inventive method and apparatus for speeding the transfer of large data objects in a Universal Messaging system. The system of FIG. **1** integrates an e-mail messaging system with a voice/fax messaging system on the messaging platform **10**. E-mail messages are stored in an e-mail message store **10-2** whereas voice and/or fax messages are stored in a separate storage area **10-9** controlled by the Voice Mail Message Manager (VMMM) **10-8**. Subscribers can access messages from a personal computer **20**, via the Internet **16**, using a standard Web browser **22** with a proprietary Java applet(s) that presents the subscriber with a "universal inbox" that displays all of the subscriber's voice, fax, and e-mail messages. The Web platform **12** controls the Web browser interface to the messaging platform **10**, accepting requests from the Web browser **22** (such as a request to read an e-mail

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or listen to a voice mail) and passing certain kinds of information back to the Web browser. The Web platform **12** interfaces with the messaging platform **10** via the generic TCP/IP interface/router **10-6**. The Session Manager **10-5** manages the Web browser's "session" with the messaging system. The CMC layer **10-4** provides the "glue" to enable communication and control between the different message stores.

A problem that can arise in such a system is that data passing through the CMC layer **10-4**, the Session Manager **10-5**, and the TCP/IP stacks on both the messaging platform **10** and the Web platform **12** necessarily cross a number of software process boundaries with substantial overhead. Having to cross at least two TCP/IP stacks adds significant overhead alone. This data path is indicated by the reference character "A" in FIG. **1**.

The presently preferred embodiment of the present invention solves this problem by sending large data objects via a separate, dedicated one-way Web server **14**, thus minimizing the path traversed by the data on its way to the subscriber's Web browser **22**. The request for that data, however, is still received via the Web platform **12**. Because the Session Manager **10-5** has already validated the subscriber through his/her Web browser connection, the transfer of a large data object does not require separate validation. The system simply sends the data through the dedicated server **14** to the subscriber's URL. This architecture allows the Web platform **12** to be optimized for smaller transactions (e.g., data requests, e-mail, GUI interactions) while the dedicated Web server **14** is optimized for large data transfers from the messaging platform to the subscriber. Data transfer is therefore much more efficient than if a single server had to handle both large and small data objects.

Process Flows

Exemplary process flows will now be summarized for a number of typical processes, including: Logon, View Inbox, Open E-mail, Open Voice/Fax Message, Subscription Sign-up, Open Subscription, Send Message, Delete Message, New Message List, and Listen to E-mail Headers. As shown in FIG. **3**, the flows typically employ the use of applets on the Web browser **22**, which are represented by blocks **22A**, **22B**, . . . **22N** in FIG. **3**. These flows are depicted in FIGS. **4A** through **4K**, respectively.

"Log On" Transaction Flow

This process is illustrated in FIG. **4A**. The transaction flow includes the following steps and acts.

1. The subscriber (Web-based client) accesses the URL of the Universal Messaging system's logon page.

2. The Internet server **12-3** presents the Logon page to the subscriber.

3. The subscriber (Web-based client) completes the Logon page with her/his user name and password and submits the details to the applet server **12-1**.

4. The applet server **12-1** passes the Logon information (user name and password) to the Session Manager **10-5** via the Sockets Interface layer **12-7**.

5. The Session Manager **10-5** passes the Logon information to the CMC API **10-4** and creates a session.

6. The CMC API **10-4** requests and receives user name and password verification from Addressing Services **10-1**, which returns either a success or failure result.

7. The CMC API **10-4** returns the success/failure result to the Session Manager **10-5**.

8. The Session Manager **10-5** passes the success/failure result to the applet server **12-1** software via the Sockets Interface layer **12-7**.

9. If the verification was a success, the applet server **12-1** displays the Universal Messaging home page and automatically downloads any newer versions of applets appearing on that page. If the verification was a failure, the applet server **12-1** displays a page prompting the subscriber to re-enter her/his user name and password.

"View Inbox" Transaction Flow

This process is illustrated in FIG. **4B**. The transaction flow includes the following steps and acts.

1. The subscriber clicks on the "Inbox" button, which causes the Inbox Java applet to send a request for message headers to the applet server **12-1**.

2. The applet server **12-1** passes the request to the Session Manager **10-5** via the Sockets Interface **12-7**.

3. The Session Manager **10-5** passes the request to the CMC API **10-4**.

4. The CMC API **10-4** requests and receives a list of message headers from the e-mail message store **10-2** (both new and existing).

5. The CMC API **10-4** reformats the message header information into fields that the Inbox Java applet can understand and passes them to the Session Manager **10-5**.

6. The Session Manager **10-5** passes the list of message headers to the applet server **12-1** via the Sockets Interface **12-7**.

7. The applet server **12-1** passes the list to the Inbox Java applet which presents the message header list to the subscriber.

"Open E-mail" Transaction Flow

This process is illustrated in FIG. **4C**. The transaction flow includes the following steps and acts.

1. The subscriber clicks on an e-mail message to open it, which causes the Inbox Java applet to send a request for that message to the applet server **12-1**.

2. The applet server **12-1** passes the Logon ID (user name and password) and the Message ID to the Session Manager **10-5** via the Sockets Interface **12-7**.

3. The Session Manager **10-5** validates the session and, if valid, passes the Message ID request on to the CMC API **10-4**.

4. The CMC API **10-4** requests and receives the e-mail message in question from the Message Store, along with information about the size of the message and pointers to attachments (if any).

5. The CMC API **10-4** returns the e-mail message and other details to the Session Manager **10-5**.

6. The Session Manager **10-5** passes the e-mail message and other details to the applet server **12-1**.

7. The applet server **12-1** passes the e-mail message and other details to the Java applet on the subscriber's PC, which displays the message text for the subscriber.

"Open Voice/Fax Message" Transaction Flow

This process is illustrated in FIG. **4D**. The transaction flow includes the following steps and acts.

1. The subscriber clicks on a voice or fax message to open it, and the Logon ID and URL for the message are passed to the Web Server **14**.

2. The Web server **14** passes the Logon ID and URL information to the Session Manager **10-5**.

3. The Session Manager **10-5** validates the session, and, if valid, passes the request to the Voice Message Management Module (VMMM) component of VNMS.

4. VMMM retrieves the message from the Voice and Fax Data File in segments and passes the segments on individu-

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ally to the Session Manager **10-5**. Each segment contains both the voice/fax data and information on the total number of bytes in each segment. The first segment also contains the total size of the entire message stream and is prefixed with the MIME type.

5. As each segment is received, the Session Manager **10-5** passes it on to the Web server **14**.

6. In turn, the Web server **14** passes each received segment to the NAP Web Plug-in on the subscriber's PC. Steps 4 through 6 are repeated until all message segments have been passed to the plug-in. The plug-in then plays or displays the voice or fax data.

"Subscription Sign-up" Transaction Flow

This process is illustrated in FIG. **4E**. The transaction flow includes the following steps and acts.

1. The subscriber initiates the sign-up process by clicking on the new subscriptions icon, which causes the Java Subscriptions applet to send a request via the Internet server **12-3** to the Content Manager **12-2** for a Subscription Details form.

2. The Content Manager **12-2** returns the Subscription Data form via the Internet server **12-3**.

3. The subscriber completes the form and submits the information to the Content Manager **12-2** via the Internet server **12-3**.

4. The Content Manager **12-2** verifies the data to make sure the form was completed properly. If yes, the Content Manager **12-2** creates a new subscription record within the Content Manager **12-2** database and creates an e-mail message that contains a URL for all instances of that subscription for that user. The e-mail is sent to the Session Manager **10-5**.

5. The Session Manager **10-5** passes the e-mail to the e-mail message store **10-2** via the CMC API **10-4**.

"Open Subscription" Transaction Flow

This process is illustrated in FIG. **4F**. The transaction flow includes the following steps and acts.

1. The information provider transmits the subscriptions via File Transfer Protocol (FTP) to the data exchange area in the Content Manager **12-2**.

2. The subscriber clicks on the Subscriptions button, which sends a request for a subscription list to the Content Manager **12-2**.

3. The Content Manager **12-2** verifies that the subscriber has signed up for subscriptions. If yes, the Content Manager **12-2** returns a list of current subscriptions via the Internet server **12-3**.

4. The subscriber selects the subscription he or she wishes to view and submits his/her choice to the Content Manager **12-2** (the subscription request contains the URL pointer for the content).

5. The Content Manager **12-2** processes the request and returns the content to the subscriber via the Internet server **12-3**.

"Send Message" Transaction Flow

This process is illustrated in FIG. **4G**. The transaction flow includes the following steps and acts.

1. The subscriber (Web-based client) composes a voice mail or an e-mail message and clicks Send. The Java applet passes the message and its attachments (if any) to the applet server **12-1**.

2. The applet server **12-1** sends the message on to the Session Manager **10-5** via the Sockets Interface **12-7**.

3. The Session Manager **10-5** passes the message and a send request to the CMC API **10-4**.

4. The CMC API **10-4** sends the message to the Transport Service Provider **10-3**, which, depending on the message's final destination, uses the X.400 MTA or the X.400/SMTP gateway to transmit the message. The Transport Service Provider returns a success or a failure result to the CMC API **10-4**.

5. The CMC API passes the success/failure result to the Session Manager **10-5**.

6. The Session Manager **10-5** passes the success/failure result to the applet server **12-1** via the Sockets Interface **12-7**.

7. The applet server **12-1** passes the success/failure result to the Java applet, which notifies the subscriber whether the message has been sent or not sent.

"Delete Message" Transaction Flow

This process is illustrated in FIG. **4H**. The transaction flow includes the following steps and acts.

1. The subscriber selects a message (voice, fax, or e-mail) for deletion. The Java applet passes the delete request (including Session ID and Message ID) to the applet server **12-1**.

2. The applet server **12-1** passes the delete request and information to the Session Manager **10-5**.

3. The Session Manager **10-5** validates the session and, if successful, passes the delete request and information on to the CMC API **10-4**.

4. The CMC API **10-4** passes the delete request on to the Message Store. If the deleted message was a voice or fax message, it also sends a delete request to the VMMM **10-8**, which deletes the message in the voice/fax data file.

5. The CMC API **10-4** sends a success or failure result to the Session Manager **10-5**.

6. The Session Manager **10-5** passes the result to the applet server **12-1** via the Sockets Interface **12-7**.

7. The applet server **12-1** passes the result to the Java applets, which notifies the subscriber if the message has been deleted or not deleted by changing the message list in the Inbox.

"New Message List" Transaction Flow

This process is illustrated in FIG. **4I**. The transaction flow includes the following steps and acts.

1. The subscriber dials into his voice mail account and accesses the UVMS Custom Client **10-7**.

2. The Custom Client **10-7** retrieves new fax and voice message counts from the VMMM **10-8**.

3. Concurrent with Step 2, the Custom Client sends a request for a new e-mail message count to the CMC API **10-4**.

4. The CMC API **10-4** requests and receives a count of new e-mail messages from the message store **10-2**.

5. The CMC API **10-4** passes the new e-mail message count back to the UVMS Custom Client **10-7**.

6. The UVMS Custom Client **10-7** presents the new message counts to the user, e.g.: "You have 5 new e-mail messages, 3 new voice messages, and 1 new fax message."

"Listening to E-mail Headers" Transaction Flow

This process is illustrated in FIG. **4J**. The transaction flow includes the following steps and acts.

1. The subscriber selects the "Listen to e-mail headers" option and a request for the first e-mail header is sent to the UVMS Custom Client **10-7**.

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2. The Custom Client sends a request for the first e-mail header (including User ID and Message ID) to the CMC API **10-4**.

3. The CMC API **10-4** requests and receives the e-mail header specified by the Custom Client from the message store **10-9**.

4. The CMC API **10-4** passes the e-mail message header back to the UVMS Custom Client **10-7**.

5. The UVMS Custom Client **10-7** plays the message header for the subscriber.

This process is repeated for each e-mail message header the subscriber selects.

"Provisioning a Subscriber"

FIG. **4K** depicts a typical process flow when a Universal Messaging subscriber is provisioned.

1. The operator, using a workstation **30**, performs the initial account set-up by entering standard subscriber data, including setting a UVMS class of service options required for Universal Messaging functionality.

2. UVMS Admin **10-10** creates a NAP address and a handset access logon ID for the subscriber and passes the subscriber data to Message Handling Service (MHS) Provisioning Services (MPS) **10-11** via the CMC API **10-4**.

3. MPS provisions MHS Addressing Services **10-1** with the subscriber data from UVMS. MHS Addressing Services returns subscriber data specific to e-mail communications and Web browser access, such as profile name, password, SMTP address, and X.400 address.

4. MPS returns the MHS-specific subscriber data to UVMS Admin. The subscriber is now successfully provisioned.

E. "Open" Architecture

The "open architecture" of the presently preferred embodiment is illustrated in FIG. **5**. In particular, FIG. **5** illustrates how the different components of the inventive Universal Messaging system use standard interfaces and protocols to provide unified messaging services.

Architecture Requirements

The preferred embodiment of the present invention is a carrier-grade system based on components that are known for their reliability, availability, and openness. The Messaging Platform **10** is based on proven technology, the same solutions at work in voice and fax messaging deployments around the world. The Web Platform **12** is based on commodity products such as Windows NT and Java. In addition, the subscriber does not have to go through a laborious installation process in order to use Universal Messaging—all that is needed is a touch-tone phone and a Java-enabled browser with which to connect to the World Wide Web, both of which are well known. Even the NAP Web Plug-In, used to access voice and fax messages, is automatically downloaded and installed the first time a subscriber accesses his or her account.

Moreover, the Universal Messaging architecture takes advantage of commodity messaging technologies and protocols, such as the CMC API and X.400 messaging. This ensures that as technology progresses, the system will continue to interoperate with other systems and standards.

Merging Telephony and Internet Environments

The philosophy behind the interactions over a telephony system versus the interactions over the Internet are vastly different. During a telephone call, a session is established and maintained from "off hook" to "on hook." Each call is a single session. Conversely, the Internet is "sessionless," i.e., interaction is based on transactions (a subscriber requesting a web page or an applet) rather than on the total time the subscriber has potential access to the Internet. To resolve the potential conflict between session-based and sessionless systems, the Session Manager **10-5** was developed.

The Session Manager creates an artificial session into the Messaging Platform **10** for Web transactions. It serves as a communications layer between the Messaging Interface's API **10-4** and the Sockets Interface **12-7** of the Web Platform **12**, and between the API **10-4** and the Web server **14**.

Industry-Standard Architecture

The preferred architecture behind Universal Messaging relies on industry-standard systems, including: a Universal Voice Message System (UVMS), a high-capacity, high-volume voice and fax messaging system employed around the world; and a Microsoft NT Server, an enterprise-grade operating system that supports the Web Platform **12** and provides the advantages of a commodity and recognizable interface.

In addition, the inventive Universal Messaging system supports and utilizes a variety of industry-standard components, including: X.400 (1984, 1988), SMTP, TCP/IP, Common Messaging Calls (CMC), MIME Attachments, Java applets and HTML.

F. Conclusion

We have described an inventive Universal Messaging system comprising, inter alia, a Session Manager **10-5**, Content Manager **12-2**, and Web server **14**. The scope of protection of the claims set forth below (following the appendix) is not intended to be limited to the particulars described herein in connection with the detailed description of presently preferred embodiments.

Appendix—Exemplary Predefined Object Content Types

The predefined object content type specifies the content type of the content item. A NULL value designates an undefined content item type.

CMC_CT_PLAIN_TEXT	Specifies plain or unformatted text content.
CMC_CT_GIF_IMAGE	Specifies image data content in the form of the Graphics Image Format used by MIME and the World Wide Web.
CMC_CT_JPEG_IMAGE	Specifies image data content in the form of the ISO Joint Picture Encoding Group standard used by MIME and the World Wide Web.
CMC_CT_BASIC_AUDIO	Specifies audio data content in the form of audio encoded using 8-bit ISDN mu-law or PCM defined by CCITT Recommendation G.711 with a sample rate of 8000 Hz and with a single channel.

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-continued

CMC_CT_MPEG_VIDEO	Specifies video content in the form of the ISO Motion Picture Encoding Group, ISO 11172 standard used by MIME and the World Wide Web.
CMC_CT_MESSAGE	Specifies that the content is an encapsulated message.
CMC_CT_PARTIAL_MESSAGE	Specifies that the content is a portion of another message. This content type allows a large message to be delivered as several separate pieces to facilitate receipt.
CMC_CT_EXTERNAL_MESSAGE	Specifies that the content is external to the message. The content information property contains a textual reference to the external content information.
CMC_CT_APPLICATION_OCTET_STREAM	Specifies that the content is an application dependent stream of octets.
CMC_CT_APPLICATION_POSTSCRIPT	Specifies that the content is a PostScript program.
CMC_CT_ALTERNATIVE_MULTIPART	Specifies that the content is one of an alternative for of content to another note or content item within the message object.
CMC_CT_DIGEST_MULTIPART	Specifies that the content is one of a group of related messages within the message object. The messages may serve as a sequence of discussions captured in a thread of messages as is found on bulletin board systems.
CMC_CT_MIXED_MULTIPART	Specifies that the content is one of an ordered sequence of messages within the message object.
CMC_CT_PARALLEL_MULTIPART	Specifies that the content is one of a group of arbitrary ordered sequence of messages within the message object.
CMC_CT_OLE	Specifies that the content item type is OLE (Object Linking and Embedding) object content item.
CMC_CT_X400_G3_FAX	Specifies that the content represents Group 3 facsimile images, a sequence of bit strings. Each G3 data component encodes a single page of data as dictated by Recommendations T.4 and T.30.
CMC_CT_X400_G4_FAX	Specifies that the content represents a final-form of document of the sort that is processable by Group 4 Class 1 facsimile terminals.
CMC_CT_X400_ENCRYPTED	Specifies that the content is bit strings and encoded in accordance with the basic encoding rules of recommendation X.209.
CMC_CT_X400_NATIONALLY_DEFINED	Specifies the content is an information object whose semantics and abstract syntax are nationally defined by a country whose identity is bilaterally agreed by the message's originator and all of its potential recipients.
CMC_CT_X400_FILE_TRANSFER	Specifies that the content information consists of relatively large amounts of data. The content information property contains the textual reference to its semantics and abstract syntax, which are denoted by an object identifier.
CMC_CT_X400_VOICE	Specifies that the content is the digitized speech, a bit string. Its encoding are currently not defined in the 1988 X.420 Recommendations.
CMC_CT_X400_VIDEOTEXT	Specifies that the content represents videotext data. Its syntax is defined in the T.100 and T.101 recommendations.
CMC_CT_X400_MIXED_MODE	Specifies that the content represents a final-form document of the sort that is processable by mixed-mode Teletex terminals and Group 4 class 2 and 3 facsimile terminals.
CMC_CT_X-400_PRIVATELY_DEFINED_6937	Specifies that the content is privately defined. The content is encoded in accordance to ISO 6937 specified character sets and encoding rules.
CMC_CT_X400_EXTERNAL_TRACE	Specifies the content contains X.400 external trace information for diagnostic purpose.

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-continued

CMC_CT_X400_INTERNAL_TRACE	Specifies the content contains X.400 internal trace information for diagnostic purpose.
CMC_CT_SMTP_SESSION_TRANSCRIPT	Specifies the content contains SMTP session transcript information for diagnostic purpose.

We claim:

1. A Universal Messaging system, comprising:

(a) a messaging platform; and

(b) a content manager application, operatively coupled to said messaging platform, for receiving information from a content provider and formatting said information into multimedia containers to be distributed to remote clients via a wide area communications network operatively coupled to said messaging platform, wherein said multimedia containers are characterized by a message portion and an attachment portion, said attachment portion comprising a plurality of fields each of which is used in a predefined manner.

2. A Universal Messaging system as recited in claim 1, further comprising a Web platform supporting said content manager application, wherein said Web platform includes or is operatively coupled to a first database containing e-mail advertisements and a second database containing news-type information from said content provider.

3. A Universal Messaging system as recited in claim 2, wherein said Web platform further supports:

an applet server for providing software applets to said remote client; and

an Internet server operatively coupled to said messaging platform.

4. A Universal Messaging system, comprising:

(a) a messaging platform supporting an e-mail messaging system and a voice/fax messaging system; and

(b) content manager means, operatively coupled to said messaging platform, for receiving information from a content provider and formatting said information into multimedia containers to be distributed to remote clients via a wide area communications network operatively coupled to said content manager means;

wherein said content manager means provides multimedia containers for delivering multimedia content to one or more clients, wherein each of said containers comprises:

(1) a message portion; and

(2) an attachment portion having associated title, type and filename fields, each of which is used in a predefined manner.

5. A Universal Messaging system as recited in claim 4, wherein said message portion is characterized by a message type field and a corresponding predefined set of message type definitions; a predefined use of a subject field; and a predefined structure for a text-note field.

6. A Universal Messaging system as recited in claim 5, wherein said text-note field is used for communication between the content manager means and the client(s).

7. A Universal Messaging system as recited in claim 4, wherein all content is carried in the attachment portion via a pointer in the filename field.

8. A Universal Messaging system as recited in claim 4, wherein only one type of content, either audio, text, HTML, or graphics, is used per attachment.

9. A Universal Messaging system as recited in claim 4, wherein the filename field is used to contain pointers to objects, including a Uniform Resource Locator (URL).

10. A Universal Messaging system as recited in claim 5, wherein the text-note field of the message portion is used to carry instructions relating to presentation and management of the content, and the actual content is referenced by pointers using attachment structures.

11. A Universal Messaging system, comprising:

(a) a messaging platform supporting an e-mail messaging system and a voice/fax messaging system; and

(b) content manager means, operatively coupled to said messaging platform, for receiving information from a content provider and formatting said information into multimedia containers to be distributed to remote clients via a wide area communications network operatively coupled to said content manager means;

wherein said content manager means provides multimedia containers for delivering multimedia content to clients, wherein each of said containers comprises a message portion and an attachment portion having associated title, type and filename fields; wherein said message portion is characterized by a message type field and a corresponding predefined set of message type definitions, a predefined use of a subject field, and a predefined structure for a text-note field; wherein said text-note field is used for communication between the content manager means and the clients; wherein all content is carried in the attachment portion via a pointer in the filename field; wherein only one type of content is used per attachment; wherein the filename field is used to contain pointers to objects; and wherein the text-note field of the message portion is used to carry instructions relating to presentation and management of the content, and the actual content is referenced by pointers using attachment structures.

12. A Universal Messaging system as recited in claim 11, further comprising a Web platform supporting said content manager means, wherein said Web platform includes or is operatively coupled to a first database containing e-mail advertisements and a second database containing news-type information from said content provider.

13. In a Universal Messaging system, a method for delivering multimedia information to remote clients, comprising the steps of:

receiving information from a content provider;

formatting said information into multimedia containers; and

distributing said multimedia containers to the remote clients via a wide area network operatively coupled to said Universal Messaging system;

wherein each of said multimedia containers comprises a message portion and an attachment portion having associated title, type and filename fields, each of which is used in a predefined manner.

14. A method as recited in claim 13, wherein said message portion is characterized by a message type field and a corresponding predefined set of message type definitions; a predefined use of a subject field; and a predefined structure for a text-note field.

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15. A method as recited in claim **14**, wherein said text-note field is used for communication between the content manager means and the client(s).

16. A method as recited in claim **15**, wherein all content is carried in the attachment portion via a pointer in the filename field.

17. A method as recited in claim **16**, wherein only one type of content is used per attachment.

18. A method as recited in claim **17**, wherein the filename field is used to contain pointers to objects.

19. A method as recited in claim **18**, wherein the text-note field is used to carry instructions relating to presentation and management of the content, and the content is referenced by pointers using attachment structures.

* * * * *

102 Claim 1, 2 and 10

US005815649A

United States Patent [19]

Utter et al.

[11] Patent Number: 5,815,649

[45] Date of Patent: Sep. 29, 1998

[54] DISTRIBUTED FAULT TOLERANT DIGITAL DATA STORAGE SUBSYSTEM FOR FAULT TOLERANT COMPUTER SYSTEM

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[73] Assignee: **Stratus Computer, Inc.**, Marlboro, Mass.

[21] Appl. No.: **546,234**

[22] Filed: **Oct. 20, 1995**

[51] **Int. Cl.**[6] **G01F 11/08**

[52] **U.S. Cl.** **395/112.04**; 315/200.4

[58] **Field of Search** 395/182.04, 441, 395/200.31, 200.03, 182.05, 200.45, 200.41; 711/114, 153, 173; 364/268.3, 268.9, 269.1

[56] **References Cited**

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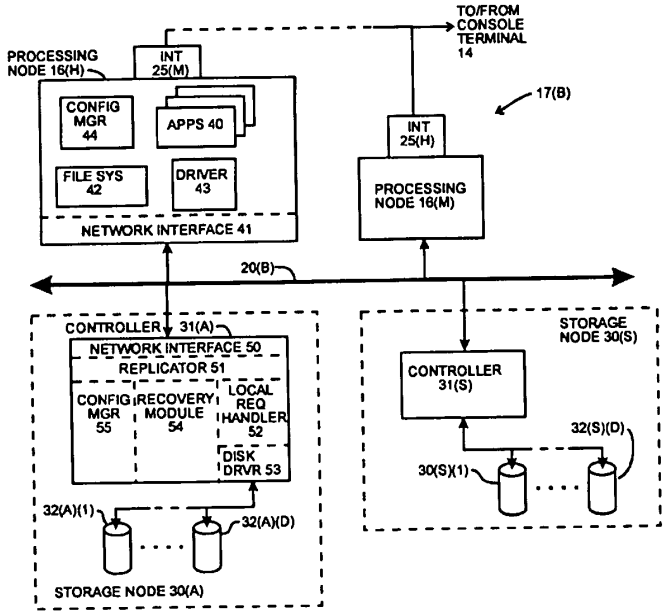
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Primary Examiner—Robert W. Beausoliel, Jr.
Assistant Examiner—Scott T. Baderman
Attorney, Agent, or Firm—Richard A. Jordan

[57] **ABSTRACT**

A fault-tolerant computer system comprises a plurality of processing nodes and a plurality of storage nodes interconnected by a network. The processing nodes perform processing operations in connection with user-generated processing requests. The processing nodes, in connection with processing a processing request, generate storage and retrieval requests for transmission to the storage node to enable storage of data thereon and retrieval of data therefrom. The storage nodes store data in at least one replicated partition group comprising a plurality of replicated partitions distributed across the storage nodes. A storage node, on receiving a retrieval request from a processing node provide the requested data to the processing node. In addition, on receiving a storage request from a processing node, a storage node initiates an update operation to update all of the replicated partitions in the replicated partition group. Following correction of a malfunction or failure of a storage node, partitions maintained by the malfunctioning or failed storage node can be recovered by use of the other members of the replicated partition group.

43 Claims, 6 Drawing Sheets



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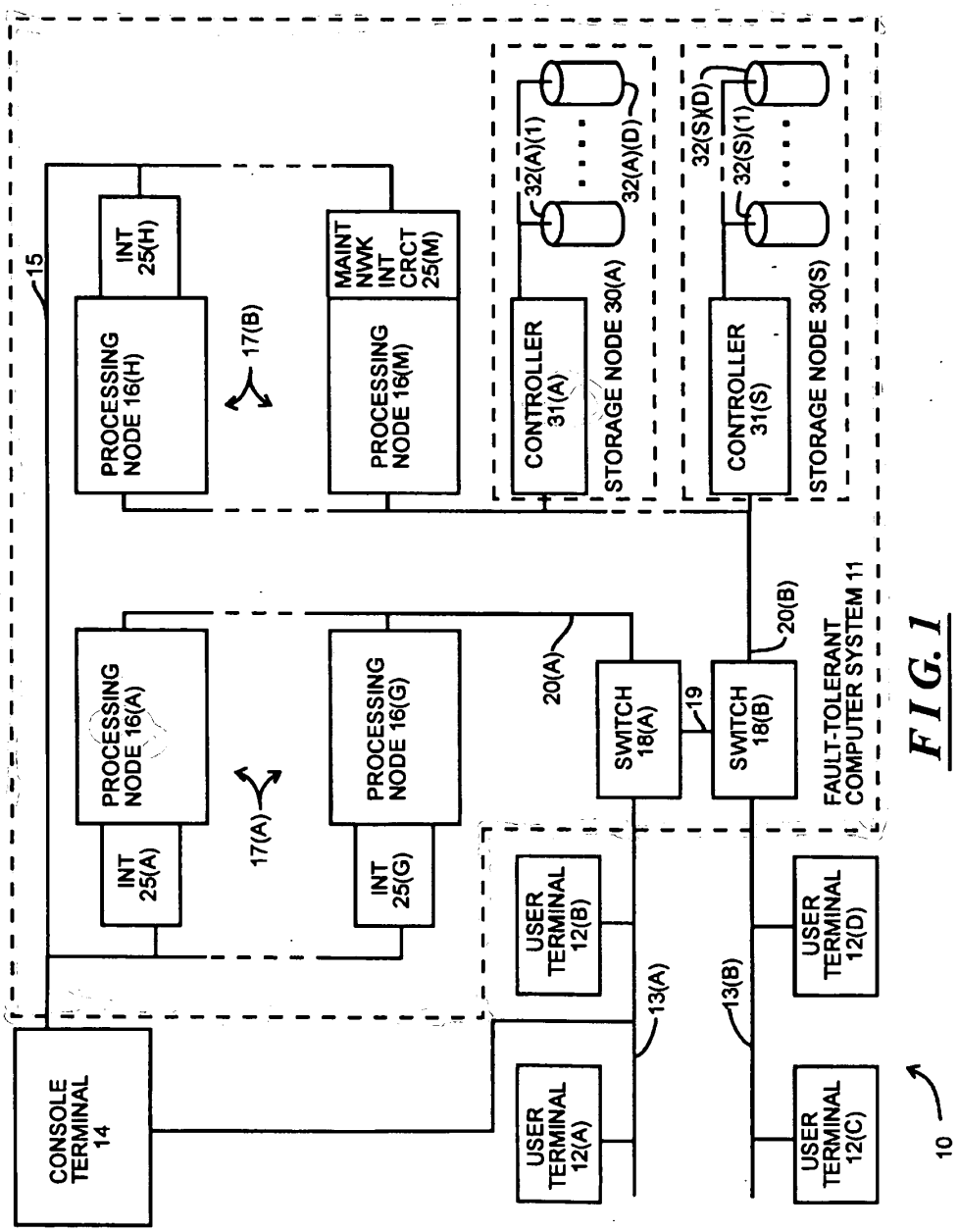


FIG. 1

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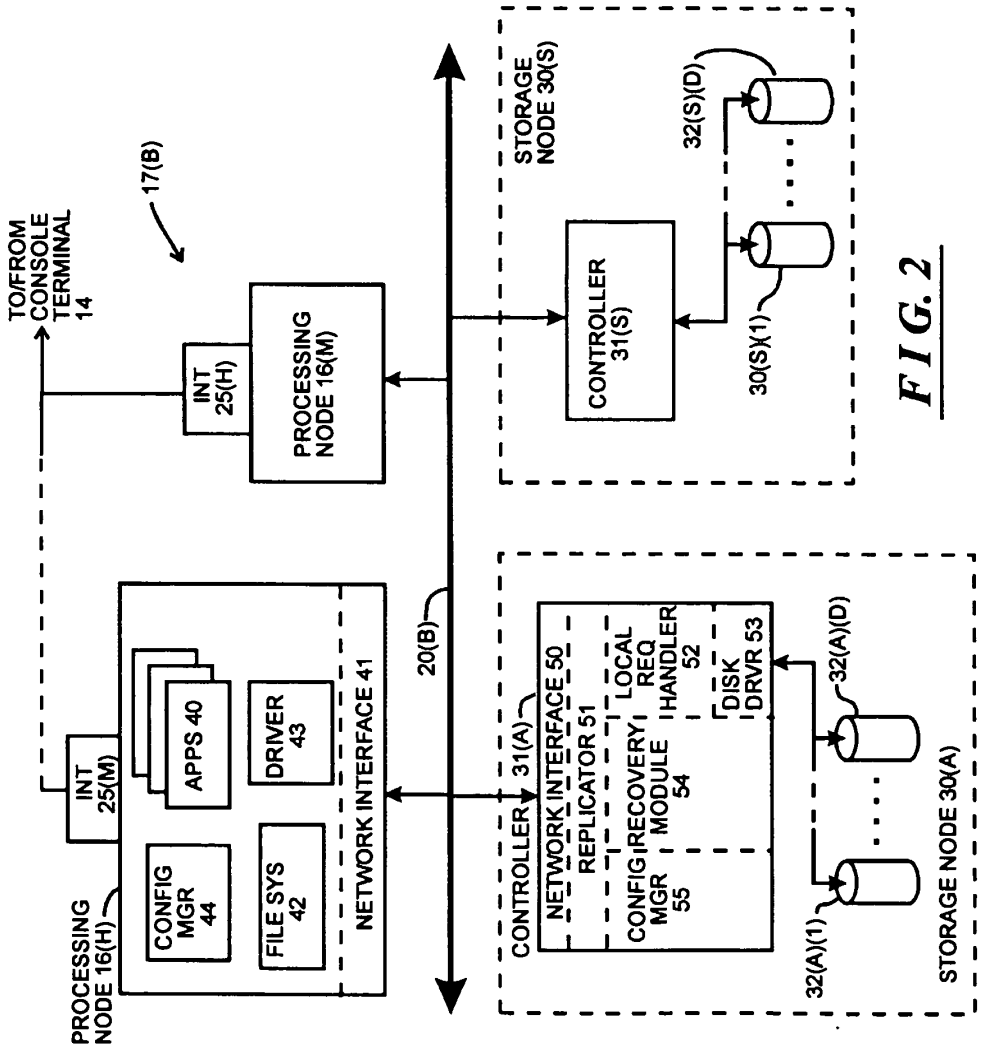


FIG. 2

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FIG. 3

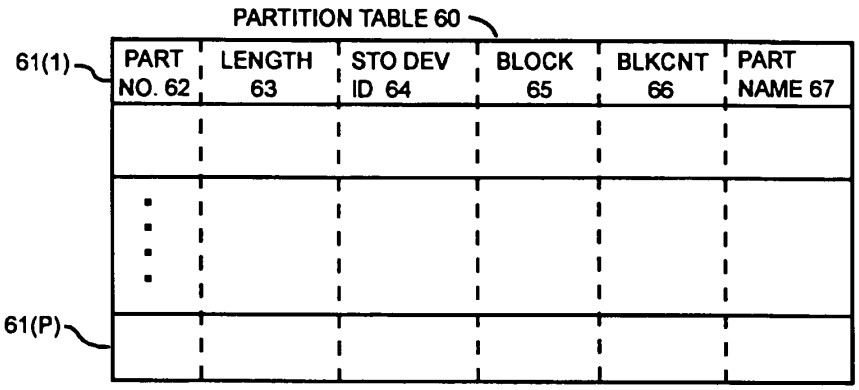
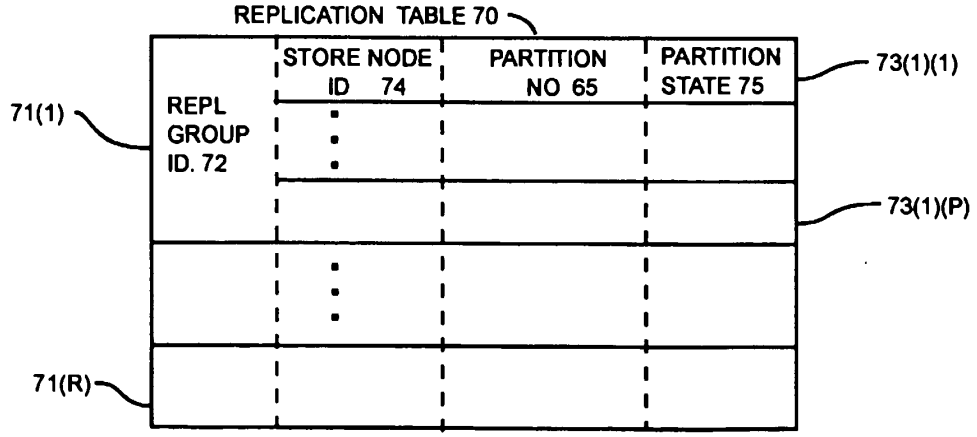


FIG. 4



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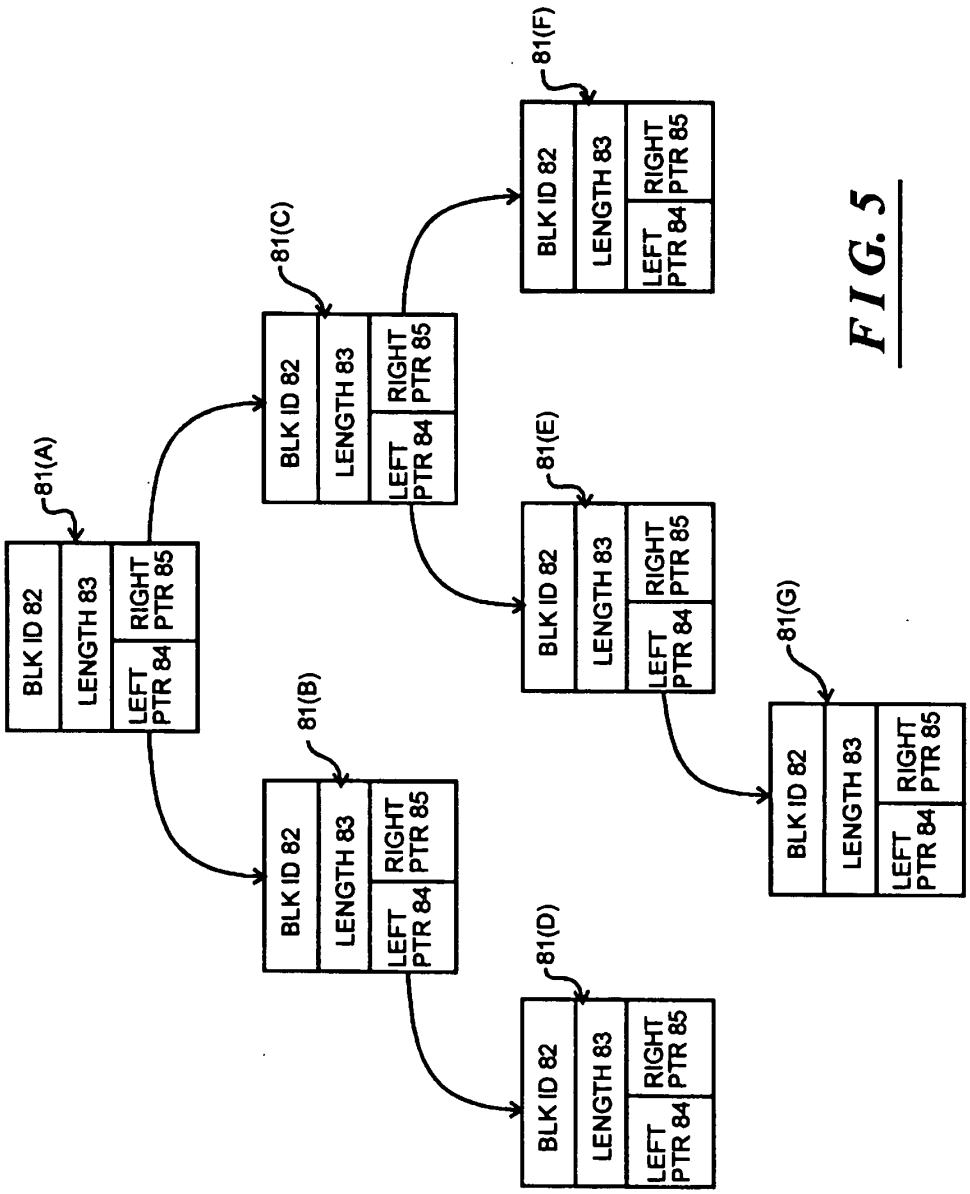


FIG. 5

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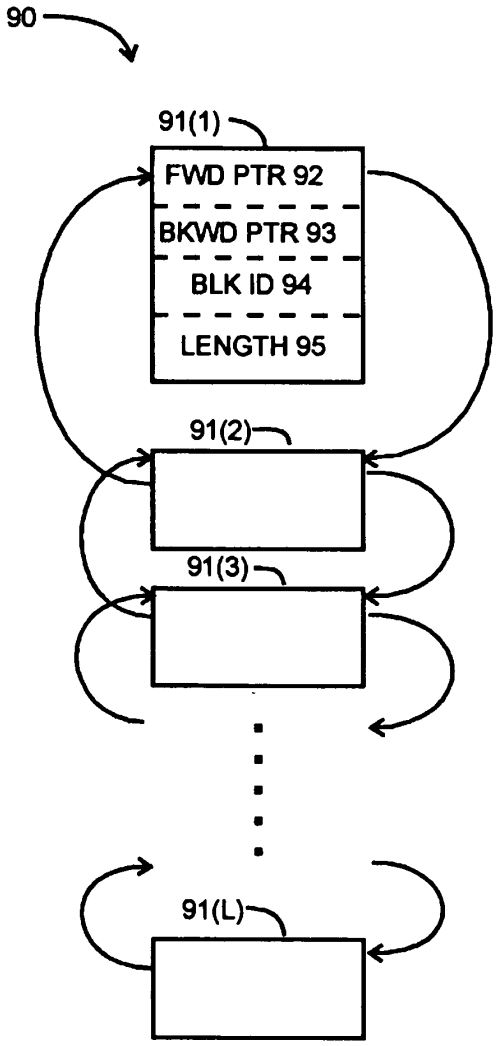


FIG. 6

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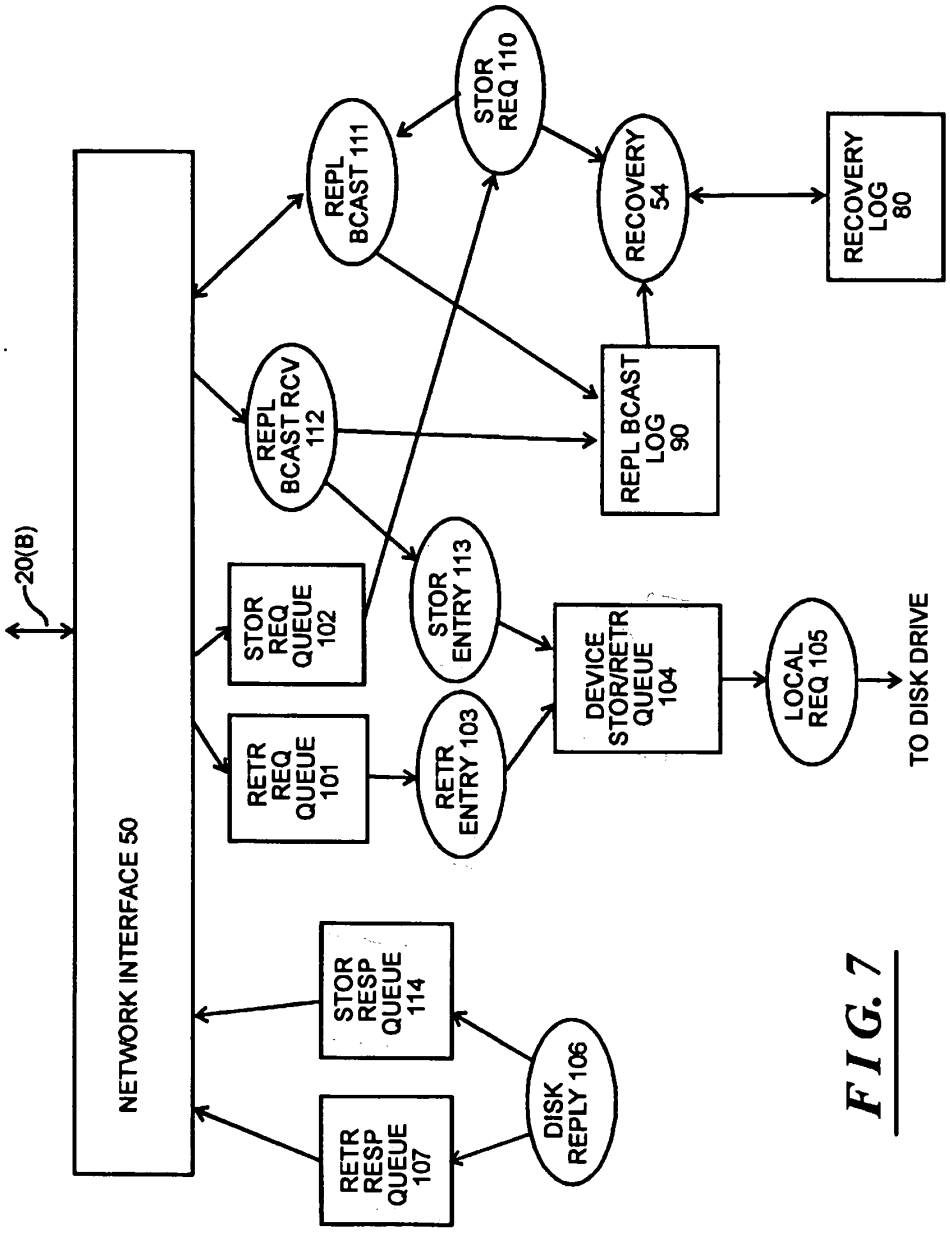


FIG. 7

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DISTRIBUTED FAULT TOLERANT DIGITAL DATA STORAGE SUBSYSTEM FOR FAULT TOLERANT COMPUTER SYSTEM

INCORPORATION BY REFERENCE

U.S. patent application Ser. No. 08/546,347, filed on even date herewith, in the name of John D. Service, et al., and entitled System Console For Fault Tolerant Computer System, (Atty. Docket No. STR-002), incorporated herein by reference.

FIELD OF THE INVENTION

The invention relates generally to the field of digital computer systems, and more particularly to a distributed fault tolerant digital data storage subsystem for use in connection with a fault tolerant computer system. The distributed fault tolerant storage subsystem provides for convenient replication of data among a number of elements of the storage subsystem and recovery following correction of a malfunction or other failure without intervention of the computer system's processing elements.

BACKGROUND OF THE INVENTION

Digital computer systems are used in a number of applications in which virtually continuous, error free operation is important to the operation of businesses or other entities using the systems. For example, in banking, computer systems are used to maintain account information and update account balances, and it is important for a bank to be able to provide accurate and up-to-date account information virtually instantaneously. Similarly, computers are used to monitor and control of airplane traffic, and around crowded airports and along major air corridors, it is vital that the computers be configured so that the air traffic control systems are continuously available. Computers are also used to control switching systems for the public telephone system, and it is similarly important that the computers be configured provision be made so that the telephone systems be continuously available.

It is generally possible to build computer systems which have extremely reliable components to accomplish tasks such as these and numerous others, and to provide preventive maintenance in such a way and with such frequency that failures are extremely improbable. However, such high-reliability computer systems would be extremely expensive to build and maintain. Accordingly, "fault-tolerant" computer systems have been developed, which is generally designed with the expectation that one or more element of the system may fail at some point in its operation, but that if an element does fail, other elements are available to detect the failure and ensure that the system will continue to give proper results. Such fault-tolerant computer systems will generally be much less expensive to build and maintain, since they may be constructed of components which individually are of lower reliability than those of high-reliability computer systems, and thus would cost less to build, and maintenance costs would also be lower. Fault-tolerant computer systems generally include redundant components which operate in parallel, and when a fault is detected in one element the other components are available to continue operation. A number of schemes may be used to detect a fault, such as fault detection circuitry which can detect certain types of faults. In addition, if a fault-tolerant system includes at least, for example, three processing components operating in parallel, the system can compare outputs of the three components and, if the outputs of two of the processing components agree but the output the third processing element differs from that of the other two, the system can with a high degree of confidence draw the inference that the one processing component is faulty and its output should be ignored and that the outputs from the two processing components which agree with each other are correct and should be used.

SUMMARY OF THE INVENTION

The invention provides a new and improved storage subsystem for use in connection with a fault-tolerant computer system, in particular a distributed storage subsystem including a plurality of storage nodes providing for replication of data and quick recovery without the necessity of intervention by the computer system's processing elements.

In brief summary, the new fault-tolerant computer system comprises a plurality of processing nodes and a plurality of storage nodes interconnected by a network. The processing nodes perform processing operations in connection with user-generated processing requests. The processing nodes, in connection with processing a processing request, generate storage and retrieval requests for transmission to the storage node to enable storage of data thereon and retrieval of data therefrom. The storage nodes store data in at least one replicated partition group comprising a plurality of replicated partitions distributed across the storage nodes. A storage node, on receiving a retrieval request from a processing node provide the requested data to the processing node. In addition, on receiving a storage request from a processing node, a storage node initiates an update operation to update all of the replicated partitions in the replicated partition group. Following correction of a malfunction or failure of a storage node, partitions maintained by the malfunctioning or failed storage node can be recovered by use of the other members of the replicated partition group.

BRIEF DESCRIPTION OF THE DRAWINGS

This invention is pointed out with particularity in the appended claims. The above and further advantages of this invention may be better understood by referring to the following description taken in conjunction with the accompanying drawings, in which:

FIG. **1** is a functional block diagram of a digital computer system including a fault-tolerant computer system constructed in accordance with the invention;

FIG. **2** is a functional block diagram of a portion of the fault-tolerant computer system depicted in FIG. **1**, including details of a processing node and a storage node useful in understanding the invention;

FIGS. **3** through **6** depict data structures maintained by the processing node and storage node depicted in FIG. **2**, which are useful in understanding the operation of the processing node and storage node depicted in FIGS. **1** and **2**; and

FIG. **7** depicts a detailed block diagram of the storage node depicted in FIGS. **1** and **2**.

DETAILED DESCRIPTION OF AN ILLUSTRATIVE EMBODIMENT

FIG. **1** is a functional block diagram of a digital computer system **10** including a storage subsystem that is constructed in accordance with the invention. With reference to FIG. **1**, the digital computer system **10** includes a fault-tolerant computer system **11** which connects to a plurality of user terminals **12**(A) through **12**(D) (generally identified by reference numeral **12**(*d*)) over respective user networks

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13(A) and 13(B) (generally identified by reference numeral 13(*n*)) which connect the user terminals 12(*d*) to the fault-tolerant computer system 11. The fault-tolerant computer system 11 performs conventional digital data processing and data retrieval and storage services that are generally typical of those performed by digital computer systems, in connection with processing, data retrieval and data storage requests provided thereto by the user terminals 12(*d*). As will be described below in greater detail, the fault-tolerant computer system 11 includes a number of subsystems which allow the data processing, storage and retrieval services to be provided in a manner which is tolerant of faults, failures and malfunctions therein. The digital computer system 10 further includes a console terminal 14, which connects to the fault-tolerant computer system 11 over a maintenance network 15 as well as over a user network 13(*n*).

The user terminals 12(*d*) used in the digital computer system 10 may comprise any of a number of devices which may be provided to enable the fault-tolerant computer system 11 to operate to perform data storage and processing operations. The detailed structures of the user terminals 12(*d*) will be generally determined by the specific types of operations to be performed by the digital computer system 10, and will not be described in detail. For example, in connection with a digital computer system 10 which may be used in, for example, a transaction processing system in a financial institution such as a bank or the like, user terminals may include conventional video display terminals or personal computers which include a keyboard through which a user may enter transaction data, a video display device which may display processed transaction data to a user, and may also include processing circuits for performing local processing. In connection with a digital computer system which may be used in a retail sale environment, user terminals may include point-of-sale terminals which may register payments and credits and changes in inventory during transactions. In connection with a digital computer system 10 used in controlling an industrial facility such as a factory, the user terminals 12(*d*) may also comprise video display terminals or personal computers which may enable an operator to control the facility as well as interfaces to the machines and the like that are used in the facility to control operations by the machines. In addition, in connection with a digital computer system 10 used in controlling operations of, for example, a telephone switching operation, at least some of the user terminals 12(*d*) may control operation of the telephone switching circuits to ensure that voice information is properly routed through the telephone system between the calling and called parties.

In addition to transferring requests from the user terminals 12(*d*) to the fault-tolerant computer system 11, the networks 13(*n*) may also download data from the fault-tolerant computer system 11 to the user terminals 12(*d*) for local processing by the user terminals 12(*d*) or for display to a user on a display terminal which may be provided with respective ones of the user terminal 12(*d*). In addition, the networks 13(*n*) may transfer data from the user terminals 12(*d*) to the fault-tolerant computer system 11 for processing or storage, and in addition may transfer data among the user terminals 12(*d*). In one embodiment, the networks 13(A) and 13(B) are each in the form of conventional high-speed (100 Mb/second) Ethernet networks, which transfer information in the form of messages. As is conventional in Ethernet networks, messages generated by one device connected to a network 13(A), 13(B) (that is, by a user terminal 12(*d*) or by the fault-tolerant computer system 11) contain information to be transferred, as well as an address which identifies the intended recipient or recipients of the information.

As noted above, the fault-tolerant computer system 11 includes a number of subsystems which allow the services to be provided in a manner which is tolerant of faults and malfunctions. In particular, the fault-tolerant computer system 11 includes a number of processing nodes 16(A) through 16M (generally identified by reference numeral 16(*m*)) and a storage subsystem comprising a plurality of storage nodes 30(A) through 30(S) (generally identified by reference numeral 30(*s*) which are divided into two groups 17(A) and 17(B) (generally identified by reference numeral 17(*g*)), with processing nodes 16(*m*) in each group 17(*g*) being connected to a respective switch 18(A) and 18(B) (generally identified by reference numeral 18(*h*)) over a respective network 20(A) and 20(B) (generally identified by reference numeral 20(*k*)). As with networks 13(*n*), networks 20(A) and 20(B) are each in the form of conventional high-speed (100 Mb/second) Ethernet networks, which transfer information in the form of messages, with each generated by a device connected to a network 20(*k*) (that is, by a processing node 16(*m*) or switch 18(*h*)) containing information to be transferred, as well as an address which identifies the intended recipient or recipients of the information.

In one embodiment, the processing nodes 16(*m*) and storage nodes 30(*s*) communicate over the networks 20(*k*) using the ISIS communications protocols, as described in, for example, Kenneth P. Birman, "Maintaining Consistency In Distributed Systems," Technical Report TR 91-1240 (November 1991), Cornell University Department of Computer Science, and references cited therein, and Kenneth P. Birman, "The Process Group Approach To Reliable Distributed Computing," (report dated Jan. 6, 1993), and references cited therein. The ISIS communications protocols provide, among other things, a mechanism for reliable transfer of information among nodes 16(*m*) and 30(*s*) connected to the networks 20(*k*), including transfer of information between pairs of nodes and from one node to a number of nodes, a mechanism for maintaining distributed databases consistent (so that they will all contain the same information), and mechanisms for determining when a node malfunctions or otherwise fails. Although the embodiment described herein makes use of the ISIS communications protocols in connection with the Ethernet network it will be appreciated that other protocols may be efficiently used in connection with other networks.

The switches 18(*h*) for the two groups 17(*g*), in turn, are interconnected by a link 19, and each switch 18(*h*) is connected to one of the networks 13(A) or 13(B). The processing nodes 16(*m*) perform the data processing services for the user terminals 12(*d*) as described above in connection with the fault-tolerant computer system 11, and the networks 13(*n*), switches 18(*h*) and networks 20(*k*) serve to transfer processing requests from the user terminals 12(*d*) to processing nodes 16(*m*) and storage nodes 30(*s*) which are to execute the request and return any data and status information that is to be returned from the processing nodes 16(*m*) executing the request to the user terminals 12(*d*). Similarly, the storage nodes 30(*s*) perform the data processing services for the user terminals 12(*d*) as described above in connection with the fault-tolerant computer system 11, and the networks 13(*n*), switches 18(*h*) and networks 20(*k*) serve to transfer storage and retrieval requests from the user terminals 12(*d*) and processing nodes 16(*m*) to the storage nodes 30(*s*) which are to execute the request and return any data and status information that is to be returned from the storage nodes 30(*s*) executing the request. The switches 18(A) and 18(B) control communication between networks 13(A) and 13(B),

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on the one hand, and the networks **20**(A) and **20**(B), on the other hand. In addition, the switches are interconnected to transfer processing and/or storage requests and returned data and storage information from devices connected to networks **13**(A), **20**(A) or **13**(B), **20**(B) that are connected to one switch **18**(A), **18**(B) to devices connected to networks **13**(B), **20**(B) or **13**(A), **20**(A) that are connected to the other switch **18**(B), **18**(A). Storage and processing requests are routed to specific processing nodes **16**(*m*) and storage nodes **30**(*s*) for processing by the specific nodes while they are functioning properly; however, if a malfunction occurs in a node to which a request is directed, requests normally directed to the malfunctioning node may be directed to other processing nodes for processing, thereby to provide fault-tolerant service to the user terminals **12**(*d*).

As described in U.S. patent application Ser. No. 08/546,347, filed on even date herewith in the names of John D. Service, et al., and entitled System Console For Fault Tolerant Computer System, (Atty. Docket No. STR-002), incorporated herein by reference (hereinafter, "the Service, et al., patent application"), in one embodiment, each processing node **16**(*m*) is in the form of a conventional personal computer module (generally termed a personal computer "motherboard"), including a microprocessor and a main memory including both a read/write random-access ("RAM") memory used for the operating system program and applications programs and a read-only memory ("ROM") for storing initialization routines and basic input/output system ("BIOS") routines. In that embodiment, the processing nodes **16**(*m*) utilize the Microsoft Windows-NT™ operating system program as the operating system program. The initialization routines are used to initialize the processing node **16**(*m*) during power-up of the personal computer module and in response to a re-initialization request from the console terminal **14**. In addition, the personal computer module includes a disk controller interface which may facilitate connection to a disk storage subsystem (not shown). Various interfaces are also provided on each personal computer module, including a video display interface, a keyboard interface and a mouse port interface are also provided on the personal computer module which, if the personal computer module were connected in a personal computer, would be connected to a video display, a keyboard and a mouse, respectively, to provide a visual output (in video form) to an operator (in the case of the video display) and to receive operator input (in the case of the keyboard and mouse). As used in the fault-tolerant computer system **11**, the video display interface, a keyboard interface and a mouse port interface of the personal computer modules receive input from and provide output to the console terminal **14**. In addition, the personal computer module includes a network interface **41**(*m*) (see FIG. **2**, not shown in FIG. **1**) which connects the processing node **16**(*m*) to the network **20**(*k*) to enable the processing node to receive and respond to requests the network **20**(*n*), and a maintenance network interface circuit **25**(*m*) to enable the processing node to communicate over the maintenance network **15**. The personal computer module may also include conventional serial and parallel ports. Furthermore, the personal computer module includes one or more "slots" which permit connection of expansion modules, in the form of printed circuit boards, to the personal computer module over a bus, which may comprise, for example, a conventional EISA, MCI, PCI, or other bus (not shown); in one embodiment, the maintenance network interface circuit comprises a "Server Monitor Module" ("SMM") sold by Intel Corporation.

In one embodiment, the console terminal **14** corresponds to the console terminal described in the aforementioned Service, et al., patent application. As in the Service, et al., patent application, the console terminal **14**, under control of an operator, performs conventional console services for the processing nodes **16**(*m*), including initialization of the respective nodes and monitoring of their operation. In addition, the console terminal **14** can perform initialization and monitoring operations in connection with the storage nodes **30**(*s*). The console terminal can use the maintenance network **15** in connection with initialization of the fault-tolerant computer system **11**, and after the system **11** is initialized it can use the networks **13**(*n*) and **20**(*k*) for communication with the processing nodes **16**(*m*). In addition, the console terminal can, under control of an operator, perform console services in connection with the storage nodes **30**(*s*), including initialization, information configuration and monitoring, using the networks **13**(*n*) and **20**(*k*).

The storage nodes **30**(*s*) store data and other information for use by the processing nodes **16**(*m*) and the user terminals **12**(*d*) in their processing operations. (FIG. **1** depicts storage nodes **30**(*s*) being connected only in section **17**(B) to network **20**(B), but it will be appreciated that storage nodes similar to storage nodes **30**(*s*) will also preferably be connected in section **17**(A) to network **20**(A) to provide fault tolerance.) The other information which the storage nodes **30**(*s*) may store may include, for example, programs which may be downloaded by the processing nodes **16**(*m*) and user terminals **12**(*d*) to be used in processing data. As shown in FIG. **1**, each storage node **30**(*s*) includes a storage controller **31**(*s*), each of which is connected to one or more storage devices **32**(*s*)(1) through **32**(*s*)(D) (generally identified by reference numeral **32**(*s*)(*d*). In one particular embodiment, the storage devices **32**(*s*)(*d*) comprise, for example, conventional disk storage devices, although it will be appreciated that storage devices may be provide comprising conventional tape storage devices, CD-ROM devices and other types of devices for storing digital information. It will be appreciated that the various storage nodes **30**(*s*) may include the same number of numbers of storage devices **32**(*s*)(*d*), or they may include differing numbers of storage devices.

In accordance with the invention, the processing nodes **16**(*m*) and storage nodes **30**(*s*) are configured to provide for replication of data that is stored on the storage nodes in the fault-tolerant computer system **11** so that, in the event of a malfunction or other failure in connection with an individual storage device **32**(*s*)(*d*), an entire storage node **30**(*s*) is not available, or an entire group **17**(*g*), a copy of the data on the unavailable storage device **32**(*s*)(*d*), storage node **30**(*s*) or group **17**(*g*) is available on another storage device, storage node or group so that processing and data storage and retrieval operations can continue in a fault-tolerant manner. In addition, the storage nodes **30**(*s*) are further configured to provide for recovery following correction of a malfunction or other failure, so that updated data that was generated while the devices, nodes or groups were unavailable, will be stored thereon after the malfunction or other failure is corrected. Furthermore, the storage nodes **30**(*s*) are configured to provide for recovery without the necessity of assistance by the processing nodes **16**(*m*), so that the processing nodes **16**(*m*) will be fully available to perform processing operations in response to requests from the user terminals.

The structure and operation of the storage nodes **30**(*s*) will be described in detail in connection with FIGS. **2** through **7**. FIG. **2** depicts a functional block diagram of a processing node **16**(*m*) (in particular, processing node **16**(H)) and a storage node **30**(*s*) (in particular storage node **30**(A)) constructed in accordance with the invention. By way of

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background, the fault-tolerant computer system **11** provides fault tolerance in connection with data storage by replicating disk partitions on each storage node **30**(*s*) among a number of storage nodes(s). As is conventional, a disk partition comprises a set of one or more units, or blocks, of storage on one or more of the storage devices **32**(*s*)(*d*), which will be replicated as a logical unit and recovered as a unit following correction of a malfunction or other failure. A storage node **30**(*s*) may define a number of partitions, whose storage blocks may overlap so that the same block may be associated with a number of partitions. In one embodiment, preferably each partition will comprise storage blocks of storage devices **32**(*s*)(*d*) within a single storage node **30**(*s*), but will not extend across storage devices from a plurality of storage nodes **30**(*s*). One or more disk partitions on diverse storage nodes **30**(*s*) are aggregated together to form a replicated partition group, which will be replicated on each of the diverse storage nodes **30**(*s*) so that all of the partitions in the replicated partition group contain the same information so that, in the event of a malfunction or failure in connection with any of the storage nodes **30**(*s*) which maintain partitions in the replicated partition group, the partition can be recovered (that is, reconstructed) from the information maintained in the other partitions in the group. The particular storage nodes **30**(*s*) and storage devices **32**(*s*)(*d*) which will maintain partitions of a replicated partition group may be selected by an operator through the console terminal **14**. It will be appreciated that limiting the extent of a partition to storage blocks within a single storage node **30**(*s*) will simplify replication of partitions across a number of storage nodes **30**(*s*), and also will simplify recovery of a partition following a malfunction or other failure in connection with a storage node **30**(*s*) or storage device **32**(*s*)(*d*).

All of the processing nodes **16**(*m*) are generally similar, and only one processing node **16**(H) will be described in detail in connection with FIG. **2**. Similarly, all of the storage nodes **30**(*s*) are generally similar and only processing node **30**(A) will be described in detail. With reference to FIG. **2**, processing node **16**(H) includes a plurality of applications programs generally identified by reference numeral **40** that perform processing operations in response to processing requests received over network **20**(B) through network interface **41**. In performing processing operations, the applications program **40** may require data or other information which is stored on a storage node **30**(*s*) and, when that occurs, may go through a file system **42** or directly through a driver **43** to issue a retrieval request for the required information. The particular storage node **30**(A) to be accessed for the information is determined by a configuration manager **44** which, as will be described below in connection with FIGS. **3** and **4**, maintains a record of the partitions on each storage node and storage nodes **30**(*s*) as well as a record of the partitions on each storage node **30**(*s*) which comprise each replicated partition group. In addition, the configuration manager **44** of each processing node **16**(*m*) maintains a record of the states of all of the partitions in each replicated partition group, including whether the partitions are available or unavailable (which may be due to a malfunction or other failure, or for other selected reasons). In addition, the configuration manager **44** of each processing node **16**(*m*) maintains a record, for each replicated partition group, of the identification of the partition which is selected as a "master partition" within the replicated partition group. The processing node **16**(H) will, in response to a request from an applications program to retrieve data or other information in a particular partition within a replicated partition group, issue a retrieval request to retrieve the requested information from the storage node **30**(*s*) whose partition in the replicated partition group is identified as the master partition. When the processing node **16**(H) receives the requested information, it will normally be provided to the applications program **40** for processing.

At some point during processing, an applications program may need to store data or other information in a storage node **30**(*s*). As with a retrieval operation described above, the applications program **40** may go through a file system **42** or directly through an appropriate driver **43** to issue a storage request to store the information. The particular storage node **30**(A) to which the storage request will be issued is also determined by the configuration manager **44**. In particular, the configuration manager **44** of each processing node **16**(*m*) maintains a record, for each replicated partition group, of the identification of the partition which is selected as a "master partition" within the replicated partition group for storage operations. The processing node **16**(H) will, when an applications program **40** needs to store data in a particular partition within a replicated partition group, issue a storage request to store the information on the storage node **30**(*s*) whose partition in the replicated partition group is identified as the master partition.

As indicated above, the storage node **30**(*s*) which maintains the "master partition" for a particular replicated partition group receives and executes the retrieval requests and storage requests from the processing nodes **16**(*m*) over network **20**(B). In executing a retrieval request, the storage node **30**(*s*), in particular the controller **31**(*s*), retrieves the required information from the storage devices **32**(*s*)(*d*) and transmits the retrieved information over the network **20**(B) to the requesting processing node **16**(*m*). In addition, in executing a storage request received over the network, the controller **31**(*s*) receives the information to be stored over network **20**(B) and stores it on the appropriate storage device **32**(*s*)(*d*), thereby to update the partition with the new information from the request. In addition, the controller **31**(*s*) that receives a storage request from a processing node **16**(*m*) will be responsible for transmitting partition update requests to storage nodes **30**(*s*) maintaining other partitions of the replicated partition group so that all of the partitions in the replicated partition group contain consistent data.

The controllers **31**(*s*) of the storage nodes **30**(*s*) are all generally similar, and FIG. **2** depicts a general functional block diagram of the controller **31**(A) of storage node **30**(A). (A detailed functional block diagram of a controller **31**(*s*) for a storage node **30**(*s*), along with a detailed description of operations performed thereby, will be described below in connection with FIG. **7**). As shown in FIG. **2**, the controller **31**(A) includes a network interface **50**, a replicator module **51**, a local request handler **52**, a local disk driver **53**, a recovery module **54** and a configuration manager **55**. The controller's configuration manager **55** is generally similar to the configuration manager **44** of the processing node **16**(H), and maintains records identifying the storage devices and blocks comprising each partition, the partitions comprising each replicated partition group, the status of each of the partitions in each replicated partition group and the identification of the master partition(s) in each replicated partition group. The controller **31**(A) receives the storage and retrieval requests from the processing nodes **16**(*m*) through its network interface **50**, and in addition transmits responses therethrough. In addition, the controller **31**(A) will transmit update requests for transmission to other storage nodes **30**(*s*) to initiate updating of partitions within respective partition groups.

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The storage controllers replicator module **51** receives the storage and retrieval requests from the network interface **50** and determines the type of request. If the replicator module determines that the request is a retrieval request, it will provide the request to the local request handler, which, in turn, will enable the disk driver **53** to initiate a retrieval operation in connection with a storage device **32**(A)(*d*). After receiving the data requested in the retrieval request, the disk driver **53** will provide the data to the local request handler **52**, which, in turn, enables the network interface **50** to transmit the information to the processing node **16**(*m*) which issued the retrieval request over the network **20**(B).

On the other hand, if the replicator module determines that a received request is a storage request, it will generate an update request for transmission through the network interface **50** to initiate update operations to enable storage of the data to be stored in other partitions in the replicated partition group. It will be appreciated that update operations need only be performed in connection with storage requests, since retrieval requests do not result in any changes in the contents of any of the partitions of the replicated partition group. The local request handler **52** generally receives retrieval, storage and update requests and initiates the actual retrieval and storage operations with the storage devices **32**(*s*)(*d*) with the disk driver module **53**. In addition, the local request handler will generate request acknowledgments for transmission over the network **20**(B) to the processing node **16**(*m*) that issued the storage or retrieval request. The timing of transmission of a request acknowledgment depends on a number of factors, which will be described below.

As indicated above, the storage node **30**(*s*) that receives a storage request to initiate storage of data in a partition is the storage node which maintains the master partition of a replicated partition group, and that storage node generates update requests to initiate updating of other partitions in the replicated partition group. In one embodiment, the storage node **30**(*s*) that receives a storage request does not actually operate to store the data requested to be stored in the storage request. Instead, the storage node **30**(*s*) also issues the update request to itself, essentially broadcasting the update request over network **20**(B) to all storage nodes which maintain members of the replicated partition group, and it will operate to store the data in response to the update request. This will ensure that all of the storage nodes **30**(*s*) which maintain members of a replicated partition group will operate to update their partitions in the same manner, generally in response to update requests provided by the storage node **30**(*s*) in response to a storage request from a processing node **16**(*m*). The storage nodes **30**(*s*) which receive the update requests will provide acknowledgments over the network **20**(B) to the storage node **30**(*s*) that broadcasted the update request, with a timing that depends on a number of factors as described below. The storage node **30**(*s*) which received the storage request from a processing node **16**(*m*) will provide an acknowledgment to the storage request after receiving acknowledgments from all of the storage nodes **30**(*s*) to which it transmitted update requests.

The storage node **30**(A) also includes the recovery module **54**, which provides recovery services after correction of a malfunction or failure in connection with another storage node. In particular, if the corrected storage node maintains a partition which is a member of a replicated partition group, the recovery modules **54** of various storage nodes **30**(*s*) which maintain members of the replicated partition group operate to help update the corrected storage node's partition so that it will be consistent with the other members of the replicated partition group. If the storage node **30**(A) maintains a master partition, in the event of a malfunction or failure in connection with a storage node **30**(*s*) which maintains another member of the replicated partition group, the recovery module **54** will maintain a recovery log, described below in connection with FIGS. **5** and **7**, which may be used, with the contents of the partition, to recover the partition on the malfunctioning or failed storage node **30**(*s*) when its malfunction or failure is corrected. The recovery log contains a record of storage requests received following a malfunction or other failure in connection with a storage node which maintains a partition other than the master partition, which can be used in recovering those partitions.

In addition, the replicator **51** of each storage node **30**(*s*) maintains one or more replication broadcast logs **90** for each partition (described below in connection with FIGS. **6** and **7**) which contains a record of certain update requests transmitted and received for the partition. The storage node **30**(*s*) which maintains the master partition for a replicated partition group will have two replication broadcast logs **90** for the partition, one for update requests that are transmitted to storage nodes **30**(*s*) which maintain other partitions for the replicated partition group and one which it maintains for update requests that it receives for the replicated partition group. The replication broadcast log maintained by the master partition's storage node **30**(*s*) for transmitted update requests includes information for all of the update requests which were broadcast to storage nodes of other members of the replicated partition group for which update request acknowledgments have not been received. The replication broadcast log maintained by the storage nodes for received update requests includes information for all of the update requests from the oldest request in the master partition's transmitted update request transmitted request log to the update request most recently received by the storage node **30**(*s*). The storage node **30**(*s*) which broadcasts the update requests may, in each update request, provide the identification of the oldest request in the master partition's transmitted update request transmitted request log (which, as noted above, corresponds to the oldest update request which has not been acknowledged by all of the storage nodes **30**(*s*) which maintaining the various members of the replicated partition group), which the storage nodes **30**(*s*) may use in identifying update requests which should be removed from their received update request transmitted request logs.

Before proceeding further, it would be helpful to describe data structures of the tables and logs which are used in connection with the invention. FIG. **3** depicts the structure of a partition table **60** which is maintained by the configuration managers **44** and **55** of both the processing nodes **16**(*m*) and storage nodes **30**(*s*) to identify the partitions maintained by each storage node storage node **30**(*s*) in the fault-tolerant computer system **11**. FIG. **4** depicts the structure of a replication table **70** which is maintained by the configuration managers **44** and **55** of both the processing nodes **16**(*m*) to identify partitions on the various storage nodes **30**(*s*) which are members of a replicated partition group and to identify the state of the partition and each of the partitions in the replicated partition group. FIG. **5** depicts the structure of a recovery log **80** which is maintained by the recovery module **54** of a storage node **30**(*s*) for each partition for which the storage node maintains the master partition of a replicated partition group. Finally, FIG. **6** depicts the structure of a replication broadcast log **90** which contains a record of update requests transmitted or received for each partition until the partition has been updated on the storage device **32**(*s*)(*d*). As will be apparent from the following, the parti-

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tion tables **60** and replication tables **70** maintained by the configuration managers **44** and **55** of all of the processing nodes **16**(*m*) and storage nodes **30**(*s*) contain information as to the locations and states of all of the partitions and the respective replicated partition groups provided by the storage nodes **30**(*s*), and thus preferably will all contain consistent information. The processing nodes **16**(*m*) and storage nodes **30**(*s*) will preferably use the ISIS communications protocols as described above to maintain the information in the partition tables **60** and replication tables **70** consistent. On the other hand, the storage nodes **30**(*s*) may maintain recovery logs and replication broadcast logs on a replicated partition group-by-replicated partition group basis to provide for replication of a partition in a replicated partition group in the event of a malfunction or other failure, and need not be consistent across the storage nodes **30**(*s*).

FIG. **3** depicts the structure of partition table **60** used in connection with one embodiment of the invention. With reference to FIG. **3**, the partition table **60** includes a series of entries **61(0)** through **61**(P) (generally identified by reference numeral **61**(*p*)), each of which comprises a plurality of fields. Each entry **61**(*p*) describes a storage device extent which comprises either an entire partition or a portion of a partition; that is, each entry identifies the storage device **32**(*s*)(*d*), the block on the storage device which is comprises the beginning of a partition, and the length, in, for example, bytes, of the series of successive blocks on the storage device which comprise the partition or portion of a partition. If a partition comprises a number of extents, that is, a number of disjoint (that is, non-successive) series of blocks on the same storage device **32**(*s*)(*d*), the partition table **60** will include an entry **61**(*p*) for each extent. In addition, if a partition comprises extents on diverse storage devices **32**(*s*)(*d*), the partition table **60** will also include an entry for each extent. The first entry **61**(*p*) in the table **60** associated with a partition (or the only entry **61** (*p*) if a partition is associated with only one entry) also contains partition identification information.

As noted above, each entry **61**(*p*) includes a number of fields. In partition, each entry **61**(*p*) includes a partition number field **62**, a length field **63**, a disk identifier field **64**, a block field **65**, a block count field **66** and a partition name field **67**. The entry **61**(*p*) for the first storage device extent of a partition contains partition identifiers in the partition number field **62** and the partition name field **67**; in particular, the partition number fields **62**(*p*) contain successive numerical values (which will identify the partition as the first, second, third and so forth, partition in the table) and the partition name fields contain textual names or handles which may be used by an applications program **40** to identify the partition. If the partition comprises a number of extents on a single storage device **32**(*s*)(*d*) or a number of storage devices **32**(*s*)(*d*), a series of entries **61**(*p*) will be provided for the partition; in that case, the partition number field **62** and partition name field **67** of the first entry **61**(*p*) of the series will contain non-null numerical and name values, and the other entries in the series will preferably be empty or contain null values. The length field **63** for the entry **61**(*p*) for the first storage device extent of a partition contains a value which identifies the total length of the partition in, for example, bytes; if a series of entries **61**(*p*) are provided for a partition, the length field **63** for the first entry **61**(*p*) will contain a non-null length value and the other entries in the series will preferably be empty or contain null values.

The disk identifier field **64**, block field **65** and block count field **66** of each entry **61**(*p*) in the table **60** contain disk identifier, block identifier and block count values, respectively. The disk identifier field **64** contains a value identifying the storage device and the block identifier field **65** contains a value identifying the first block of the storage device extent for the entry **61**(*p*), and the block count field **66** contains a value identifying the length in, for example, bytes, of the extent. It will be appreciated that the sum of the block count values in fields **66** of the entries **61**(*p*) associated with a partition will correspond to the total length of the partition, which, in turn, corresponds to partition length value in the length field **63** of the first entry associated with the partition.

The structure of the replication table **70**, which identifies the various partitions comprising each of the replicated partition groups, is depicted in FIG. **4**. With reference to FIG. **4**, the replication table **70** includes a number of entries **71**(1) through **71**(R) (generally identified by reference numeral **71**(*r*)) each associated with a replicated partition group. Each entry **71**(*r*), in turn, includes a replicated partition group identifier field **72**, and a number of sub-entries **73**(*r*)(1) through **73**(*r*)(P) (generally identified by reference numeral **73**(*r*)(*p*)). The first sub-entry **73**(*r*)(1) contains state information which is applicable to the replicated partition group as a whole. The other sub-entries **73**(*r*)(2) through **73**(*r*)(P) each identifies one of the partitions in the replicated partition group, and in addition includes state information identifying the state of the partition identified in the sub-entry **73**(*r*)(*p*).

Each sub-entry **73**(*r*)(*p*) of a replication table entry **71**(*r*) includes a number of fields, including an storage node identifier field **74**, a partition number field **75** and a state field **76**. For the first sub-entry **73**(*r*)(1) of an entry **71**(*r*), which contains only state information for the replicated partition group as a whole, the storage node identifier field **74** and partition number field **75** are empty, and the state field **76** contains state information, which will be described below. For the other sub-entries **73**(*r*)(2) through **73**(*r*)(P) of entry **71**(*r*), which contain identifiers and state information for the partitions in the replicated partition group, the storage node identifier field **74** and partition number field **75** of a sub-entry **73**(*r*)(*p*) together identify the storage node **30**(*s*) and the partition on the storage node **30**(*s*) which is the member of the replicated partition group associated with the sub-entry **73**(*r*)(*p*). The value in the partition number field **75** corresponds to the partition number value in the partition number field **72** of the partition table **60** which describes the partition. The state field **76** of sub-entries **73**(*r*)(2) through **73**(*r*)(P) of entry **71**(*r*) also contains state information, which will be described below.

As noted above, state field **76** of sub-entry **73**(*r*)(1) of a replication table entry **71**(*r*) contains state information for the replicated partition group as a whole. In one particular embodiment, the replication group can have one of five different states, including in use, not in use, changing write master, write-back and write through. It will be appreciated that the replicated partition group states are not necessarily mutually-exclusive, and a number of such states may be indicated for a replicated partition group. In addition, it will be appreciated that some of the states may be conditioned by the respective configuration managers **44** and **55** of the processing nodes **16**(*m*) and storage nodes **30**(*s*), and may also be conditioned by an operator using the console terminal **14**. The in use state indicates that the replicated partition group is currently being accessed, that is, that a processing node **16**(*m*) has issued a storage or retrieval request to the storage node **30**(*s*) which maintains a partition (specifically, the partition which is the master partition) which is a member of the replicated partition group, which request has

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not been completed. The not-in-use state indicates that the replicated partition group is not currently being accessed.

The changing write master state indicates that the partition identified as the master partition in connection with storage requests is being changed. This may occur if, for example, a malfunction or other failure has occurred in connection with the storage node **30**(*s*) which maintains the partition identified as the master partition in connection with storage requests. This may also occur for a number of other reasons, for example, for load balancing if that storage node **30**(*s*) is over-burdened with requests while other storage nodes are generally not as busy. If a replicated partition group is indicated as being in the changing write master state, processing nodes **16**(*m*) will preferably delay issuing storage requests until a new master partition is selected.

The write back and write through states identify when the storage node **30**(*s*) will issue an acknowledgment to a storage node **30**(*s*) following receipt of an update request. If the write back state is indicated, the storage node **30**(*s*) will issue an acknowledgment after it receives the update request. On the other hand, if the write through state is indicated, the storage node **30**(*s*) which receives the update request will issue an acknowledgment when it has actually stored the information on their respective storage devices **32**(*s*)(*d*). Accordingly, since the storage node **30**(*s*) which maintains the master partition will provide an acknowledgment to the storage request after receiving acknowledgments to all of the update requests which it generated in response to the storage request, if the write back state is indicated the storage node **30**(*s*) will generate the storage request acknowledgment when all of the storage nodes **30**(*s*) which maintain members of the replicated partition group have acknowledged receipt of the update requests. On the other hand, if the write through state is indicated, the storage node will generate the storage request acknowledgment when all of the storage nodes **30**(*s*) which maintain members of the replicated partition group have actually stored the data to be stored on a storage device **32**(*s*)(*d*).

As noted above, state field **76** of sub-entries **73**(*r*)(2) through **73**(*r*)(P) of a replication table entry **71**(*r*) contains state information for the partition associated with the respective sub-entry. In one embodiment, the partitions can have a number of states, including normal, failed, invalid, needs-full-record, master, failed master, logging, recovery source and being recovered. It will be appreciated that the partition states are not necessarily mutually-exclusive, and a number of such states may be indicated for a partition. The normal state is used as a default state, in particular, when no other state is applicable. The master state identifies the partition as being the master partition at least in connection with storage requests; each processing node **16**(*m*) will issue storage requests for partitions in the associated replicated partition group to the storage node **30**(*s*) which maintains the partition which is identified as the master partition. If the storage node **30**(*s*) which maintains the master partition is logging storage requests, which may occur if, for example, a malfunction or other failure has occurred in connection with a storage node **30**(*s*) which maintains another member of the replicated partition group, the state field **76** will also identify the logging state.

Several states are used to identify malfunctions or other failures in connection with partitions. The failed master state is used to identifies a partition as being a master partition, for whose storage node **30**(*s*) a malfunction or other failure has occurred. The failed state, which may also be used with partitions other than the master partition, indicates that a malfunction or other failure has been detected in connection with the storage node **30**(*s*) which maintains the partition. The failed master state is used when the last member of a replicated partition group fails, and there are no other members of the group which can serve as master. The partition associated with the failed master state is the last master partition of the replicated partition group, and generally will be expected to contain the most valid data of all partitions in the replicated partition group. The invalid state is used in connection with a partition which is listed in the various tables, but for which there may be a discrepancy which renders the integrity of its information suspect.

Several of the states are used in connection with recovery of a partition. The being recovered state indicates that the partition is in the process of being recovered, using replicated information from other partitions in the replicated partition group. It will be appreciated that, if the storage node **30**(*s*) of the partition being recovered had malfunctioned or failed for a brief time, so that most of its contents are intact and it only needs updates that had not been stored during that time, the partition may be efficiently recovered merely by providing the storage node **30**(*s*) with the updates that it had missed. These updates may be provided from the recovery log **80** maintained by the storage node **30**(*s*) which maintains the master partition, or alternatively if the malfunction or other failure occurs in connection with that storage node, from the replicated broadcast logs **90** maintained by the various storage nodes **30**(*s*). The needs full recovery state, used in connection with a partition being recovered, indicates that the partition being recovered needs a full copy from another member of the replicated partition group. In addition, the recovery source state identifies the partition as the source for the recovery of the partition being recovered.

As noted above, FIG. **5** depicts the structure of a recovery log **80** which is maintained by the recovery module **54** of a storage node **30**(*s*) for each partition for which the storage node maintains the master partition of a replicated partition group. The recovery log **80** contains information which may be used in connection with recovery of a partition in the replicated partition group after correction of a malfunction or other failure of the storage node **30**(*s*) which maintains the partition, in particular a record of portions of the partition which are updated in response to storage requests received following a malfunction or other failure in connection with a storage node which maintains a partition other than the master partition. When a storage node **30**(*s*) is generating a recovery log **80** in connection with a partition, the associated sub-entry **73**(*r*)(*p*) in the replication table **70** so indicates with the "logging" state in the state field **76**.

With reference to FIG. **5**, the recovery log **80** comprises a plurality of log nodes **81**(A) through **81**(G) (generally identified by reference numeral **81**(1)) organized in a tree. Each log node **81**(1) identifies a portion of the partition that has been updated in response to a storage request. Each log node **81**(1) includes a plurality of fields, including a block identifier field **82**, a length field **83**, a left pointer field **84** and a right pointer field **85**. The left and right pointer fields **84** and **85** maintain the structure of the tree, for each node **81**(1) pointing to the nodes **81**(1_L) and **81**(1_R) comprising left and right children, respectively, if the child nodes are present. If a node **81**(1) does not have a left or right child node **81**(1_L) and **81**(1_R), the respective pointer field(s) will contain a null value. The block identifier field **82** and length field **83** identify the starting block and length (in, for example, bytes) of the portions of the partition which have been updated in response to storage requests received by the storage node **30**(*s*) which maintains the partition.

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The benefit of using a tree-structured recovery log **80** will be clear from the following. As noted above, the recovery log **80** in one embodiment stores records of the portions of the master partition which are updated in response to storage requests; it does not, however store records relating to the individual storage requests themselves. The tree structured recovery log **80** allows for the efficient identification of the specific portions of the master partition which have been updated in response to storage requests, but without identifying overlapping portions in multiple log nodes **81(1)**. This ensures that, when the recovery log **80** is used in recovering a partition the same portion of the partition will not be updated multiple times, which may occur if the storage node **30**(*s*) were to merely maintain a list of the portions updated.

Thus, in response to the first storage request for the master partition after logging is commenced, the storage node **30**(*s*) will establish the root log node **81**(A), including the starting block identifier and length values in the respective fields **82** and **83**. When the next storage request is received, the storage node **30**(*s*) will determine whether the portion of the partition to be updated in response to the storage request is below or above the portion identified by the root node **81**(A), or whether it overlaps the portion identified by the root node **81**(A). If there is an overlap, the storage node **30**(*s*) will adjust the starting block identifier and length values in fields **82** and **83** to identify both the original portion and the new portion as being updated in response to update requests.

On the other hand, if the storage node **30**(*s*) determines that the portion to be updated in response to the newly-received storage request is above or below the portion identified by the root node **81**(A), it will generate a new left or right child node **81**(B) or **81**(C). If the portion to be updated in response to the newly-received storage request is below the portion identified by root node **81**(A), the storage node **30**(*s*) will generate a left child node **81**(B), including the starting block identifier and length values in respective fields **82** and **83** of that child node, and will update the left child pointer field **84** of the root node **81**(A). On the other hand, if the portion to be updated in response to the newly-received storage request is above the portion identified by root node **81**(A), the storage node **30**(*s*) will generate a right child node **81**(C), including the starting block identifier and length values in respective fields **82** and **83** of that child node, and will update the right child pointer field **85** of the root node **81**(A).

For the next storage request received by the storage node **30**(*s*), the operations performed by the storage node **30**(*s*) will also be determined by whether the portion to be updated in response to the storage request overlaps the portion of the partition identified by the root node, or whether it is below or above the portion of the partition identified by the root node. If there is an overlap, the storage node **30**(*s*) will also determine whether there is an overlap with either of the node's child nodes **81**(B) or **81**(C), and if so collapse the child nodes which there is an overlap, adjusting the values of the root node's block identifier and length fields **82** and **83** to identify the overlapping portions (that is, the portions identified by the nodes **81**(A), **81**(B) and/or **81**(C) and the portion identified by the newly-received storage request). These operations will be repeated for each of the child nodes in the recovery log **80** down the tree, as long as there is an overlap.

On the other hand, if the storage node **30**(*s*) determines at the root node **81**(A) that there is no overlap of the portion identified by the root node and the portion to be updated in response to the newly-received storage request, it will determine whether the portion identified by the storage request is below or above the portion identified by the root node. If the storage node **30**(*s*) determines that the portion identified by the root node is below the portion identified by the storage request, it will determine whether the portion identified by the storage request is above the portion identified by left child node **81**(B), and if so, it will generate a new left child node for the root node and adjust the left pointers in fields **84** of the root node and new left child node to link the new left child node between the root node and the old left child node. On the other hand, if the storage node **30**(*s*) determines that the portion identified by the root node is above the portion identified by the storage request, it will determine whether the portion identified by the storage request is below the portion identified by right child node **81**(C), and if so, it will generate a new right child node for the root node and adjust the right pointers in fields **85** of the root node and new right child node to link the new right child node between the root node and the old right child node.

If the storage node **30**(*s*)(*i*) determines that there is no overlap between the portion of the partition identified by the root node and the portion identified by the newly-received storage request, and (ii) if it does not generate a new left or right child node as described above, it will perform the same operations as described above in connection with the portion of the tree starting with the left or right child node **81**(B) or **8**(C). That is, if the storage node **30**(*s*) determines that the portion of the partition to be updated in response to the newly-received storage request is below the portion identified by the root node, it will repeat the operations using the left child node. On the other hand, if it determines that the portion of the partition to be updated is above the portion identified by the root node, it will repeat the operations using the right child node. These operations will be performed successively down the tree until either the portions identified by the nodes have been updated based on overlapping of the respective portions, or the storage node **30**(*s*) has generated a new node as described above. This will ensure that the nodes **81(1)** of the recovery log **80** do not define overlapping partition portions, so that the log will facilitate the efficient recovery of a partition on a failed storage node.

As noted above, FIG. **6** depicts the structure of a replication broadcast log **90** which contains a record of update requests transmitted and received for each partition. As described above, the storage node **30**(*s*) which maintains the master partition will maintain a replication broadcast log **90** for update requests that it broadcasts to the storage nodes which maintain the various members of the replicated partition group (including the master partition), which log will contain a record of update requests have been broadcast but which have not been acknowledged by all of the storage nodes to which update requests were broadcast. In addition, each storage node **30**(*s*) which maintains a member of a replicated partition group (including the master partition) will maintain a replication broadcast log **90** for update requests that it receives for the partition, which log will contain a record of update requests which have been received, from the earliest update request which has not been acknowledged by all of the storage nodes to which update requests were broadcast. Since all of the storage nodes **30**(*s*) maintain at least one replication broadcast log **90** in connection with update requests for a partition, not just the storage node **30**(*s*) which maintains the master partition, the replication broadcast logs **90** may be used to recover any of the partitions following a malfunction or other failure, including the master partition.

With reference to FIG. **6**, the replication broadcast log **90** is a first-in, first-out queue comprising doubly-linked list

including a plurality of entries **91(1)** through **91(L)** (generally identified by reference numeral **91(1)**). The double-linking of entries in the list allows for addition to entries at the beginning of the list, and removal of entries from anywhere in the list, in a conventional manner. Each entry **91(1)** includes a number of fields, including a forward pointer field **92**, a backward pointer field **93**, a block identifier field **94** and a length field **95**. The forward and backward pointer fields **92** and **93** essentially define the entries in the queue; in particular, the forward pointer field **92** of each entry **91(1)** contains a pointer that points to the next entry **91(1-1)** in the queue, and the backward entry field **91(1)** contains a pointer that points to the previous entry **91(1-1)** in the queue. The storage node **30(*s*)** may maintain pointers (not shown) to the first and last entries in the queue, and the backward pointer field **93** of the first entry **91(1)** may point to the storage node's first entry pointer and the forward pointer field **92** of the last entry **91(L)** may point to the storage node's last entry pointer. The block identifier field **94** and length field **95** of each entry **91(1)** have the contents which are similar to contents of the block identifier field and length field of the recovery log **80**; that is, they contain values which identify the starting block and length (in, for example, bytes) of the portions of the partition which are to be updated in response to update requests transmitted and/or received by the storage node **30(*s*)**.

With this background, the operations performed by a storage node **30(*s*)** in connection with storage, retrieval and update requests will be described in connection with FIG. **7**. In addition, operations performed by a storage node **30(*s*)** in connection with recovering from a malfunction or other failure will also be described in connection with FIG. **7**. FIG. **7** depicts a detailed functional block diagram of the controller **31(*s*)**. With reference to FIG. **7**, the controller **31(*s*)** receives retrieval requests and storage requests over network **20(B)** through its network interface **50**. As noted above, if the controller **30(*s*)** receives a retrieval or storage request in connection with a particular partition, that partition is the master partition for a replicated partition group. In any case, the network interface **50** will direct retrieval requests which it receives to a retrieval request queue **101**, and storage requests which it receives to a storage request queue **102**, both of which form part of the replicator **51** described above in connection with FIG. **2**. In addition, in accordance with the ISIS communication protocol, the network interface **50** may generate a network acknowledgment for transmission over the network to the processing node **16(*m*)** that generated the storage or retrieval request.

The retrieval request queue **101** buffers retrieval requests until they can be processed by a storage device retrieval entry generator **103**, which forms part of the local request handler **52** described above in connection with FIG. **2**. The storage device retrieval entry generator **103** generates a retrieval entry for a storage device **32(*s*)(*d*)**, which it loads into a device storage/retrieval queue **104**, which forms an interface between the local request handler **52** and the disk driver **53** described above in connection with FIG. **2**. The controller **51(*s*)** provides a disk storage/retrieval queue **104** for each of the storage devices **32(*s*)(*d*)**, and includes both retrieval and storage entries, which are generated as described below, and so the retrieval entry generator **103** will load the retrieval entry into the device storage/retrieval queue **104** for the appropriate storage device **32(*s*)(*d*)**. A local storage device request handler **105**, which also forms part of the disk driver **53** described above in connection with FIG. **2**, will retrieve retrieval and storage entries from the device storage/retrieval queue **104** and transfer them to the appropriate storage device for processing.

In response to a retrieval entry, a storage device **32(*s*)(*d*)** will perform the retrieval operation required in the retrieval entry. If the storage device **32(*s*)(*d*)** successfully performs the operation, it will provide the data, along with status information regarding the status of the operation, to the controller **31(*s*)**, in particular to a disk reply module **106**, which also forms part of the disk driver **53** described above in connection with FIG. **2**. The disk reply module **106** will generate a request response, which includes the data and status information regarding the status of the retrieval operation, which it enqueues in a retrieval response queue **107**. The retrieval response queue **107** forms part of the local request handler **52** described above in connection with FIG. **2**. The network interface **50** handles dequeuing of the request responses from the retrieval response queue **107** and transfers them to the requesting processing nodes **16(*m*)** over the network **20(B)**. If a malfunction or other failure occurs in connection with the retrieval operation, either the storage device **32(*s*)(*d*)** will provide status information indicating the malfunction, which the disk reply module **106** may use in generating a response; if the storage device **32(*s*)(*d*)** is unable to provide the status information indicating the malfunction or other failure, the controller **31(*s*)** itself may provide the required information, which the disk reply module **106** may use in generating a request response.

As noted above, the network interface **50** loads storage requests received over the network **20(B)** into the storage request queue **102**. Unlike retrieval requests, storage requests will result in updating of the information stored in the partition which is the target of the storage request, and the replicator **51** (FIG. **2**) of the controller **31(*s*)** which receives the storage request will be responsible for enabling storage nodes **30(*s*)** which maintain other partitions in the replicated partition group to update their partitions as well. Accordingly, the replicator **51** is provided with a storage request handler **110** which receives storage requests from the storage request queue **102** and provides them to a replication broadcast transmission module **111**, which enables the network interface **50** to broadcast the storage request as an update request to all of the storage nodes **30(*s*)** which maintain members of the replicated partition group. As described above, the replication broadcast transmission module **111** and network interface **50** will perform the broadcast using the ISIS communications protocols. In accordance with the ISIS communication protocol, the network interfaces **50** of the storage nodes **30(*s*)** which receive the messages will be expected to generate a network acknowledgment for transmission over the network to the storage node **30(*s*)** that generated the update request, and the network interface **50** will monitor the network **20(B)** to verify that update requests for all of the storage nodes **30(*s*)** have been received.

It will be appreciated that the replication broadcast transmission module **111** can determine the identifications of the various storage nodes which maintain members of the replicated partition group from the replication table **70** maintained by the configuration manager **55** (FIG. **2**). Since the storage node **30(*s*)** that receives the storage request is the storage node **30(*s*)** which maintains the master partition for the replicated partition group, the replication broadcast transmission module **111** will also generate an entry **91(1)** for the replication broadcast log **90** which is maintained by the storage node **30(*s*)** for update requests which it transmits for the replicated partition group.

If the partition is in the "logging" state, as indicated by an appropriate entry in the partition state field **75** of the sub-entry **72(*r*)(*p*)** for the partition in the replication table

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70, the storage request handler 110 also enables the recovery module 54 to generate an entry 81(1) for the recovery log 80 for the storage request as described above.

The storage node 30(*s*) receives update requests from the network 20(B), including both update requests generated by the storage node 30(*s*) itself and update requests generated by other storage nodes 30(*s*). The network interface 50 will generate a network acknowledgment for transmission over the network 20(B) to the storage node 30(*s*) which generated the update request. In addition, the network interface 50 will provide the update requests to a replication broadcast receive module 112, which also forms part of the replicator 51 described above in connection with FIG. 2. The replication broadcast receive module 112 will provide the update request to a storage entry generator module 113 (which forms part of the local request handler 52 described above in connection with FIG. 2) that generates a storage entry for storage in the storage device storage/retrieval request queue 104 for the appropriate storage device, which will be handled by the local request handler 105 as described above. In addition, the replication broadcast receive module 112 will also generate an entry 91(1) for the replication broadcast log 90 which is maintained by the storage node 30(*s*) for update requests which it receives for the replicated partition group.

As noted above, the local storage device request handler 105 will retrieve entries from the disk storage/retrieval queue 104, including the storage entries generated by the storage entry generator module 113 and transfer them to the appropriate storage device 32(*s*)(*d*) for processing. The storage entry will include the data to be stored, and in response to a storage entry, a storage device 32(*s*)(*d*) will store the data in the partition where indicated in the partition. After the storage device 32(*s*)(*d*) has completed the storage operation, it will generate a response indicating, for example, the success or failure status of the operation.

At some point during processing of a storage request, the disk reply module 106 will generate an acknowledgment, which it will load into a storage response queue 114, which forms part of the local request handler 52 described above in connection with FIG. 2. The network interface 50 handles dequeuing of the responses from the storage response queue 114 and transfers them to the processing nodes 16(*m*) which generated the requests over the network 20(B). The particular point in the processing at which the disk reply module 106 generates the acknowledgment will be determined by whether the partition being updated is in the write-back state or the write-through state, as indicated by an appropriate entry in the partition state field 75 of the sub-entry 72(*r*)(*p*) for the partition in the replication table 70 as described above. If the partition is in the write-back state, the disk reply module 106 will generate an acknowledgment to indicate receipt of the storage request, but if the partition is in the write through state the disk reply module 106 will wait until it receives a response from the storage device 32(*s*)(*d*) before generating the acknowledgment.

As noted above, the various partitions of a replicated partition group may be used in connection with recovery of a partition on a storage node 30(*s*) which has malfunctioned or otherwise failed. The configuration managers 44 and 55 of the respective processing nodes 16(*m*) and storage nodes 30(*s*), along with the replicators 51 of the respective storage nodes 30(*s*) determine whether a malfunction or other failure has occurred which may require logging and, if the malfunction or other failure occurred in connection with the master partition, selection of a new master partition. The configuration manager 44 of a processing nodes may detect a malfunction or other failure in connection with a storage node 30(*s*) if it, for example, transmits a storage or retrieval request thereto and fails to receive either a network acknowledgment or a request response as described above. The replicator 51 of a storage node 30(*s*) can determine when a malfunction or other failure has occurred from a number of indicia, including, for example,

(i) if the storage node 30(*s*) maintains a master partition, if it fails to receive a network acknowledgment from a storage node in response to an update request in connection with the replicated partition group;

(ii) if an error is detected in connection with one of its storage devices 32(*s*)(*d*) or its disk driver 53,

(iii) it detects a change is detected in its copy of the recovery table 70 indicating an error or other malfunction, (FIG. 4); and

(iv) if the storage node 30(*s*) maintains a master partition, if it receives a failure notification from the configuration manager 55 of its storage node 30(*s*), which may result from a malfunction or other failure in connection with another storage node 30(*s*).

The storage nodes 30(*s*) will perform a number of operations in response to these indicia. In particular, their configuration managers 55, along with the configuration managers 44 of the processing nodes 16(*m*), will update their recovery tables 70 to indicate the change in status of the partition on the malfunctioning or failed storage node 30(*s*). In addition, the replicators 51 of the storage nodes 30(*s*) which maintain members of the affected replicated partition group will initiate logging, in particular enabling establishment of the respective replication broadcast log(s) 90 (FIG. 6) and, if the storage node 30(*s*) maintains a master partition, will enable the recovery module 54 to establish the recovery log 80 (FIG. 5).

Furthermore, if the malfunction or failure occurred in connection with a storage node 30(*s*) which maintains a master partition of a replicated partition group, the configuration managers 44 and 55 of the processing nodes 16(*m*) and storage nodes 30(*s*) will select a new master partition and update their recovery logs 80 accordingly. In that operation, when a configuration manager 44 or 55 detects a malfunction or other failure in connection with a master partition, it (the configuration manager) will condition the partition state field 75 of the associated sub-entry 72(*r*)(1) of the entry 71(*r*) of the replication table 70 for the associated replicated partition group to indicate the changing write master and changing read master states. If the configuration manager which performs this operation is the configuration manager 44 of a processing node 16(*m*), this will inhibit the processingnode 16(*m*) from transmitting storage or retrieval requests for the partition until a new master partition is selected. In addition, the configuration manager will broadcast a "changing master" message over the network 20(B) using the ISIS protocol, to enable the configuration managers of the other processing nodes and storage nodes to also condition their replication tables 70 for the replicated partition group to indicate the changing write master and changing read master state, which, in turn, disables all of the processing nodes 16(*m*) from transmitting storage or retrieval requests for the partition until a new master partition is selected.

Thereafter, the configuration manager 44 or 55 which detected the malfunction or other failure will use the replication table 70 to select a new master partition. In selecting the new master partition, the selecting configuration manager may use any selection algorithm; in one embodiment, the new master partition is the next partition in the replica-

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tion table **70** which is indicated as being in the "normal" state. In addition, the partition state field of the sub-entry **72**(*r*)(*p*) associated with the former master partition will be indicated as being in the "failed" state. After selecting a new master partition, the selecting configuration manager will broadcast a message to the other configuration managers identifying the new master partition. All of the configuration managers will update their replication tables **70** to indicate the new master partition cancel the "changing write master" and "changing read master" states for the replicated partition group, and the processing nodes **16**(*m*) can thereafter transmit retrieval and storage requests to the storage node **30**(*s*) which maintains the new master partition.

In one embodiment, the master partition can also be changed for a number of reasons in addition to detection of a malfunction or other failure. For example, the storage node **30**(*s*) which maintains the master partition may voluntarily withdraw from the replicated partition group, and an operator, through, for example, the console terminal **14**, may force a change in the master partition. When that occurs, the configuration managers operate generally as described above to select a new master partition and update their replication tables **70** accordingly.

As noted above, if a malfunction or other failure occurs in connection with a storage node **30**(*s*) which maintains a member of a replicated partition group, the storage node which maintains the master partition will begin a recovery log **80**, which, with the replication broadcast logs **90**, may be used to recover the partition following recovery of the malfunctioning or failed storage node **30**(*s*). If the malfunction or other failure is corrected, or if a storage node **30**(*s*) or storage device **32**(*s*)(*d*) is substituted for the malfunctioning or failed storage node **30**(*s*) or storage device **32**(*s*)(*d*), the contents of one or more of the other partitions and the respective replication broadcast logs **90** and recovery logs **80** can be used in recovering the partition on the previously-malfunctioning or -failed storage node **30**(*s*). Indication that a malfunction or other failure has been corrected, or substitution of a storage node or storage device, may be provided by an operator through the console terminal **14**.

In one embodiment, the storage node **30**(*s*) which maintains the master partition (even if it is a new master partition) performs recovery. The storage node **30**(*s*), in particular its recovery module **54**, performs recovery by copying some or all of the master partition to the storage node which maintains the partition being recovered over the network **20**(B). The actual operations performed in connection with recovering a partition depend on a number of factors, including whether the partition being recovered was the previous master partition or another member of the replicated partition group, and whether the partition being recovered was a member or was newly-added to the replicated partition group (which may occur if, for example, a storage node **30**(*s*) or storage device **32**(*s*)(*d*) is substituted for a previous node or device). In addition, if the malfunctioning or failed storage node was the storage node **30**(*s*) which maintained the master partition, operations will depend on whether the new master partition was a member of the replicated partition group for a sufficient period of time to have a replicated broadcast log **90** to support recovery; in particular whether its replicated broadcast log **90** contains entries from the oldest unacknowledged update request broadcast by the previous master partition.

If the partition being recovered is a new partition, or if the new master was not a member of the replicated partition group for a sufficient period of time, the recovery module **54** of the storage node **30**(*s*) which maintains the new master partition will not recover the partition from the replication broadcast log **90**, but instead will copy its entire partition to the partition being recovered. Prior to beginning recovery, the recovery module will preferably ensure that outstanding update requests, which are listed in its replication broadcast log **90** at the time recovery begins, are executed, since the storage node **30**(*s*) of the partition being recovered will not have received the update requests.

If the partition being recovered is not a new partition, and if the master partition is not a new master partition (that is, the malfunctioning or failed storage node **30**(*s*) was not the storage node which maintained the master partition), the recovery module **54** of the storage node may recover the partition using the recovery log **80**. The recovery module **54** may step down the tree-structured recovery log **80** copying the various portions of the master partition identified in the recovery log **80** to the partition being recovered. Since the recovery log **80** identifies disjoint (that is, non-overlapping) portions of the master partition, the recovery module **54** can efficiently recover the partition.

Finally, if (i) the partition being recovered is not a new partition and (ii) the master partition is a new master partition (which may occur if the malfunctioning or failed storage node **30**(*s*) was the storage node which previously maintained the master partition) which has been a master partition for a sufficient period of time that its replicated broadcast log **90** contains entries from the oldest unacknowledged update request broadcast by the previous master partition, the recovery module **54** of the storage node **30**(*s*) which maintains the new master partition will use its replication broadcast log **90** to perform recovery. The recovery module **54** will copy the portions of the master partition identified by the sequence of the entries **91**(**1**) in its replicated broadcast log **90** to the partition being recovered. It will be appreciated that a plurality of entries **91**(**1**) in the log **90** may relate to overlapping portions of the partition, and so portions of the partition will be copied in the order of the entries **91**(**1**) in the log **90**.

It will be appreciated that, during recovery, the storage node **30**(*s*) which maintains the master partition may receive a storage or retrieval request from a processing node **16**(*m*) in connection with the partition. Since a retrieval request will not result in a change to the contents of the partition, it can perform the retrieval request while it is performing recovery operations. However, since a storage request will result in a change to the contents of the partition, the recovery module **54** and the replication module **51** of the storage node **30**(*s*) of the master partition will cooperate to delay operations in connection with the storage request, if the storage request relates to a portion of the master partition which overlaps a portion which is to be copied to the partition being recovered, until after portion has been copied. After the recovery module **54** has copied the portion of the master partition to the partition being recovered, it (the recovery module **54**) will broadcast update requests for the storage request to storage nodes **30**(*s*) which maintain the other members of the replicated partition group.

Broadcast

It will be appreciated that the invention provides a number of advantages. In particular, it provides a fault-tolerant computer system which includes a distributed, fault-tolerant storage subsystem in which information is replicated in a convenient manner, and that will quickly recover replicated data following correction of a malfunction or other failure, without the need of processor node intervention. Thus, processing by the processor nodes can continue without degradation in connection with data which is not stored on a malfunctioning or failing storage node, and possibly with

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only some degradation in connection with data which is stored on the malfunctioning or failing storage node.

The foregoing description has been limited to a specific embodiment of this invention. It will be apparent, however, that various variations and modifications may be made to the invention, with the attainment of some or all of the advantages of the invention. It is the object of the appended claims to cover these and such other variations and modifications as come within the true spirit and scope of the invention.

What is claimed as new and desired to be secured by Letters Patent of the United States is:

1. A fault-tolerant computer system comprising at least one processing node and a plurality of storage nodes interconnected by a network;

A. the processing node performing processing operations in connection with user-generated processing requests, in connection with processing a processing request generating storage and retrieval requests for transmission over the network to enable storage of data on and retrieval of data from respective ones of said storage nodes;

B. the storage nodes storing data in at least one replicated partition group comprising a plurality of replicated partitions distributed across the storage nodes, one of said replicated partitions of said at least one replicated partition group comprising a master partition and each other replicated partition of said at least one replicated partition group comprising a respective slave partition, each said storage node on receiving a retrieval request from said processing node providing the requested data to the processing node, and said storage node which maintains the master partition on receiving a storage request from said processing node initiating an update operation in connection with the storage nodes which maintain said replicated partitions to update all of the replicated partitions in the replicated partition group in the same manner.

claims

2. A fault-tolerant computer system as defined in claim 1 in which said processing node directs retrieval requests to the one of said storage nodes which maintains the master partition.

3. A fault-tolerant computer system as defined in claim 1 in which said processing node directs storage requests to the one of said storage nodes which maintains the master partition.

4. A fault-tolerant computer system as defined in claim 1 comprising a plurality of processing nodes, each processing node performing processing operations in connection with user-generated processing requests, in connection with processing a processing request generating storage and retrieval requests for transmission over the network to enable storage of data on and retrieval of data from respective ones of said storage nodes.

5. A fault-tolerant computer system as defined in claim 1 in which the one of said storage nodes which maintains the master partition comprises:

A. a network interface for receiving storage requests from said network, the network interface further receiving replicated storage requests directed to the one of said storage nodes which maintains the master partition;

B. a replicator module for receiving storage requests from said network interface and broadcasting replicated storage requests to the storage nodes which maintain ones of the replicated partitions of the replicated partition group;

C. a local request handler for said receiving replicated storage requests directed to the one of said storage nodes which maintains the master partition, and in response thereto updates the master partition.

6. A fault-tolerant computer system as defined in claim 5 in which the storage nodes to which replicated storage requests are broadcast includes the one of the storage node nodes which maintains the master partition.

7. A fault-tolerant computer system as defined in claim 5 in which said replicator module comprises:

A. a storage request queue for receiving and enqueuing storage requests from said network interface;

B. a replicated storage request broadcast module for retrieving enqueued storage requests from said storage request queue and generating retrieved storage requests for broadcast to the storage nodes which maintain ones of the replicated partitions of the replicated partition group.

8. A fault-tolerant computer system as defined in claim 7 in which the replicator module further comprises a replicated broadcast log, the replicated storage request broadcast module enabling the replicated broadcast log to maintain a record of the replicated storage requests broadcast by the replicated storage request broadcast module.

9. A fault-tolerant computer system as defined in claim 8 in which the replicator module further includes a replicated storage request receiver module for receiving the replicated storage requests from the network interface and for providing the received replicated storage requests to the local request handler.

10. A fault-tolerant computer system as defined in claim 9 in which the replicated storage request receiver module further generates an acknowledgment for transmission by the network interface to the one of the storage nodes which maintains the master partition.

11. A fault-tolerant computer system as defined in claim 9 in which in which the replicator module further comprises a replicated broadcast log for maintaining a record of the replicated storage requests broadcast by the replicator module, the replicated broadcast log removing the records of replicated storage requests for which acknowledgments have been received from all of the storage nodes which maintain replicated partitions of said replicated partition group.

12. A fault-tolerant computer system as defined in claim 10 in which the replicated storage request receiver module operates in a write-through mode, in which it generates said acknowledgment to said replicated storage request when the one of the replicated partitions of the replicated partition group maintained thereby has been updated in response to the replicated storage request.

13. A fault-tolerant computer system as defined in claim 10 in which the replicated storage request receiver module operates in a write-back mode, in which it generates said acknowledgment to said replicated storage request when the replicated storage request has been received.

14. A fault-tolerant computer system as defined in claim 5 further comprising a recovery module for providing recovery services after correction of a malfunction in connection with another of said storage nodes which maintains one of said replicated partitions of said replicated partition group to update the other storage node's replicated partition so that it will be consistent with the other replicated partitions of the replicated partition group.

15. A fault-tolerant computer system as defined in claim 14 further comprising a recovery log maintained by said recovery module after said other of said storage nodes has malfunctioned, the recovery log maintaining a record of portions of the replicated partition which are updated during a malfunction period.

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16. A fault-tolerant computer system as defined in claim 15 in which said recovery module, after correction of the malfunction in connection with the other storage node, uses the recovery log to facilitate updating of the replicated partition on the other storage node.

17. A fault-tolerant computer system as defined in claim 15 in which the recovery log comprises a plurality of entries organized in a tree, each entry identifying one of said portions of said master partition.

18. A fault-tolerant computer system as defined in claim 17 in which:

A. each of said portions is associated with a block identifier and a length, the block identifier identifying a storage block on which said portion of the master partition is stored on said one of said storage nodes;

B. said tree includes a plurality of entries each identifying a one of said portions of the master partition updated during the malfunction period, the entries identifying non-overlapping portions of said master partition, one of said entries comprising a root entry associated with a first of said portions of the master partition updated during the malfunction period, and each of said other entries comprising a respective "lower" or "higher" child entry defining a respective one of said portions of the master partition updated during the malfunction period whose block identifier is respectively lower or higher than the block identifier of its respective parent entry.

19. A fault-tolerant computer system as defined in claim 18 in which said recovery module generates entries for the recovery log in response to receipt of replicated storage requests during the malfunction period.

20. A fault-tolerant computer system as defined in claim 19 in which, in response to receipt of a first one of said replicated storage requests during the malfunction period, the recovery module generates said root entry.

21. A fault-tolerant computer system as defined in claim 20 in which, in response to receipt of each subsequent replicated storage request during the malfunction period, the recovery module selectively generates a new entry or updates selected existing ones of entries so as to provide that the entries of said tree identify non-overlapping portions of said master partition.

22. A fault-tolerant computer system as defined in claim 1 in which at least one of said storage nodes which maintains at least one slave partition comprises:

A. a network interface for receiving replicated storage requests broadcast by the one of said storage nodes which maintains the master partition;

B. a replicator module including a replicated storage request receiver module for receiving the replicated storage requests from the network interface and for providing the received replicated storage requests to a local request handler;

C. the local request handler, in response to replicated storage requests directed to the one of said storage nodes which maintains the respective one of said slave partitions, and updating the respective one of said slave partitions.

23. A fault-tolerant computer system as defined in claim 20 in which the replicated storage request receiver module further generates an acknowledgment for transmission by the network interface to the one of the storage nodes which maintains the master partition.

24. A fault-tolerant computer system as defined in claim 23 in which the replicated storage request receiver module operates in a write-through mode, in which it generates said acknowledgment to said replicated storage request when the one of the replicated partitions of the replicated partition group maintained thereby has been updated in response to the replicated storage request.

25. A fault-tolerant computer system as defined in claim 23 in which the replicated storage request receiver module operates in a write-back mode, in which it generates said acknowledgment to said replicated storage request when the replicated storage request has been received.

26. A fault-tolerant computer system as defined in claim 22 in which the at least one of said storage nodes further comprises a recovery module for providing recovery services after correction of a malfunction in connection with another of said storage nodes which maintains one of said replicated partitions of said replicated partition group to update the other storage node's replicated partition so that it will be consistent with the other replicated partitions of the replicated partition group.

27. A fault-tolerant computer system as defined in claim 26 in which the replicator module further comprises a replicated broadcast log, the replicated storage receiver broadcast module enabling the replicated broadcast log to maintain a record of the replicated storage requests received by the replicated storage request receiver module, the recovery module using the replicated broadcast log in providing the recovery services.

28. A storage node for use in connection with a fault-tolerant computer system comprising at least one processing node and a plurality of storage nodes interconnected by a network, the processing node performing processing operations in connection with user-generated processing requests, in connection with processing a processing request-generating storage and retrieval requests for transmission over the network to enable storage of data on and retrieval of data from respective ones of said storage nodes, the storage nodes storing data in at least one replicated partition group comprising a plurality of replicated partitions distributed across the storage nodes, one of said replicated partitions of said at least one replicated partition group comprising a master partition and each other replicated partition of said at least one replicated partition group comprising a respective slave partition, the storage node maintaining the master partition and comprising:

A. a network interface for receiving storage requests from said network, the network interface further receiving replicated storage requests directed to the one of said storage nodes which maintains the master partition;

B. a replicator module for receiving storage requests from said network interface and broadcasting replicated storage requests to the storage nodes which maintain ones of the replicated partitions of the replicated partition group;

C. a local request handler for said receiving replicated storage requests directed to the one of said storage nodes which maintains the master partition, and in response thereto updating the master partition.

29. A storage node as defined in claim 28 in which said replicator module comprises:

A. a storage request queue for receiving and enqueuing storage requests from said network interface;

B. a replicated storage request broadcast module for retrieving enqueued storage requests from said storage request queue and generating retrieved storage requests for broadcast to the storage nodes which maintain ones of the replicated partitions of the replicated partition group.

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30. A storage node as defined in claim 29 in which the replicator module further comprises a replicated broadcast log, the replicated storage request broadcast module enabling the replicated broadcast log to maintain a record of the replicated storage requests broadcast by the replicated storage request broadcast module.

31. A storage node as defined in claim 30 in which the replicator module further includes a replicated storage request receiver module for receiving the replicated storage requests from the network interface and for providing the received replicated storage requests to the local request handler.

32. A storage node as defined in claim 31 in which the replicated storage request receiver module further generates an acknowledgment for transmission by the network interface to the one of the storage nodes which maintains the master partition.

33. A storage node as defined in claim 31 in which in which the replicator module farther comprises a replicated broadcast log for maintaining a record of the replicated storage requests broadcast by the replicator module, the replicated broadcast log removing the records of replicated storage requests for which acknowledgments have been received from all of the storage nodes which maintain replicated partitions of said replicated partition group.

34. A storage node as defined in claim 32 in which the replicated storage request receiver module operates in a write-through mode, in which it generates said acknowledgment to said replicated storage request when the one of the replicated partitions of the replicated partition group maintained thereby has been updated in response to the replicated storage request.

35. A storage node as defined in claim 32 in which the replicated storage request receiver module operates in a write-back mode, in which it generates said acknowledgment to said replicated storage request when the replicated storage request has been received.

36. A storage node as defined in claim 28 further comprising a recovery module for providing recovery services after correction of a malfunction in connection with another of said storage nodes which maintains one of said replicated partitions of said replicated partition group to update the other storage node's replicated partition so that it will be consistent with the other replicated partitions of the replicated partition group.

37. A storage node as defined in claim 36 further comprising a recovery log maintained by said recovery module after said other of said storage nodes has malfunctioned, the recovery log maintaining a record of portions of the replicated partition which are updated during a malfunction period.

38. A storage node as defined in claim 37 in which said recovery module, after correction of the malfunction in connection with the other storage node, uses the recovery log to facilitate updating of the replicated partition on the other storage node.

39. A storage node as defined in claim 37 in which the recovery log comprises a plurality of entries organized in a tree, each entry identifying one of said portions of said master partition.

40. A storage node as defined in claim 39 in which:

A. each of said portions is associated with a block identifier and a length, the block identifier identifying a storage block on which said portion of the master partition is stored on said one of said storage nodes;

B. said tree includes a plurality of entries each identifying a one of said portions of the master partition updated during the malfunction period, the entries identifying non-overlapping portions of said master partition, one of said entries comprising a root entry associated with a first of said portions of the master partition updated during the malfunction period, and each of said other entries comprising a respective "lower" or "higher" child entry defining a respective one of said portions of the master partition updated during the malfunction period whose block identifier is respectively lower or higher than the block identifier of its respective parent entry.

41. A storage node as defined in claim 40 in which said recovery module generates entries for the recovery log in response to receipt of replicated storage requests during the malfunction period.

42. A storage node as defined in claim 41 in which, in response to receipt of a first one of said replicated storage requests during the malfunction period, the recovery module generates said root entry.

43. A storage node as defined in claim 42 in which, in response to receipt of each subsequent replicated storage request during the malfunction period, the recovery module selectively generates a new entry or updates selected existing ones of entries so as to provide that the entries of said tree identify non-overlapping portions of said master partition.

* * * * *

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US005790789A

United States Patent [19]

Suarez

[11] Patent Number: 5,790,789

[45] Date of Patent: Aug. 4, 1998

[54] **METHOD AND ARCHITECTURE FOR THE CREATION, CONTROL AND DEPLOYMENT OF SERVICES WITHIN A DISTRIBUTED COMPUTER ENVIRONMENT**

[76] Inventor: **Larry Suarez**, 240 Hillcrest Ct., Pleasant Hill, Calif. 94523

[21] Appl. No.: **691,567**

[22] Filed: **Aug. 2, 1996**

[51] **Int. Cl.**[6] **G06F 13/00**

[52] **U.S. Cl.** **395/200.32**; 395/680

[58] **Field of Search** 395/200.3, 200.31, 395/200.32, 200.33, 200.5, 200.53, 200.54, 200.55, 200.59, 610, 670, 671, 672, 684, 685, 680

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Primary Examiner—Moustafa M. Meky

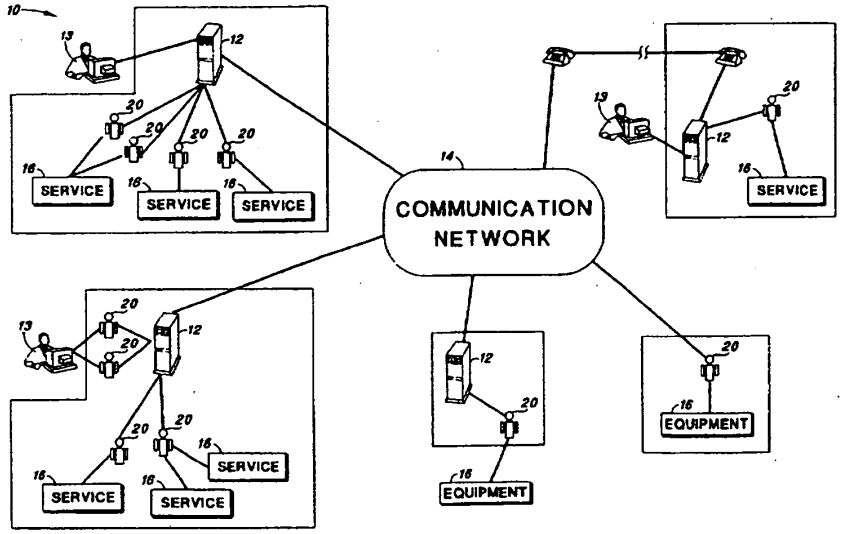
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[57] **ABSTRACT**

A distributed computing system comprising a plurality of computer hosts, a communication network for exchanging information and data between the computer hosts, and a plurality of services, including software-based services, distributed throughout the computing system is disclosed. Each of the services within the present distributed computing system, including some basic system-services are adapted to perform prescribed functions in response to the receipt of an electronic message. The disclosed distributed computing system also includes a plurality of intelligent agents executing on the computer hosts and associated with one or more of the services, wherein an agent exercises control of an associated service by manipulating the electronic messages directed to and originating from the associated service. In addition, the services are adapted to cooperatively perform various tasks by exchanging electronic messages across the communication network via their associated agents.

30 Claims, 15 Drawing Sheets

Microfiche Appendix Included
(1 Microfiche, 68 Pages)



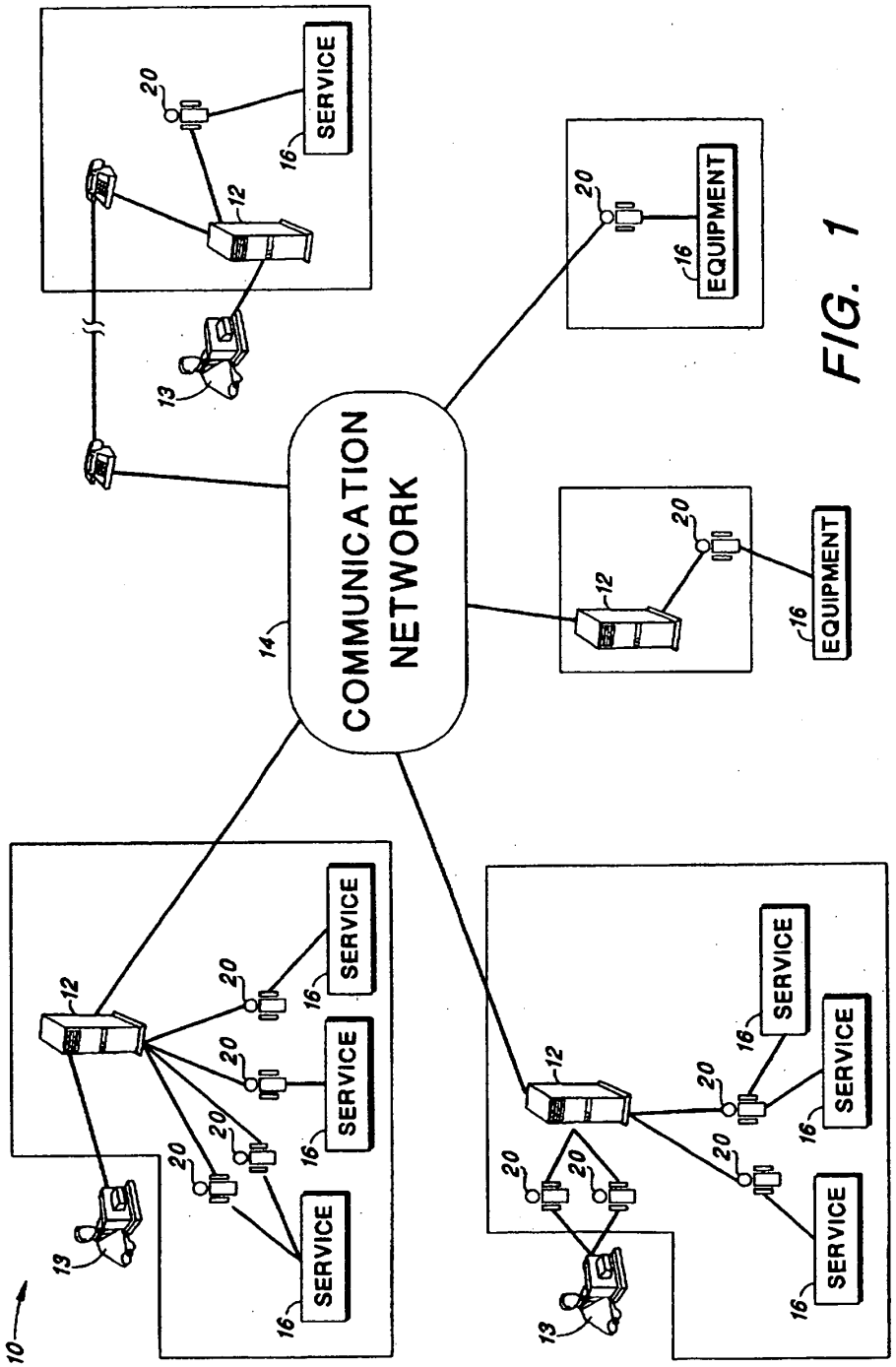


FIG. 1

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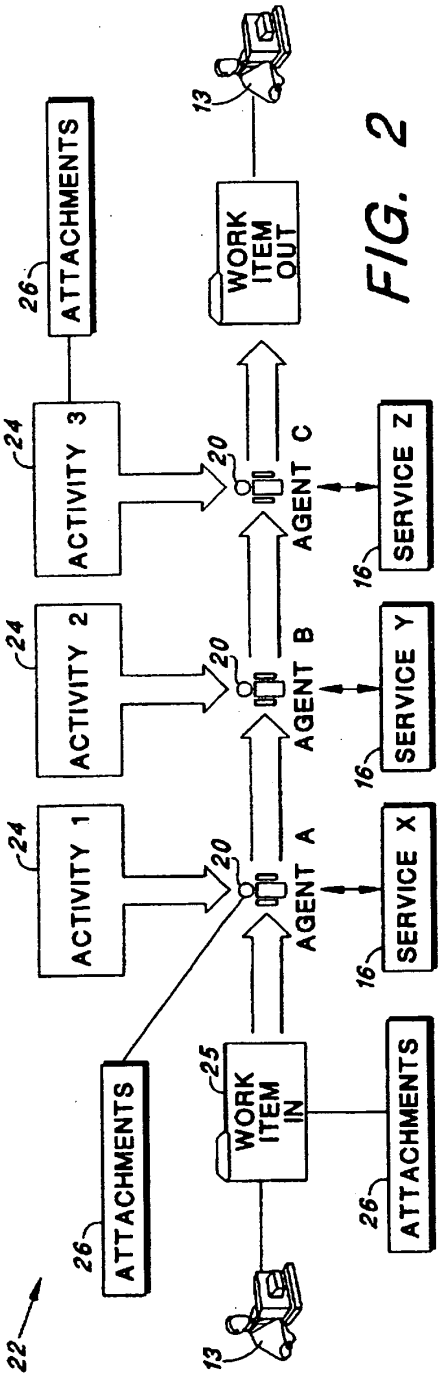


FIG. 2

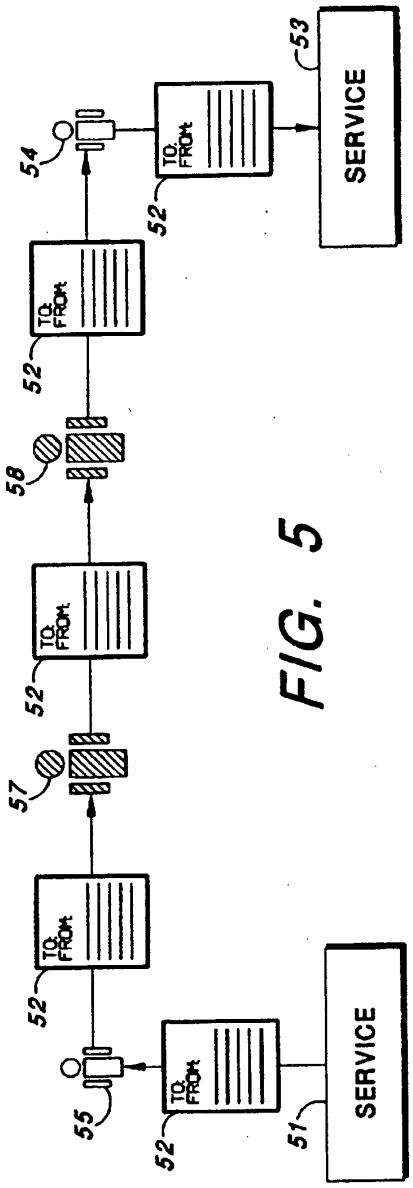


FIG. 5

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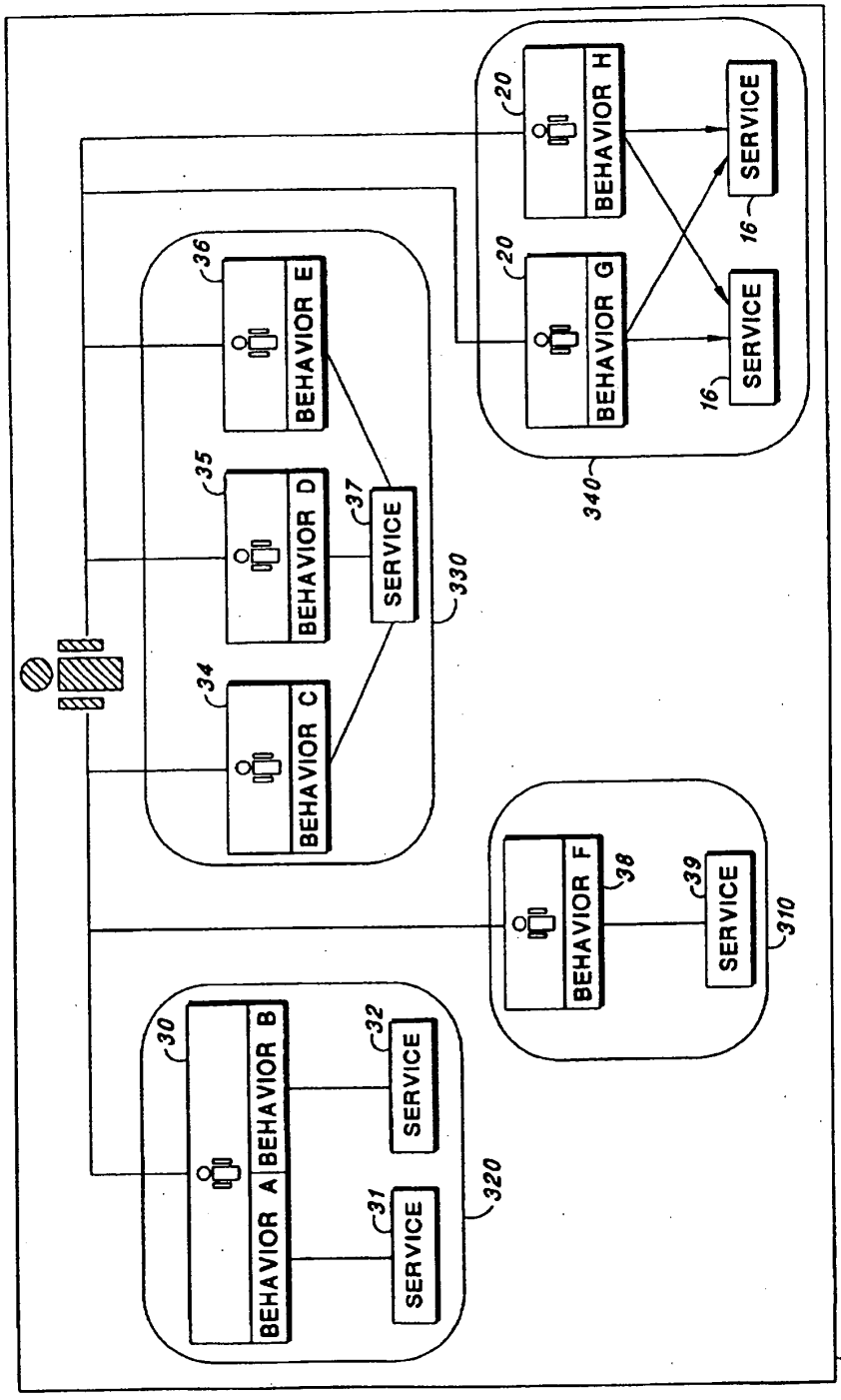


FIG. 3

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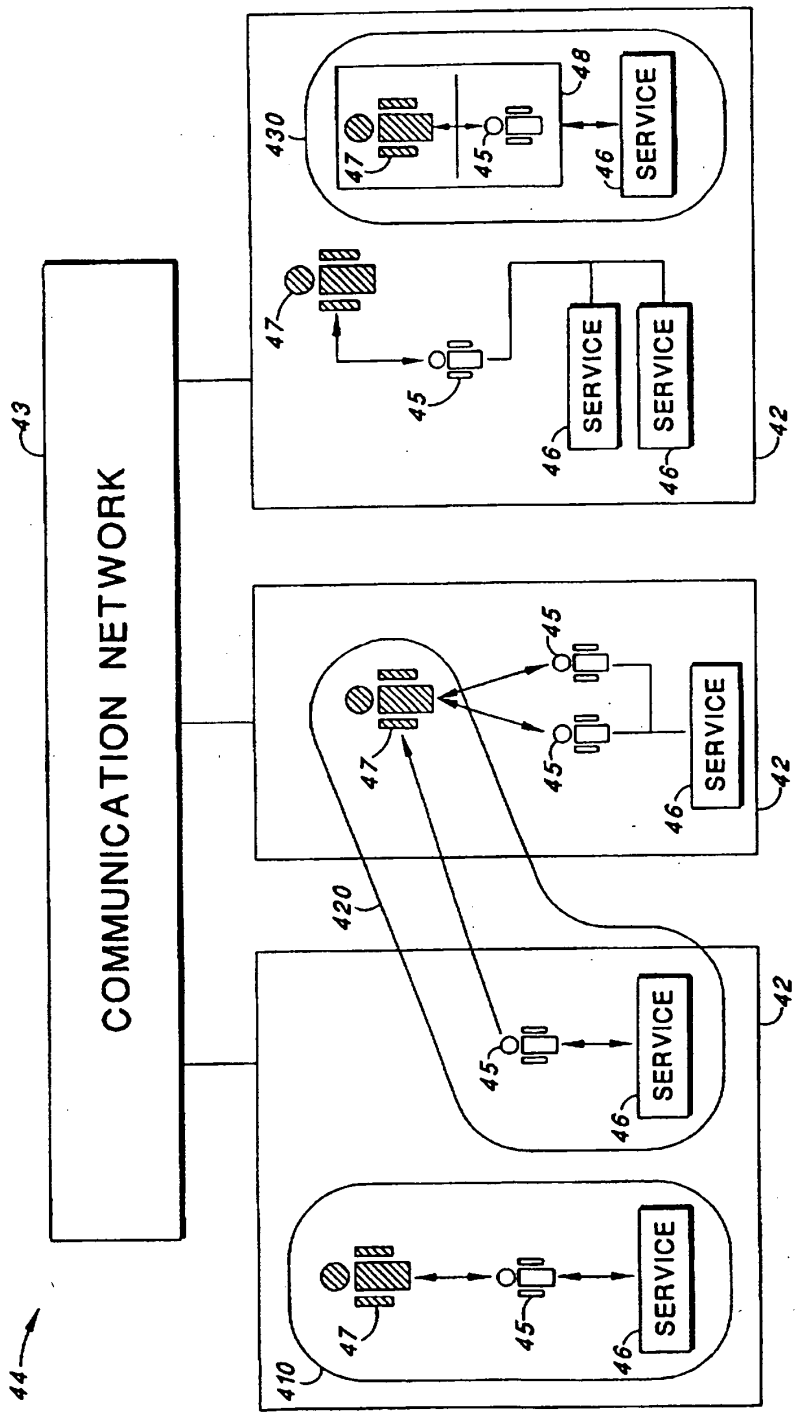


FIG. 4

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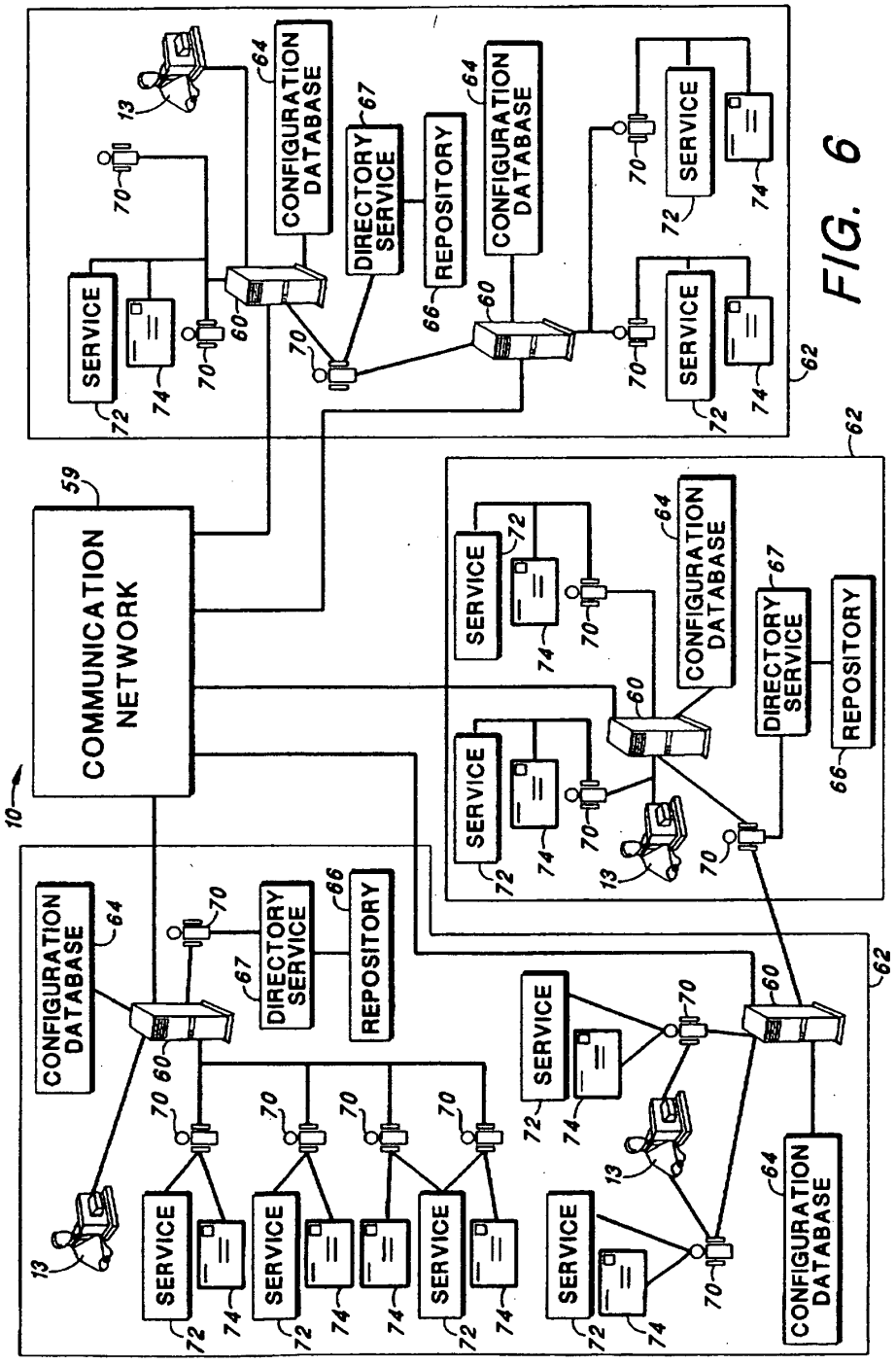
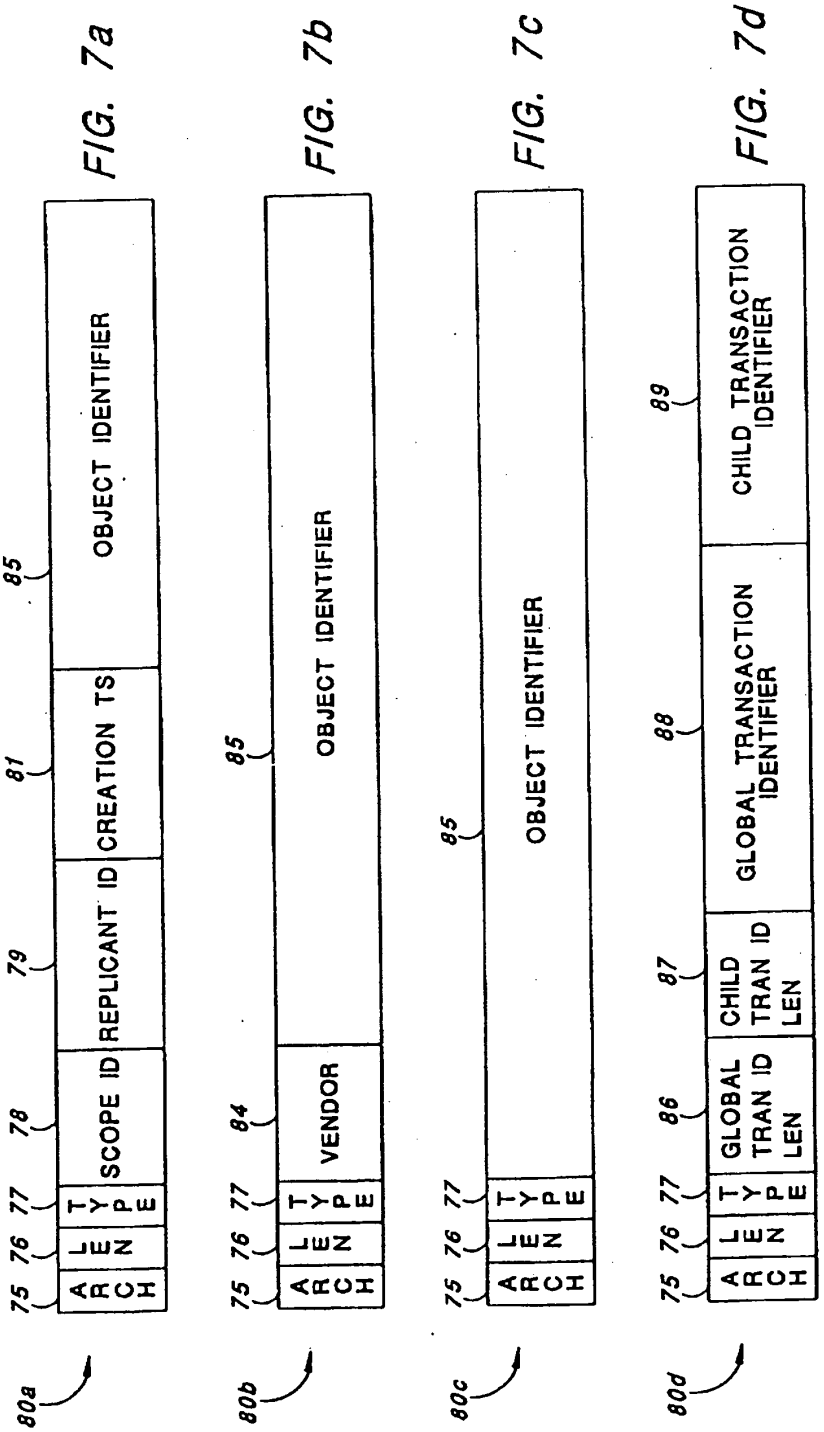


FIG. 6

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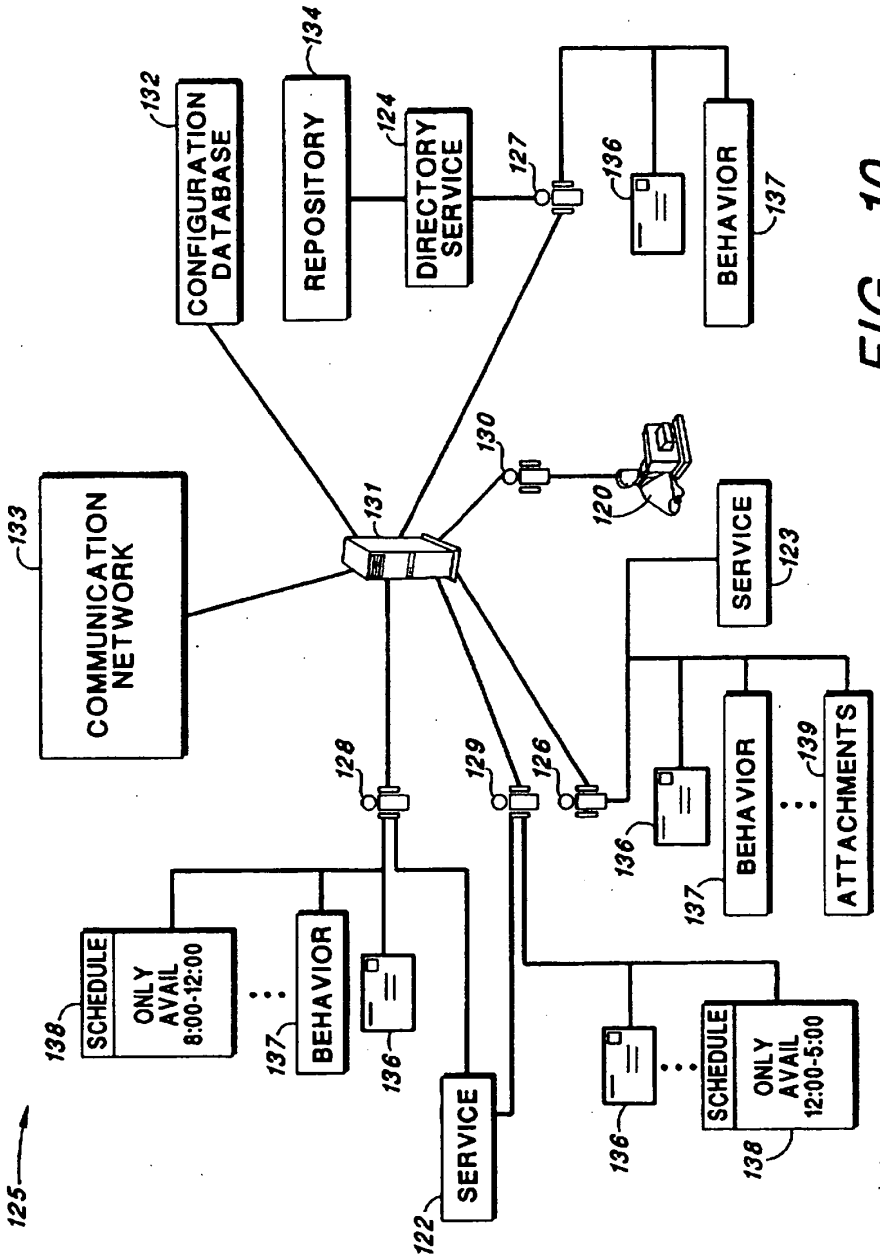


FIG. 10

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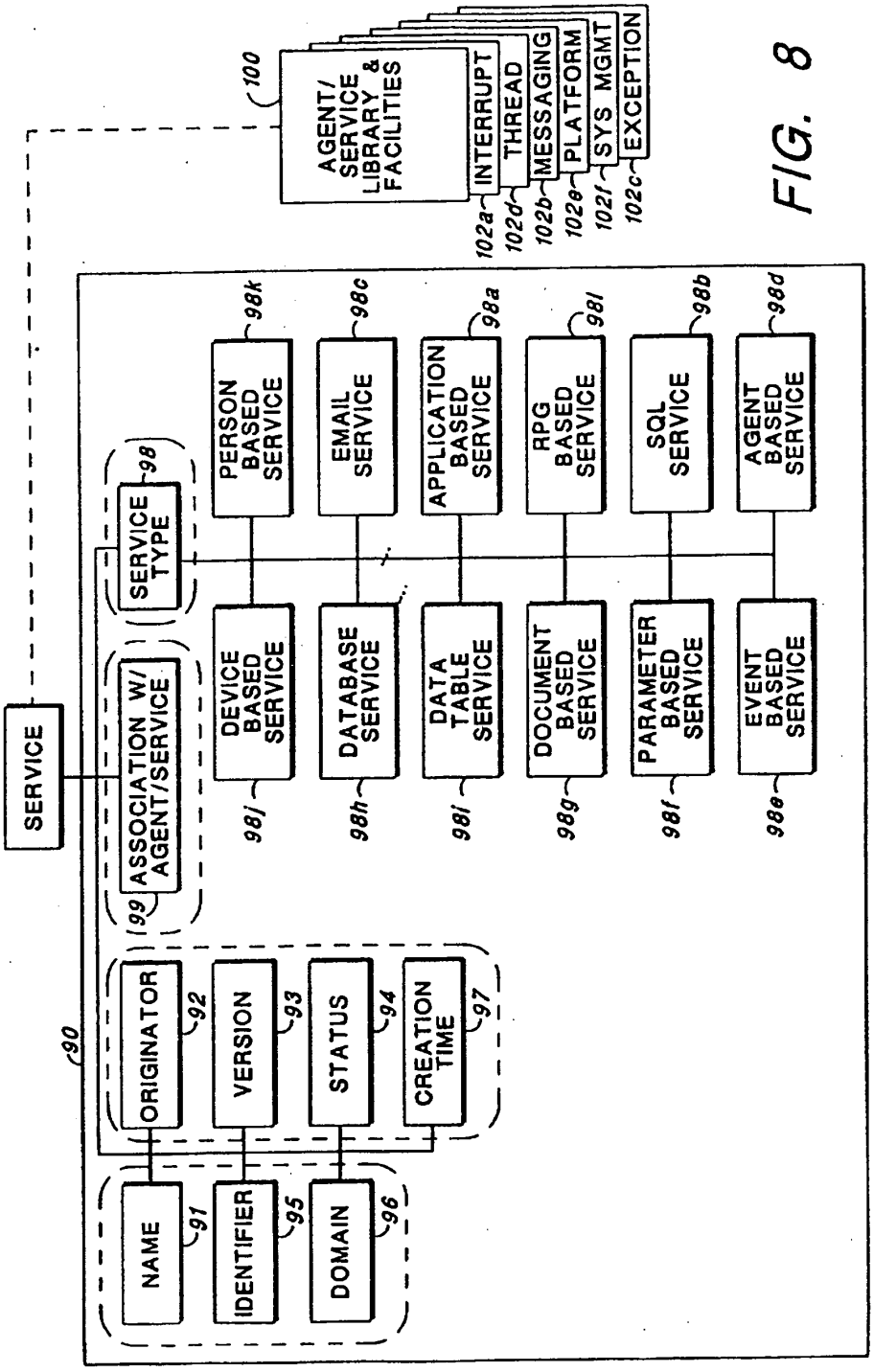


FIG. 8

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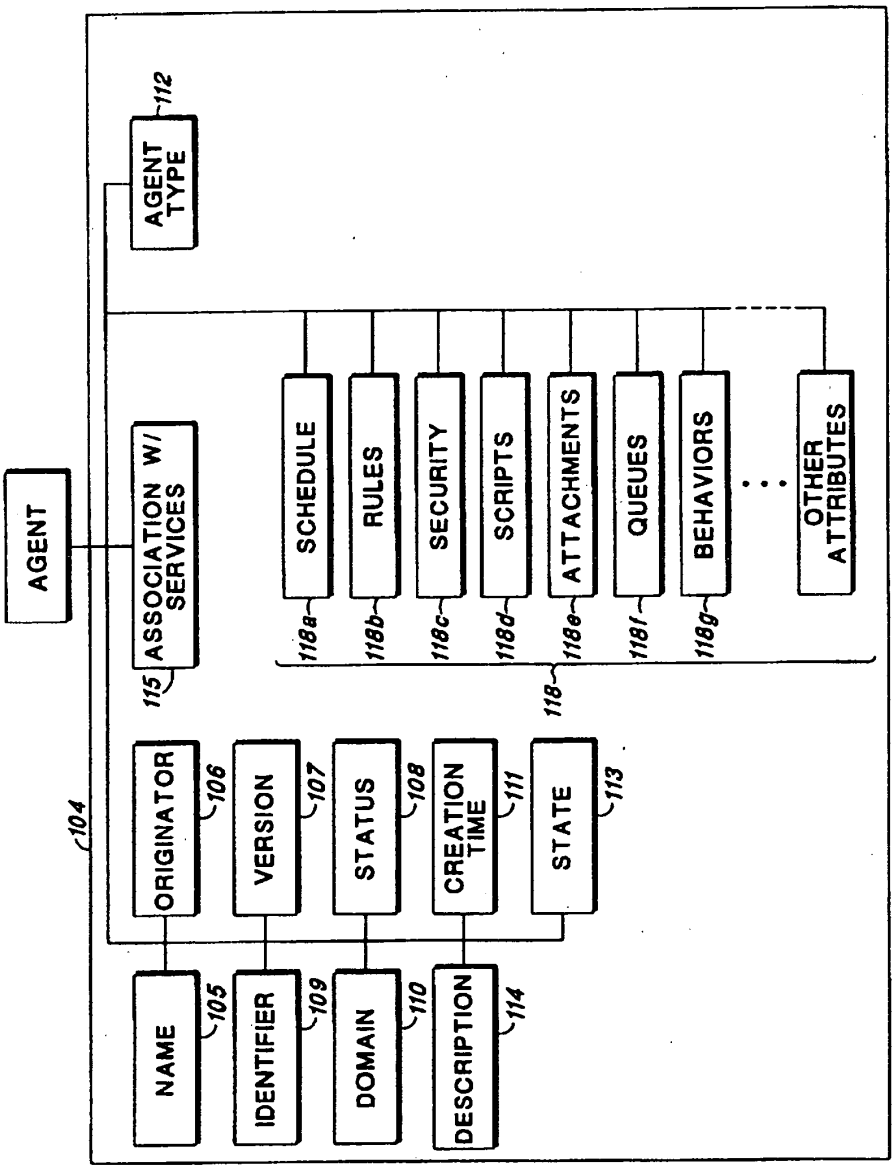


FIG. 9

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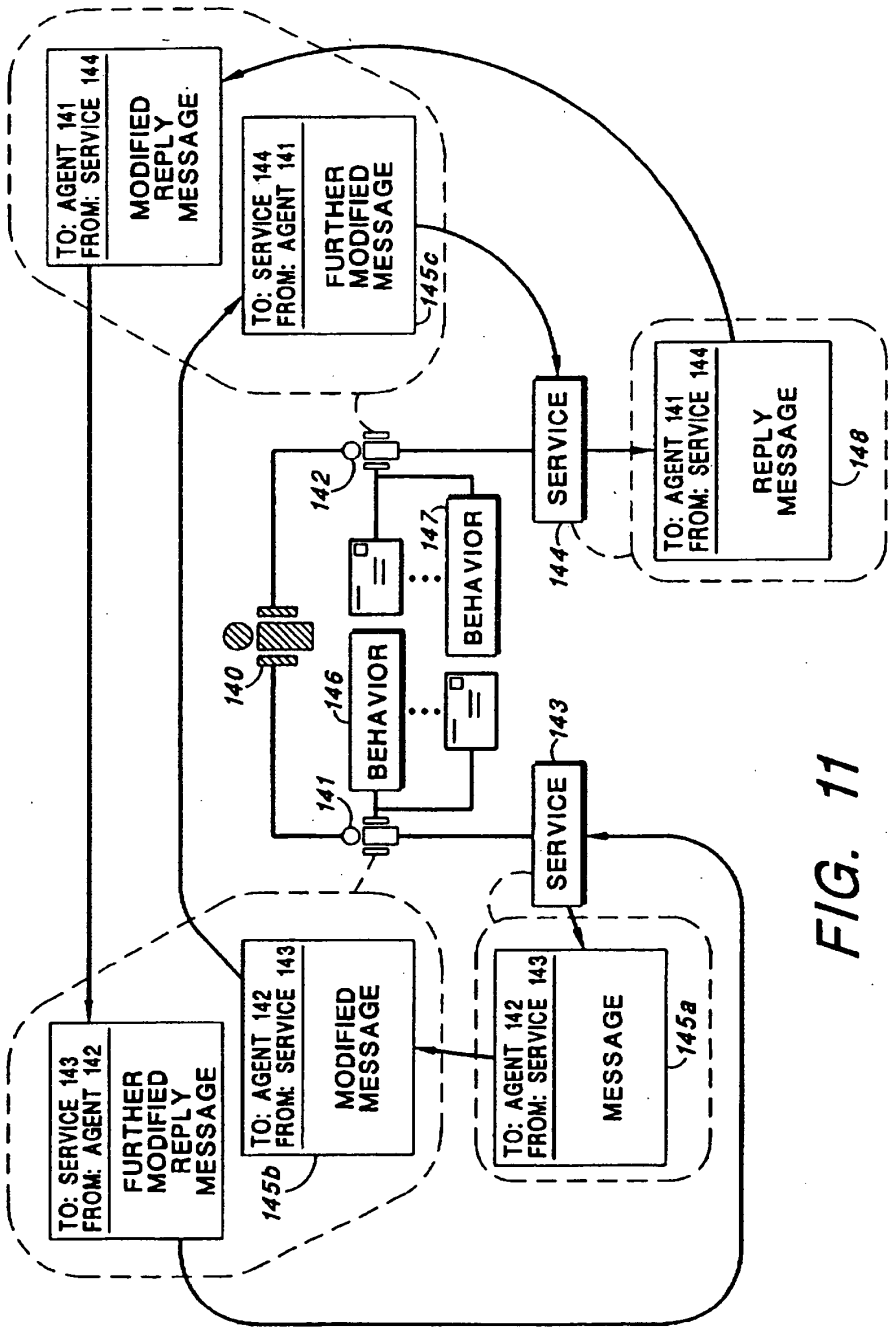


FIG. 11

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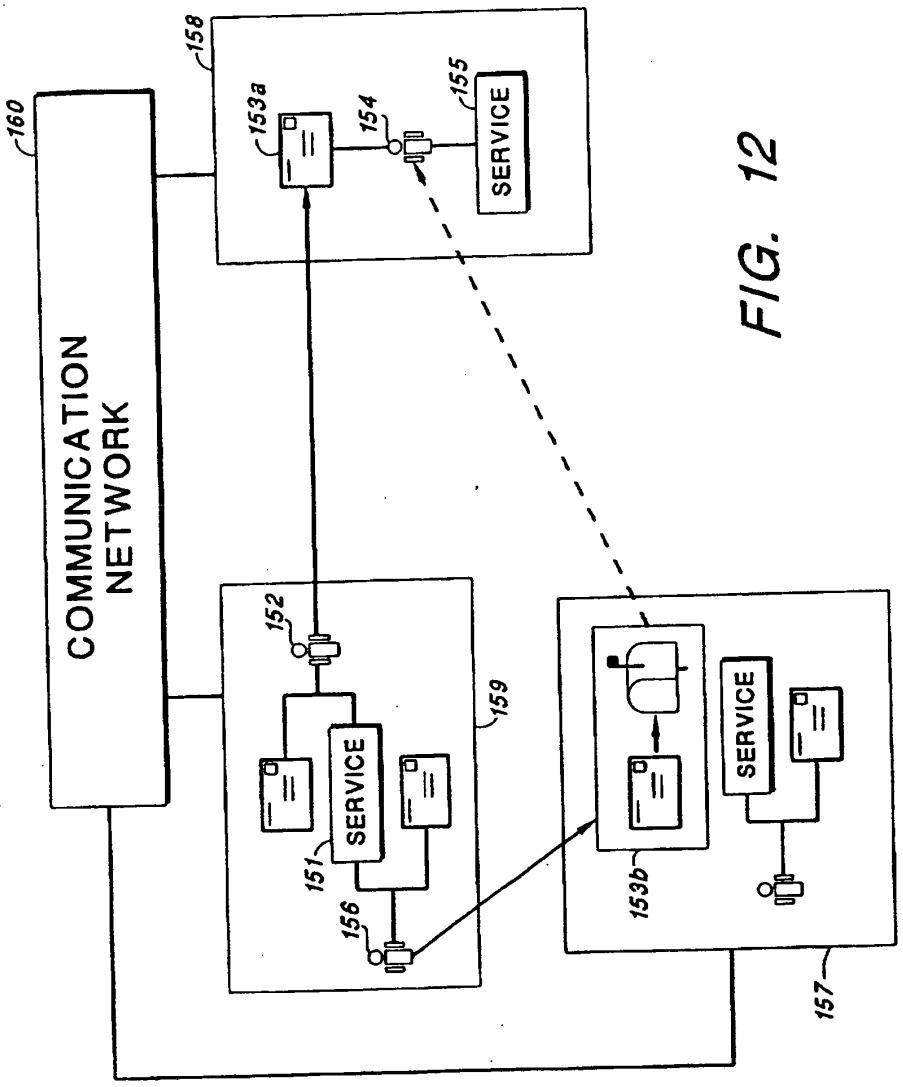


FIG. 12

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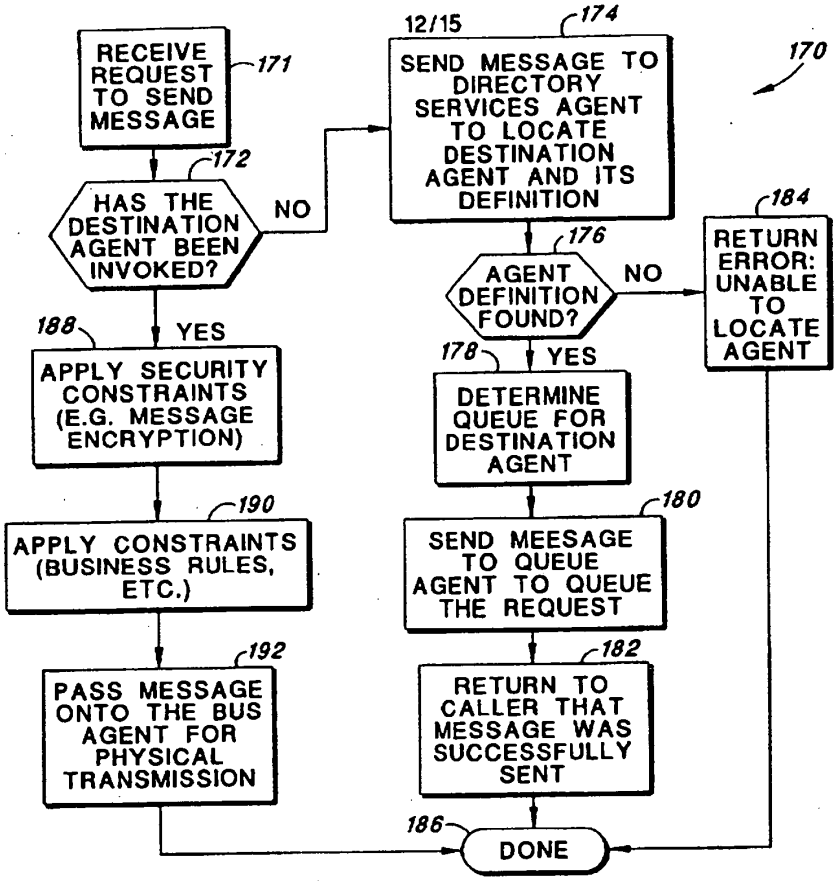


FIG. 13

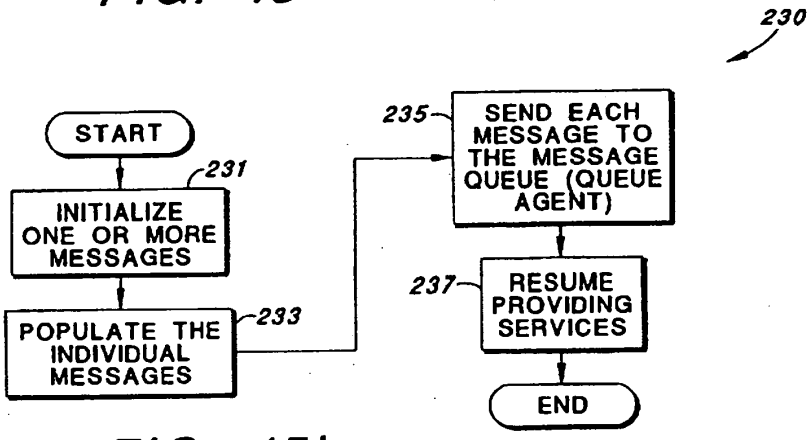


FIG. 15b

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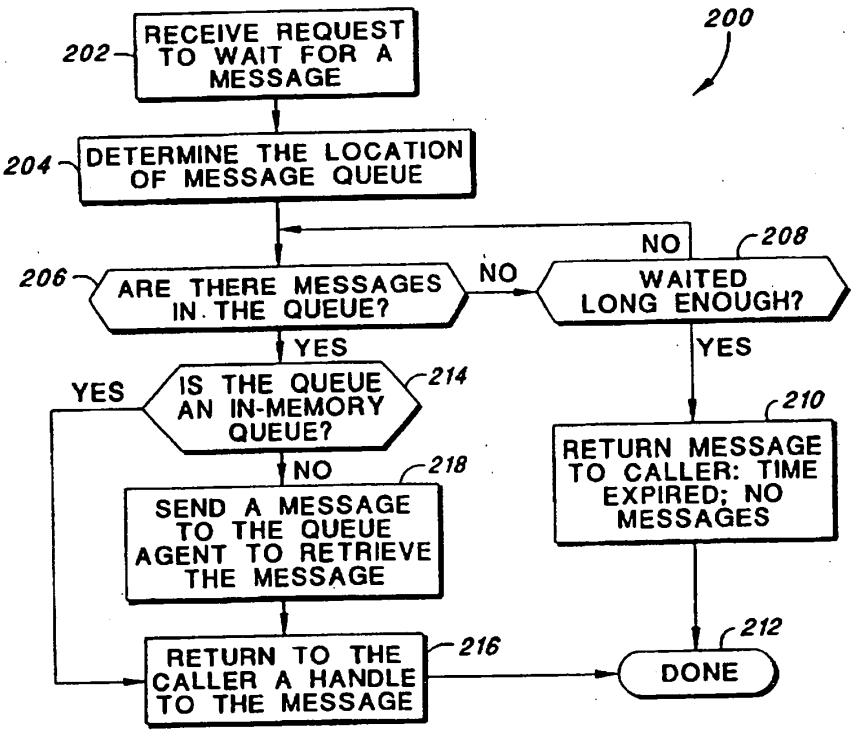


FIG. 14

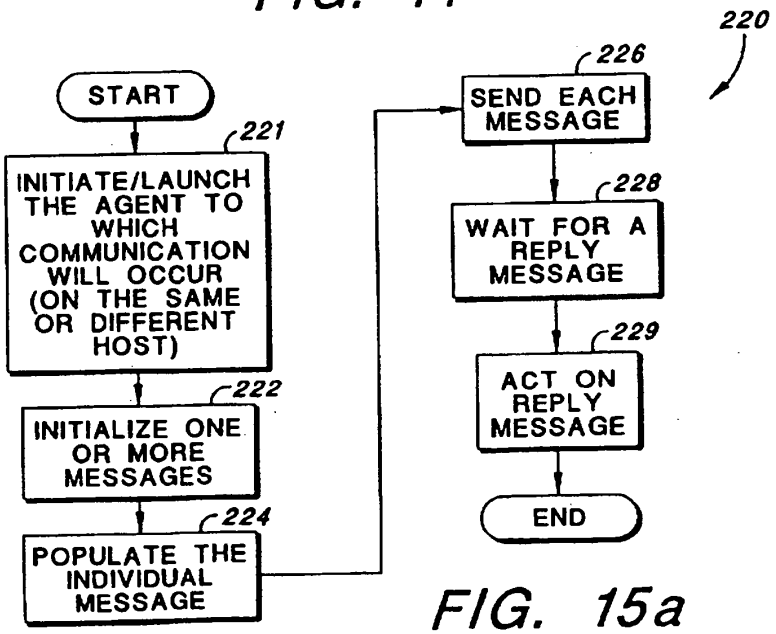


FIG. 15a

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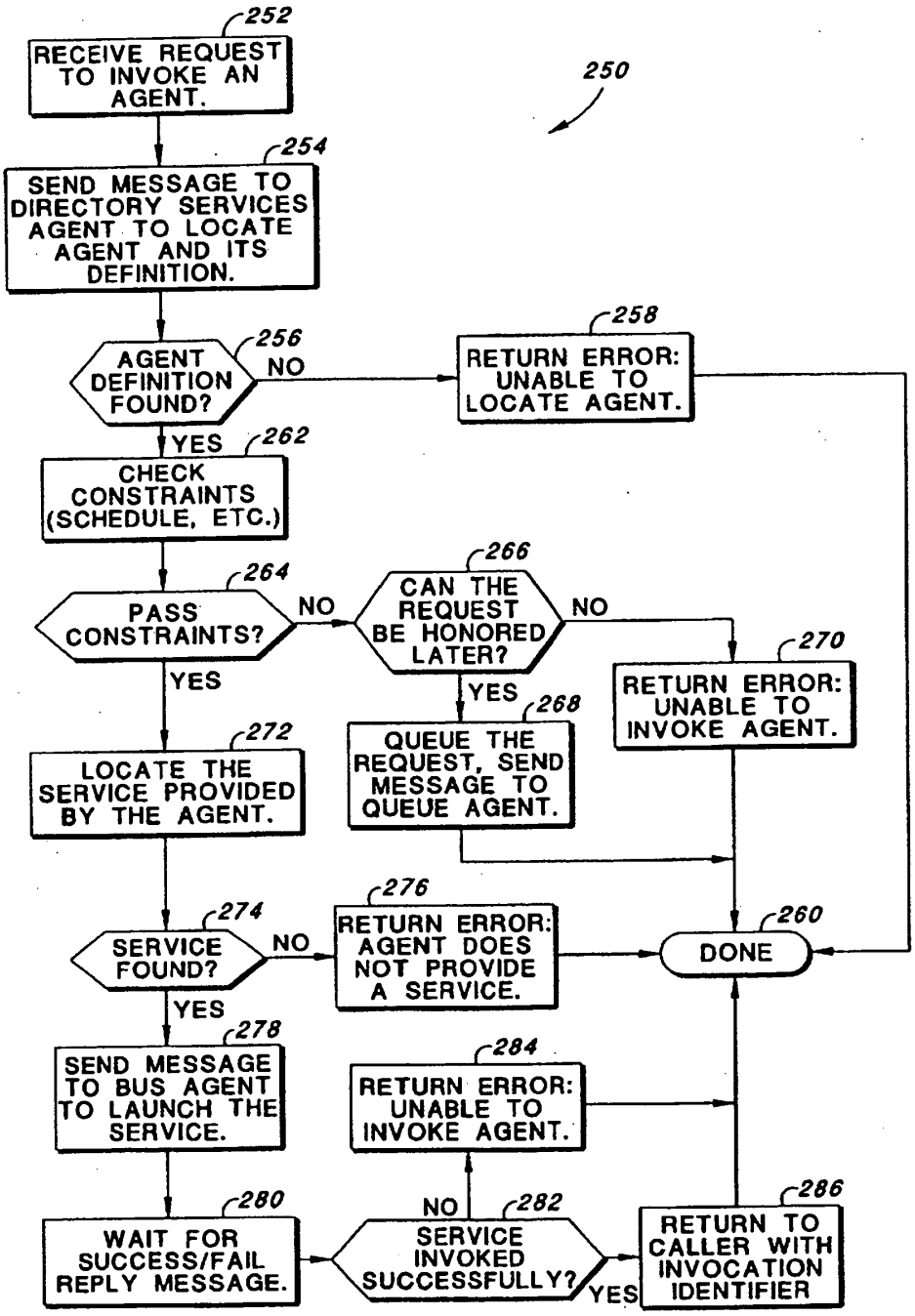


FIG. 16

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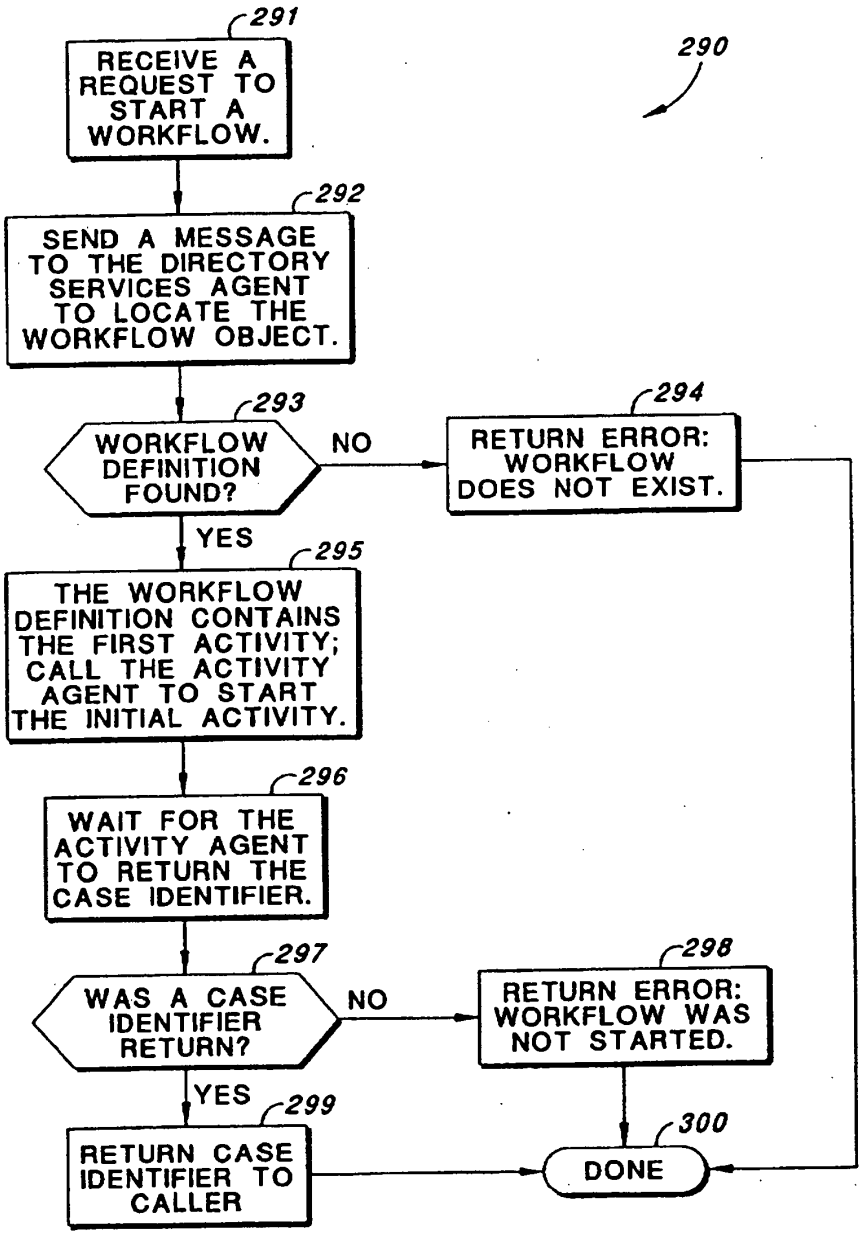


FIG. 17

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METHOD AND ARCHITECTURE FOR THE CREATION, CONTROL AND DEPLOYMENT OF SERVICES WITHIN A DISTRIBUTED COMPUTER ENVIRONMENT

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A microfiche appendix, designated as Appendix F consisting of one microfiche and of 68 frames is included as a part of the specification. All material therein is subject to copyright protection as indicated above.

FIELD OF THE INVENTION

The present invention relates to a distributed computing system utilizing intelligent agents within a service-based computing environment, and more particularly, to a method and architecture for the creation, control and deployment of services within a distributing computer environment.

BACKGROUND OF THE INVENTION

To aid in the understanding of the prior art and the problems associated therewith, it may be helpful to provide a brief overview of distributed computing environments. As used herein, a computing environment consists of a plurality of computers connected by a network which allows the computers to communicate and pass information and/or data between themselves. The network may range from a local environment, such as a local area network (LAN), to a very large and expansive network, such as a wide area networks (WAN), and many other distributed network systems. The computer environment also includes the various operating systems, storage mediums, and other processing resources which reside on these computers and that are interconnected and accessible via the network through various software products.

Further, a collection of information service systems and application systems generally embodied within software products, are also considered to be part of the computing environment. The information service systems and application systems used within any given computing environment range from commercially available software applications (e.g. spreadsheets, wordprocessors, databases) to custom developed software products tailored for a specific use within a designated computing environment.

Participants (i.e. companies, organizations, groups or individuals) can also be viewed as part of the computing environment. Generally, there are multiple types of participants associated with a distributed computing environment including application users, application developers, and system administrators. Within a distributed computing environment, the many different participants typically require access to a number of different application systems concurrently which requires the sharing of computer resources.

A dominant architecture that is receiving widespread use in many current distributed computing environments is known as the client-server architecture. Client-server architecture is a hierarchical architecture for distributed computing environments that is generally divided into two layers. One layer within the client-server architecture includes most of the application systems. Application systems include

fourth generation languages, computer aided software engineering tools, programming languages and their support tools, and various other commercially available software products. This first layer typically represents the client layer.

A second layer within the client-server architecture includes most of the information service systems. The information service systems are software products such as database management systems and data repositories, specialized data access methods, application servers, and any number of service based monolithic software systems. This second layer represents the server layer.

Recent innovations to the client-server architecture include the introduction of a third or middle layer. This third layer typically includes software products designed to provide various infrastructure or interfacing services between other components of the distributed computing environment such as between an application system and an information service system. Such software products are classified as middleware products or systems. A recent term for the hierarchical architecture that utilizes middleware systems is a three-tier system or multi-tier system architecture, where the middleware system consists of software products, applications and services that had previously existed either in the client layer or server layer. Three-tier or multi-tier layers are well known in the art.

Another increasingly popular distributed computing environment architecture is the peer-to-peer architecture. A peer-to-peer architecture provide any number of peers or service providers while removing some of the constraints imposed by a traditional client-server or other hierarchical architecture. Within a peer-to-peer system architecture, each peer provides one or more services and is able to cooperate and collaborate with fellow peers as services need to be performed concurrently or sequentially.

An inherent limitation in many client-server architecture systems is that as the size of various application systems become larger, more encompassing, more complex, and use more computing resources, the performance of the entire computing environment suffers. Monolithic systems or single software packages operating across different tiers or among various peers are rapidly becoming unable to support complex tasks because the shear size of software (i.e. total number of lines of code) necessary to run the system and the lack of necessary features. Moreover, it is readily apparent that many participants are transitioning toward desktop computing environments with an increasing number of individual users. It is often difficult, if not impossible, for large information service system or application systems to run on a single desktop computer host because of the large usage of computing resources such as memory and disk space. In addition, because application systems and information service systems are being accessed by a large number of participants, numerous contention problems and priority problems arise which in turn affects the perceived performance of the overall system. Another problem with many conventional client-server architecture systems is that they are not designed to be inherently fault-tolerant. For example, unless the computing system is designed with complete redundancy, all participants are typically affected if the server becomes unavailable due to a system failure.

The related art has addressed the problem of application systems becoming too large through the partitioning of applications as taught, for example, in the U.S. Pat. No. 5,457,797 (Butterworth), and U.S. Pat. No. 5,212,790 (Ohler). While these U.S. patents by no means represent the only form of partitioning schemes available for large appli-

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cations and application systems, they are generally representative of the conventional concept of partitioning a software base application.

Specifically, U.S. Pat. No. 5,457,797 (Butterworth) discloses a method of partitioning an application program into a plurality of objects, with selected objects being capable of executing on a different classes of computer. Disadvantageously, the partitions of an application system into such objects as disclosed in U.S. Pat. No. 5,457,797 and many other related art references are comprised of only software modules. Thus, such partitioning schemes are limited in their use to software applications only. However, as described below, advanced applications systems are involving not only conventional software applications, but also individuals, software fragments that are under the control of vendor systems such as database systems storage procedures, and even physical components such as medical monitoring devices, office equipment and the like. Furthermore, most of the related art partitioning schemes typically impose a number of rules or artificial constraints in the variation of partitions.

Several other examples of related art partitioning schemes include those schemes disclosed in U.S. Pat. Nos. 5,386,568 (Wold), 5,369,765 (Collete), and 5,257,369 (Skeen). These related art references teach techniques for partitioning software modules in very specific manners. Again, the partitioning schemes disclosed within these other examples of related art references, are limited in that they can only be used with conventional software based applications or application systems and are not suitable for use with advance or next generation application systems that include both software and other application technologies.

As application systems and information service systems are requested to accomplish more difficult tasks, the assumption that a single monolithic application must carry the burden of those tasks is too much to ask. Large software applications and large repositories of data, even when partitioned, are expensive to develop, test and maintain. It is much simpler and more cost effective to develop a autonomous, small software components of an application and allow those small components to communicate with one another to complete a large task and to standardize the information resulting from that task. Smaller cohesive services such as these are easier to develop, test, use and maintain than their large counterparts. Thus, there is an increasing move away from data driven solutions using large software applications toward process driven solutions using a collection of smaller cohesive services. For good reason, the conventional client-server architecture typically includes various applications in the client layer while the data repositories and data management systems typically reside in the server layer. It is believed that the next generation of applications will still need to access this data, however, it will be predominantly involve process driven solutions where pieces of applications or services cooperate to complete complex tasks.

Another common problem existing in client-server architecture systems and some existing peer-to-peer architecture systems is that users are finding themselves with a number of distinct application systems and information service systems resulting from the adoption of technology at different paces by participants, consolidation of multiple participants through company mergers, or the need of participants to cooperate and collaborate. Many client-server architecture systems do not adequately support the integration of numerous existing application systems. Rather, client-server architecture systems and existing peer-to-peer architecture systems typically require migration to a set of uniform application systems to make efficient use of the information service systems. Such migration often sacrifices performance of some aspects of the computing system and further creates a general reluctance on the part of participants to adopt new technology.

The reluctance to adopt new technology and make improvements to existing application systems results in a the existence of legacy applications (i.e. earlier revisions of established software products). These legacy applications represent a major obstacle in the evolution of the information industry. Moreover, there is a reluctance on the part of system administrators to evolve their computing environments to utilize current language systems, preferring to remain with systems in which most existing users and developers are comfortable. Accordingly, any new distributed computing environment must address the continuing need of users and developers to access and support legacy applications many of which will never migrate to new and current language systems.

Even where migration is a feasible alternative, the migration will preferably be towards an open computing environment. It is presently unrealistic and unreasonable to require the development of new software based applications or services in a proprietary language or proprietary system. System administrators typically prefer to maintain a flexible and open environment to avoid developing what may one day be considered a legacy application. Moreover, avoiding proprietary languages and proprietary systems in the development of software-based services makes economic sense in that there are many different software and hardware vendors competing within the information industry, which tends to lower the cost associated with the development, operation, and maintenance of the computing environment.

Another trend that is becoming readily apparent within the information industry is that many new application systems are not merely a piece of software executing in a computer environment. Application systems can and do entail a number of various technologies and various computer resources to be effective. The next generation of applications consist of distributed services that are able to cooperate and collaborate to accomplish complex tasks. These advanced application systems merely require users or other participants to describe relationships between services through a set of business rules and/or classic workflow features.

Another requirement of many present application systems operating in a distributed computer environment is a need to provide fault tolerant capabilities. Fault tolerant capabilities include the ability for an application and/or computing environment to be up and operating seven days a week, 24 hours per day and to eliminate single-point-of-failure nodes (i.e. nodes of a computing environment or application system which when unavailable affect the entire system or make the entire system unavailable).

Yet another important requirement of many present application systems operating within a distributed computing environment is scaleability. Scaleability is the ability of an application system and information service system to address computer environments that range from small (i.e., small numbers of users and computers) to very large computing environments (i.e., large numbers of users and computers) without the significant loss of efficiency. There is a growing demand for a distributed computing system architecture to incorporate such advantageous features as scaleability, fault-tolerance, support of legacy applications,

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and other features such as modeling and simulation capabilities, etc., without significantly contributing to the complexity of the computing environment and without significantly sacrificing performance of the distributed computing system.

In addition, advanced applications which incorporate various other technologies and data processing resources such as facsimile machines, document scanners, bar code readers, magnetic card readers are commonplace. Assimilating the various application technologies and computing resources into a distributed computing environment currently requires a vast amount of dedicated resources which in turn sacrifices performance and/or efficiency of the distributed computing environment. With this in mind, there is a need for a distributed computing system architecture that readily supports the addition and incorporation of such technological features without requiring an excessively large amount of dedicated resources and which does not adversely affect the performance or efficiency of other aspects of the system.

An alternative technique aimed at addressing some of the aforementioned problems arising in distributed computing environments is the application of agent technology. The notion of agents and agent technology has existed for some time in the information industry, however, there does not exist a standard definition of what an agent entails. A common perception of an agent is a software module or process that accomplishes a task, typically on behalf of a user. For example, conventional agents can filter electronic mail messages for a user based on a specific criteria to reduce the number of junk mail that a user receives. Related art disclosures, such as U.S. Pat. Nos. 5,421,013 (Smith) and 5,367,635 (Bauer) reflect the more conventional concept of an agent. However, these disclosures make little distinction, if any, between a standard software process and agents. See also U.S. Pat. No. 5,317,688 (Watson) which discloses a representation of the software-based agent whose behavior is relatively dynamic and changing as it receives instructions during execution.

Disadvantageously, the more an agent looks and functions as a customized software process, the less likely that agents will be able to cooperate with other customized agents operating within the distributed computer environment. Many of the related art agents, both static and dynamic, operating within a distributed computing environment inevitably demonstrate different behaviors and characteristics. However, because these different agents often need to cooperate with one another within the distributed computing environment to accomplish various tasks, there is a need to facilitate communication between different agents. This is especially true where the agents are associated with different application systems or services. To that end, there is a need to provide a universal or generic architecture for agents which facilitates the cooperative behavior of agents associated with different applications or services. The architecture of an agent based computing system should be independent of the environment in which it exists and independent of the application system or service which it supports.

There exist several related art middleware products that address some of the aforementioned needs. These products are primarily transaction processing monitors, messaging products, and distributed processing infrastructures. Disadvantageously, many middleware products require the acceptance of the object oriented paradigm and require the use of proprietary languages to build distributed services. Problems associated with the object oriented paradigm include the tendency for objects and their methods to be too fine grained in that they are highly focused code fragments that are relatively small in size. Distributing, invoking and maintaining fine grained methods in a network environment is expensive and difficult to administer. Conversely, the present invention is a non-proprietary based system that encourages the development of relatively, coarse services in order to reduce network traffic, reduce distribution complexities, and support alternative language systems other than object oriented systems.

SUMMARY OF THE INVENTION

The present invention satisfies the above and other needs by providing a distributed computing system comprising a plurality of computer hosts, a communication network for exchanging information and data between the computer hosts, and a plurality of services associated with the computer hosts and distributed throughout the computing system. Each of the services within the present distributed computing system are adapted to perform a prescribed function in response to the receipt of an electronic message. The present distributed computing system also includes a plurality of agents executing on the computer hosts and associated with one or more of the services, wherein an agent exercises control of an associated service by manipulating the electronic messages directed to and originating from the associated service. In addition, the services are adapted to cooperatively perform various tasks by exchanging electronic messages across the communication network via their associated agents.

The present invention takes a specialized and non-process oriented approach to agents in that an agent is assigned specifically to control services and to service behavior. In other words, an agent within the present invention, is not a static software implemented process but rather a dynamic means for controlling the services. The behavior of the agent in controlling a service is dynamic in that the agent's behavior toward a service changes over time. This dynamic behavior is an important feature of the present system which allows individual agents throughout the distributed computing environment to react to a changing computing environment.

Accordingly, one feature of the present invention is to provide a computing system that does not require the use of proprietary development language to build application services. Developers may construct service based systems that contain services that are built for a number of different vendor application development products. This feature allows an organization to leverage off both its existing development products and existing developer skills.

Another feature of the present invention is that the impact of employing a service based system is minimal on an existing computing environment, both in terms of computing resources and computing hardware requirements. The present invention is designed to support a migrating approach to moving existing computing systems toward the present architecture.

It is yet another feature of the present invention to support the distribution of services to other computing environments. Users are able to control the environment as to where the services execute, how long the service is used and access privileges to particular services.

Another aspect of the present invention is that it facilitates the use of advanced Agent technology. Advanced Agent technology allows users to intelligently control the overall behavior of the agents and its corresponding services. Users can control how, when, and where prescribed services

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execute. In addition, advanced capabilities such as method manipulations, security enforcement and transactional behavior can be governed by the agent.

The present invention also maintains information about computing resources that exist within a particular computing environment. Users can take advantage of existing computer resources to execute services. For example, host computers that have large computing resources such as disk space and memory can be used by services that are computing intensive, alternately saving the users host computer from being inundated with costly services. Another feature of the present invention is that it supports access and control of legacy applications.

The present invention can initiate legacy applications, including passing parameter data and other information to the application. Users can later migrate a legacy application to take full advantage of the present architecture or continue the user legacy application as it exists. This feature allows the invention to be introduced within an organization with little infusion costs and little interference with existing applications. Yet another feature of the present invention is that it is uniquely architecture so that only a minimum number of services are required to reside on any particular computer host. The remaining services can reside anywhere on the network where they are used more efficiently. This permits the invention to run on systems ranging from small laptops to large computer systems and mainframes. Users may already be using products and support services already provided by the present invention and would rather take advantage of their current investment. Users will be able to replace existing services with either their own services or competing services from other vendors.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other aspects, features and advantages of the present invention will be more apparent from the following, more descriptive description thereof, presented in conjunction with the following drawings, wherein:

FIG. **1** illustrates the general architecture of a competing environment incorporating the present invention showing the relationship between agents, services, computer hosts distributed across a computer network;

FIG. **2** illustrates a typical process flow and the relationship between activities and the agents and services assigned to an activity;

FIG. **3** illustrates the relationships that exist between agents and the services they provide;

FIG. **4** is a more detailed representation of the general architecture of a computing environment incorporating the present invention showing the relationship between Bus Agents, agents, and services, within a distributed computing environment;

FIG. **5** is a schematic representation of selected elements of the present invention as a message flows from an originating service to a destination service;

FIG. **6** is another more detailed representation of the architecture of the present invention showing additional features embodied therein;

FIGS. **7***a* through **7***d* depicts the different object identification formats supported by the preferred embodiment of the system;

FIG. **8** illustrates the internal structure of a service in the preferred embodiment of the present invention

FIG. **9** illustrates the internal structure of an agent in the preferred embodiment of the present invention;

FIG. **10** illustrates an example of the use of agents in controlling services, specifically in the area of time scheduling;

FIG. **11** illustrates an example of how a message is sent between services;

FIG. **12** depicts the queuing capabilities of agents within the present system by illustrating alternative techniques in which a message destined for a particular service is queued by an associated agent;

FIG. **13** is a flow chart depicting the steps involved in sending a message to a destination service;

FIG. **14** is a flow chart depicting the steps involved in receiving a message from an originating service;

FIGS. **15***a* and **15***b* illustrate the general message flow from one service to another using the various models of communication;

FIG. **16** is a flow chart depicting the steps involved in the launching or invoking an agent and associated service;

FIG. **17** is a flow chart depicting the steps involve in the starting a work flow;

Appendix F is a microfiche Appendix containing a computer listing of the system schema, the service library, and some portable definitions and structures used within the described embodiment of the distributed computing system;

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

The following description is of the best mode presently contemplated for carrying out the invention. This description is not to be taken in a limiting sense, but is made merely for the purpose of describing the general principles of the invention. The scope of the invention should be determined with reference to the claims.

Before describing the details associated with the present invention, it may be helpful to provide a general overview of the present invention coupled with an explanation of several terms used to describe the present invention.

The present invention can be characterized as a message based system operating within a distributed computing environment which supports the communication between services to accomplish tasks. A message is a formatted string of data or information that travels through the distributed computing environment. Within the present system, messages have a well-defined format to convey information. A message consists of a collection of attribute-value pairs. Each attribute-value pair consists of the name of the attribute, the data type of the attribute, the length of the attribute, security aspects of the attribute including who may access the attribute, and the value of the attribute.

The present invention, however, should not be mistaken for a system that only concerned with the communications aspect of a distributed application or distributed computing environment. Rather, the present invention is a complete system that affects all aspects of a distributed application including, communication, processing, reliability, efficiency, storage etc. The communication network supports the passing of information and data between the various computer hosts and other physical equipment. Each computer host includes an operating system, processing means for performing various services, storage means for the storage and retrieval of information, and a communication means for interfacing with other computer hosts and equipment via the communication network.

Generically speaking, a service is a unit of work. Services are typically embodied in software applications, electronic

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mail, application systems, software fragments or modules, macros, database procedures, physical actions of individuals, and operation of physical equipment. Some of the defined services provided within the computing environment are necessarily internal or system based services while many of the services provided within the computing environment are external or participant based services. Much like, related art software solutions partitioned large software applications into a series of smaller segments in accordance with a series of rules, the present system partitions the computing environment into a plurality of services yet does not impose any rules in such partitioning or derivation of services.

Agents are entities which provide and control the aforementioned services. Agents may or may not physically exist within the computing system as does a software process. Agents within the presently disclosed system are broadly classified as intelligent agents that provide both interconnectivity and services on behalf of a user or another agent with some degree of autonomy. In doing so, the agent assumes a dynamic behavior tailored to the service it provides, the process flows incorporated within the computing environment, the physical attributes of the computing environment into which it is incorporated, and specific tasks to be accomplished. Other characteristics of the agents, such as its' structure and functionality, however, are generally independent of the services they control. In this manner, the agents represent a standard architecture which facilitates cooperation and collaboration between agents associated with different hosts and various services. The services, on the other hand, are typically static. For example, services embodied within software applications or modules are mere compiled language code that change only upon modification of the source code and re-compilation. Agent behavior is preferably controlled by the environment in which it exists (virtually or physically) and does not require a scripting language to define the behavior. However, the use of interpretive scripting language to internally define agent behavior is contemplated.

Referring now to the drawings, FIG. **1** illustrates the general architecture of a computing environment incorporating the present invention **10**. The illustrated computing environment includes such traditional elements such as computer hosts **12**, users **13**, and a communication network **14** but does so within an architecture that further includes a plurality of defined services **16**, and a plurality of agents **20** adapted to dynamically control such services **16**. The illustrated communication network **14** may be comprised of a local area network (LAN), wide area network (WAN), secure network, wireless communication network, satellite communication networks, direct internal connections with computer hosts, and any combination thereof.

Referring to FIGS. **1** and **2**, the illustrated computing environment, like related art computing environments, is adapted to facilitate the performance of prescribed tasks. Within the present computing environment, tasks may be accomplished in accordance with a series of well-defined processes that operate on various work items. As seen in FIG. **2**, the illustrated process flow **22** is typically comprised of one or more activities **24** which are performed on a work item **25** in a prescribed sequence. It is through the communication of defined services **16** with one another that the various processes and process flows **22** are performed and tasks are accomplished. Associated with each process or process flow **22** is a variety of other information referred to as attachments **26**. These attachments include information attributable to the overall process **22**, individual agents, individual activities **24**, and/or work item **25**. A work item **25** is a collection of data that is flowing through the distributed system (e.g., forms, invoices, etc.) and is typically associated with specific processes defined by a participating organization. The attachments **26** may include information that is static as well as dynamic information generated by the process, modified by the process, or otherwise used within the process flow **22**. A process flow **22** also typically involves or affects a plurality of users **13** and other participants and is typically adapted to operate on multiple work items concurrently.

FIG. **3** illustrates the general relationships between an agent and a service within the present system. An agent exists to provide a service and services are accessed only through agents. As seen therein, within a given computer host **12**, the agent-service relationship can exist as a one-to-one relationship (block **310**), a one-to-many relationship (block **320**), a many-to-one relationship (block **330**), or a many-to-many relationship (block **340**). In other words, an agent may provide more than one service and a service **16** may be provided by more than one agent. Where an agent provides more than one service (block **320**), the agent's behavior is dependent on the service it is providing. Some typical behaviors include monitoring the service, encrypting outgoing messages, etc. In FIG. **3**, agent **30** is providing services **31** and **32**. When providing service **31**, agent **30** may need to duplicate all incoming and outgoing messages to a designated agent (behavior A), whereas when providing service **32**, outgoing messages are encrypted (behavior B). Where a service is provided by more than one agent (block **330**), each agent is said to have a different view of the service it provides. For example, each of the three agents **34**, **35**, **36** providing service **37** in FIG. **3** may exhibit a different behavior when providing service **37**. For example, service **37** provided by agent **34** may only be available during regular business hours whereas the same service **37** when provided by agent **35** or agent **36** are available **24** hours a day. Block **310** of FIG. **3** also illustrates a one-to-one relationship between agent **38** and service **39**.

Referring now to FIG. **4**, there is shown a collection of computer hosts **42** connected to each other and communicating via a communication network **43**. The total collection of computer hosts **42** together with the operating systems, communication means, processing means, storage means, and other computing facilities, as well as the communication network **43**, and processes executing on the computer hosts **42** is the computing environment **44**. Also included in the computing environment **44** is a plurality of agents **45** and services **46**, which, in the illustrated embodiment, are present on the computer hosts **42**. Each agent **45** and associated service **46** present on a host **42** is associated with a special agent called a Bus Agent **47**. Typically, the Bus Agent **47** resides on the same computer host **42** that its associated agents **45** and their services **46** are executing, although this is not an essential requirement. In the preferred embodiment, the Bus Agent **47** is actually an agent/service combination having a very specific function and having system defined associations.

FIG. **4** illustrates several possible relationships between a Bus Agent **47** and its associated agent **45**. The relationship outlined in block **410** shows agent **45** associated with Bus Agent **47** wherein both are residing and executing on the same computer host **42**. The relationship outlined in block **420** shows an alternative arrangement wherein agent **45** is associated with Bus Agent **47**, however, the agent **45** and Bus Agent **47** are executing on different computer hosts **42**. Finally, the relationship outlined in block **430** shows agent

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45 associated with Bus Agent 47 but both are embedded within the same software process 48 and hence are executing on the same computer host 42.

The task of the Bus Agent 47 is to route messages to the appropriate agents 45 under its control while simultaneously monitoring the health and status of each of the associated agents 45 and their respective services 46. Specifically, a Bus Agent 47 is adapted to detect the failure of any of its associated agents 45. In addition, Bus Agents 47 are adapted to manipulate the incoming and outgoing message flow to its associated agents 45 as well as manipulate the content of the messages. These capabilities are accomplished using various facilities (e.g. messaging facility, system management facility, etc.) that are resident in an agent library.

Referring next to FIG. 5, it is seen that by utilizing the Bus Agent, agent, and service architecture, a service never actually communicates directly with another service. Services communicate only through their corresponding agents which in turn communicate via their corresponding Bus Agents. A service identifies the destination or recipient of a message by identifying the agent corresponding to the destination service. For example, if service 51 needs to send a message 52 to service 53, service 51 indicates that the message 52 destined for agent 54 which is providing service 53. The agent 55 providing service 51 receives the message and applies all necessary semantics in accordance with its defined behavior. For example, agent 55 may need to add language to the message, change addressees, encrypt the message, etc. The Bus Agent 57 controlling agent 55 then receives the message and determines the correct destination for the message 52. The Bus Agent 57 may further manipulate the message in accordance with a prescribed behavior. Finally, Bus Agent 57 sends the message 52 to the destination Bus Agent 58. Bus Agent 58 manipulates the message and forwards it to destination agent 54, where after further manipulation, the message 52 is forwarded to the destination service 53. When service 53 ultimately receives the message 52, the originator of the message 52 is identified as agent 55 (operating under the control of Bus Agent 57), which is providing the originating service 51. In this manner messages are never sent directly from one service to another service but is always controlled through the agents and associated Bus Agents.

A major capability of the present architecture is the ability of the application system designer to place the intelligence of their systems at the most appropriate places in a distributed environment. Intelligence not only represents software application logic but also application behavior. Traditionally, the intelligence in application systems has been embedded within the software application systems thus creating large monolithic systems which are difficult to change. With the advent of sophisticated Database Management Systems (DBMS), some intelligence can be embedded within DBMS triggers and stored procedures. One of the major goals of the present invention is to allow designers to move intelligence out of their application software to more dynamic and appropriate places. This reduces the need to change static application software and allows an application software system to be used in more diverse situations.

The presently disclosed system introduces a concept referred to as "Point of Control". A Point of Control implies the ability of a designer to take control of a process at a particular point in time. Controlling a process includes: (1) controlling the messages that travel between services including changing message contents, changing message destinations, and controlling message format; (2) controlling the transactional behavior of services; (3) controlling the security aspects of services and their messages; and (4) controlling where and when services execute.

Most related art systems or infrastructures have only two Points of Control. The Points of Control within a related art system or application include when an application requests a communication with another application and when the destination application receives a communication. Even with advance messaging systems that support some form of message queuing, there are still only two Points of Control with a possible third Point of Control being the queuing facility.

The present system provides a number of additional Points of Control including agents, Bus Agents, and a queuing facility, as well as the traditional Points of Control (i.e. message sending and message receiving). Specifically, the existence of agents and agent behaviors as Points of Control provides a number of ways to control the messages and overall behavior of an aspect of the distributed computing system. As you may recall, an agent is an entity having a dynamic behavior which provides and controls designated services. The Bus Agent is responsible for monitoring the health of services executing on a host computer and processes every message originating and destined from services running the host. Another Point of Control within the present system exists within the queuing facility which is discussed in more detail below. System developers may manipulate the behavior of a message queue by limiting the number of messages within the queue, controlling the order of messages within the queue, and applying security constraints on the messages within the queue or impose similar such behaviors. Each Point of Control allows the system designer or developer to change or adapt the behavior of their systems during execution.

IDENTIFICATION OF AGENTS/SERVICES

As with any distributed computing system, there exists a need to maintain information about the existence of any services and agents as well as other objects within the computing environment. The information is stored on some persistent storage (e.g. disk) associated with a computer host and is available for retrieval at any time. Once a service and agent are registered (i.e., their existence is stored on persistent storage), the service is then available to other services and agents. In addition, certain aspects of the service and agent are also defined when registered. These attributes or aspects of the agents and services are contained within the defined structure of the agent or service. In addition to the services and agents registered with the computing system, the present computing system also maintains information about other objects such as computer hosts, system partitions or domains, users, queues and other objects or entities resident in the computing environment. The preferred embodiment of the distributed computing system maintains registration information on the following objects: Services (i.e. units of work); Agents (i.e. entities that provide and control services); Hosts (i.e. individual computers in the distributed system); Domains (i.e. defined partitions within the system); Queues (information about message queues assigned to an agent); Users (i.e. individuals who are using the system); Work Flows (i.e. information about defined work-related processes); Activities (i.e. information about the steps in a process flow); and Transitions (i.e. information about the sequencing of activities in a work flow).

A domain is a logical entity which represents an area of control or partition within the computing system. As such, it represents a segment of the computing system that is broader

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in scope than an individual agent/service combination, yet narrower in scope than the entire computing system or enterprise. Through the creation, modification, and deletion of domains, one has the ability to partition an overall enterprise into more manageable segments and provide localized services to only the domain. Hence, the implications of domain-to-domain interaction is highly controlled.

In the preferred embodiment of the system, domains are restricted to logical entities. In one embodiment of the present system, the only components of a domain are computer host systems. Thus, if an agent/service is restricted to a particular domain, then the agent may only execute on one of the computer hosts contained within that domain. A domain further defines the scope of a number of important attributes of the system including the uniqueness of object names, security space, and transaction/concurrency space. In other words, an object name or object identifier is scoped according to a particular domain and is required to be unique within a specific domain but is not guaranteed to be unique across domains.

Another important object included within the present system are the message queues. Each agent that is registered with the present system is given a queue from which to store incoming messages. The queue can take on many forms. In support of real-time programming where there are performance and time constraints, messages can be sent to a queue represented in the physical memory of the computer host containing the destination agent if the agent receiving the message is active or running. For communications which are not critical, messages are sent to persistent queues which implies that the messages are stored on disk. In the case of persistent queues, the queue of the destination agent need not reside on the same computer host on which the agent is active. In fact, the agent need not be active when the message is received. For all queues registered within the present system, the user has control over the size of the queue, the general priority of the queue, the maximum time in which a message may reside in the queue, and whether the sender is notified when the message has been queued.

Registration information may be inserted, updated or deleted at any time. All objects, including services and agents need not be registered at the same time, however, an object's registration information is needed only when the particular object is to be used. There are at least two types of system data stores contained within the present computing system, each containing various registration information. The first type is a data store called the Configuration Database which resides on each computer host accessing the system. The Configuration Database maintains information about the configuration of the computing system as it relates to the specific computer host on which the Configuration Database resides. The second type of data store is called the Repository and contains most of the registration information and may exist in numerous forms. The Repository may be distributed across the computing environment, it may be replicated across the computing environment, or it may be localized to one computer. Any service accessing the Repository does not need to know how the registration information is maintained. The registration information is accessed through a system-based service called the Directory Service. Any issues concerning the physical aspects of the Repository used to maintain the registered information, (i.e. which vendor database management system is storing the information) is consolidated within the Directory Service, which is described more fully below. All other services are unaffected by changes to the Repository. The Directory Service can be accessed by other services to create, update and delete registered information.

Turning now to FIG. 6, there is shown a more detailed schematic representation of the general architecture of the present distributed computing system **10** showing the relationship of computer hosts, domains, agents, services, and the object registration information. Specifically, FIG. **6** illustrates an embodiment of the system **10** that includes a computer network **59**, five computer hosts **60** partitioned into three domains **62**. Associated with each computer host **60** is a configuration database **64**. Each host **60** also maintains an association with the system repository **66** which distributed throughout the system. The system repository **66** is accessed through the directory service **67** via an agent **70** associated with the Directory service **67**. Some of the hosts **60** are adapted to interface with users or participants **68** while all computer hosts **60** typically include one or more agents **70**. The agents **70** are the entities which control or provide the plurality of services **72** distributed throughout the system **10**. Associated with each agent **70** is a message queue **74** which is adapted to store electronic messages.

Every object registered within the present computing system is identified using an object identifier (OID). The OID uniquely identifies any object within the entire distributed computing system. Objects can also be identified by an Alias name. The Alias name is presented as a text string while an OID is a coded byte stream.

An Alias name for a given object is an unbounded text string whose uniqueness in the distributed computing system is bounded by a defined partition or domain as well as by the object version and object status. The object version is a numerical version number of the particular object whereas the object status is a character-based identification of the level of completeness of the object. Presently, the system supports three status values including: Definition Status, Production Status and Historical Status. Additional status values can, however, be incorporated within the scope of Alias names.

When an object status within the present architecture is identified as 'Definition Status', the object is considered under construction. As such, the present computing system does not enforce certain semantics concerning the object. Likewise, when an object status is identified as 'Production Status', the object is considered as in use and is subject to strict configuration management practice. Accordingly, the present computing system ensures certain semantics are enforced when an object has a "production status". For example, an object in the production state cannot be deleted, however, it may be amended to reflect either a 'Definition Status' or 'Historical Status'. Finally, when an object status is identified as 'Historical Status', the aspects of the object, including its Alias name, are not to be manipulated.

The present system defines a particular structure of an Alias name as containing four fields including the character field 'object name', the character field 'domain' the numeric field 'version' and the character field 'status'. When the identity of an object is queried or otherwise used, only the object name field is required need be provided. The other three fields in the Alias name structure need not be specifically identified since the present computing system applies default values for the domain, version, and status when such values are not provided. When in use, the default value for domain is the domain of the agent which is trying to identify the object, whereas the default value of the object version is the highest version for that object name and the default value for object status is the 'Production Status'.

Alternatively, objects can be identified by using the OID. As indicated above, an OID is a byte stream which provides

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a means to identify and locate an actual object within the distributed computing system. An OID within the present system is a self-describing entity whose actual format depends on the object that the OID is representing. As seen in FIGS. 7*a*, 7*b*, 7*c*, and 7*d*, the four OID formats (**80***a*, **80***b*, **80***c*, and **80***d*) supported by the disclosed embodiment of the present system are shown. Each of the four OID formats **80***a*, **80***b*, **80***c*, and **80***d* contain an 'ARCH', 'LEN' and 'TYPE' field or entry wherein 'ARCH' **75** is a byte value describing the architecture that generated this OID. Knowing this will allow the present system to interpret the other fields in the OID format. In other words, the values within the OID need not be in some canonical format for interpretation. 'LEN' **76** is a two byte value describing the full length of the OID, and 'TYPE' **77** is a byte value describing the type of the OID. In addition, each of the four OID formats **80***a*, **80***b*, **80***c*, and **80***d* contain specific information. For example, the OID format **80***a* illustrated in FIG. 7*a* is a unique OID tailored for the present system. This OID format contains additional bytes identifying the scope of access to the object **78**, the scope of replication **79**, a creation time stamp **81** and an Object Identifier value **85**.

The OID format **80**b illustrated in FIG. 7*b* represents an object identifier value **85** that is defined by a particular vendor coupled with a vendor identification **84**. The OID format **80***c* illustrated in FIG. 7*c* represents an abstract OID that in addition to the 'ARCH' **75**, 'LEN' **76**, and 'TYPE' **77** entries includes only an object identifier value **85**. Finally, the OID format **80***d* illustrated in FIG. 7*d*, represents a transaction OID. In addition to the 'ARCH' **75**, 'LEN' **76** and 'TYPE' **77** fields, the transaction OID format **80***d* includes a two-byte Global Transaction Identifier Length value **86**, a two byte Child Transaction Identifier Length value **87**, followed by the Global Transaction Identifier **88** and the Child Transaction Identifier **89**.

As stated earlier, objects are those components which reside in the present distributed computing system and includes entities that are associated with or embodied in the present distributed computing system. Specifically, objects within the present distributed computing system include user-defined or market services, user-defined agents, hosts, domains, queues, participants, transitions, activities and process-flows. The list of objects further includes a plurality of system-based services and system agents which provide various important functions. Some of the more important objects, including system-based services and system agents, together with attributes associated therewith are broadly described in the paragraphs that follow.

SERVICES

As indicated above, a service is defined as a unit of work. Within the present distributed computing system, a service can be represented by many different entities, but are always associated with one or more agents. A service may be an agent (agent-based service), an executable (software-based service), an electronic mail (E-mail-based service), a person (an individualbased service), an item of equipment (equipment-based service), a database stored procedure or other software fragment (processing or RPC-based service), or a system service. Those services not viewed as a system service are also referred to as a market service. System-based services are associated with corresponding system agents, while most user-defined services are associated with one or more user defined agents.

Each of the services included within the present computing system is comprised of an internal structure to support, as a minimum, the capability to send and receive massages. Additionally, each service optionally includes additional capabilities or facilities particularly suited for that service. For example, a service represented by an individual typically needs only the facility to send and receive messages to and from other services. Likewise, equipment-based services may need the capability to not only send and receive messages, but also to log requests, perform self-tests, interrupt service performance, etc.

Each service, whether a system-based service or a market service, is associated with at least one agent and has an internal structure including one or more service-specific internal facilities. This internal structure is generically presented in FIG. **8**. As seen therein, each service within the illustrated embodiment comprises a plurality of common elements including: name **91**; originator **92**, version **93**, status **94**, identifier **95**, domain **96**, creation time **97**, type **98**, and association **99**. The types of services supported by the present system include an Application-based Service **98***a*, SQL Service **98***b*, EMail Service **98***c*, Agent-based Service **98***d*, Event-based Service **98***e*, Parameter-based Service **98***f*, Document-based Service **98***g*, Database Service **98***h*, Data Table Service **98***i*, Device-based service **98***j*, Person-based service **98***k*, and RPC-based Service **98***l*. Many other types of services can also be defined to meet the needs of the specific environment into which the present system is incorporated. Each of these different types of services also have additional specific elements unique to each type of service. For example, an Email Service **98***c* includes the additional specific elements such as Mailbox, Address, Contents. Similarly, an Applicationbased Service **98***a* includes, for example, the additional elements of Application Host, Username, Password, Path, and Application Name. An RPC-based Service **98***m* includes the additional elements of Vendor, Login Name, Database Name, Server Name, and RPC Name.

The collection of elements for each service facilitates the identification of the service (e.g. alias name, OID or similar identification tag), identification of agent associations of the service, launching of the service (i.e. making the service available for receiving messages or requests from other services), as well as other important historical information about the service.

The actual launch process depends on the type of service being launched and the behavior of the agent associated with the service. For example, launching a Application-based service implies executing the service on a defined host in the computing environment. Launching a physical device such as a heart monitor or facsimile machine implies powering and initializing the equipment. Each type of service maintains its own semantics as to what launching implies and is usually maintained within the specific elements of the service. Remember, however, that an agent associated with the service may impose additional semantics or rules with regard to launching a service. Launching a service, for example, may be time restricted or access restricted.

It should be appreciated by those persons skilled in the art that substantial modifications to the internal structure of a service can be made by combining elements, defining auxiliary elements, and quite possibly removing some non-critical elements without affecting the functionality and cooperative nature of the services, these features being central to what constitutes a service. In this manner, the present system is designed to be quite flexible in the creation of both agents and services. Advantageously, the present system does not impose harsh constraints on the type and form of the services and agents. It does, however, provide

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prescribed limitations in terms of functionality of its components and further maintains a degree of commonality between like components.

Services that need to cooperate must be able to communicate with each other. It is the internal structure **90** of each service together with some basic system facilities which allows the service to create messages, populate messages, and send and receive messages via an associated agent. Because all messages pertaining to a particular service are routed through an associated agent, the user retains the ability to define certain aspects of the messaging capabilities by modifying or defining characteristics of the agent. For example, a user can determine whether messages sent to or from the agent are to be secure and free from unauthorized manipulation or interrogation. Secure messages are typically encrypted prior to sending across a network.

Unlike most client-server systems which require that the server be running at all times even when no one is communicating with the server, services tend to be light-weight and non-state based (i.e., not maintaining memory resident state information that would be lost of the service terminated execution). In addition, a service can execute on different hosts on a per-request basis and as multiple concurrent services for reasons such as load-balancing and fault-tolerance.

Referring back to FIG. 8, when a service consists of a software application as opposed to a person, electronic mail, physical device, etc., an agent library **100** (i.e. Dynamic Link Library in desktop computing terminology) is provided. Software applications must link with the agent library **100** to convert the application into one or more services. The agent library provides a number of internal facilities **102** required to allow the newly created services to participate in the distributed computing system. The types of internal facilities **102** that resides within each software service include, for example, an Interrupt facility **102***a*, Messaging facility **102***b*, Exception facility **102***c*, Thread facility **102***d*, Platform facility **102***e*, and System Management facility **102***f*.

The Interrupt facility **102***a* provides software-based service with the ability to interrupt other services that are executing. An interruption implies stopping a service from continuing its current task and then to have the service respond accordingly to the interrupt request. The Messaging facility **102***b* provides a service with the ability to create, author, send and receive messages. The Exception facility **102***c* provides software based service with the ability to detect run-time software errors that occur. The Thread facility **102***d* provides a software based service with the ability to create and delete process threads to increase the performance of the software based service. The Platform facility **102***e* provides the software based service with the ability to execute on a number of computer platforms and operating systems. The System management facility **102***f* allows the software based service to track process execution behavior and to provide the information to another service if requested.

An important feature of the present system is the creation and deployment of a number of distributed services or facilities called system-based services. In the present embodiment, system based-services are software implemented services and, as such, utilize the agent library **100**. Each system-based service is responsible for a set of semantics that facilitate the operation of the distributed computing system. The system-based services are designed to support important and distinct distributed capabilities. The presently described embodiment of the distributed computing system includes the following system-based services: Transaction Services; Queue Services; Event Services; Audit/Logging Services; Data Services; Identity Services; Directory Services; and Workflow Services.

TRANSACTION SERVICE

One of the most important of the system-based services is the Transaction Service which provides transaction processing and concurrency services. Transaction processing provides services with the ability to define the scope of the work to be performed. Coupled with the logging facilities described later, a particular service may undo work accomplished during a transaction if a problem occurs during processing. Services generally require a number of different transaction behaviors. A specific transaction behavior implies, for example, what type of currency behavior is expected, when and how modified data is written to a persistent store, and the semantics of a transaction abort or transaction commit. Transaction behaviors identified throughtout the industry include long transactions, short transactions, nested transactions, and cooperative transactions.

Services executing within a computing environment may at times access the same information. In order to insure consistent and well-behaved changes to data, services must synchronize their access to shared data. This is typically referred to as concurrency. Concurrency is especially important within the bounds of a transaction where multiple "bits" of shared data are accessed. As was the case with transaction behavior, services typically require a number of different concurrency behaviors. Concurrency behavior is identified in the industry as either optimistic, pessimistic, or cooperative. As was the case with transaction behavior, the present computing system directly supports a number of concurrency behaviors in order to accommodate a diverse set of market segments.

Current industry service providers are finding that Management Information Systems and commercial software applications are becoming more sophisticated and encompassing a wider range of application domains (e.g. telecommunications, design, and geographical). Providing transaction services to these software applications requires facilities that are both powerful and flexible. The present embodiment of the invention provides transaction capabilities that are designed to support on-line transaction processing applications, complex data applications, and distributed cooperating applications which are briefly described in the following paragraphs.

On-line transaction processing applications include those applications which require basic transactional facilities supported by most management information systems and commercial vendors. Transactions within this domain exhibit behavior that is short in duration and satisfies the stringent requirements of atomicity, consistency, isolation, and durability (ACID).

Complex data applications include those applications which require transactional facilities dealing with complex structures such those found in telecommunications, ECAD/MCAD, and CIM. Transactions within this domain includes a mixture of both long and short transactions, transactions that require locking at a more abstract level, and transactions that generally satisfy the ACID requirements.

Distributed cooperating applications include those applications which require transaction facilities dealing with distributed, shared, and concurrent use of data. There may be

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many applications processing the same data space in response to a common goal (e.g. delivering a chip design). Transactions within this domain typically exhibit the following behavior: mixture of long and short transactions but dominated by long transactions; transactions that require locking at a more abstract level; and a varying degree of ACID requirements depending on the design structure of the user (i.e. how designs are accomplished).

Transaction services to support the above application domains can be accomplished by providing a core set of features upon which industry specific functionality can be derived. The basic features supported by the transaction service facility includes: nested transactions, serializable and non-serializable isolation behaviors; optimistic and pessimistic models of concurrency; and a restricted two-phase commit model. Moreover, the transaction capabilities of the presently described embodiment are designed to encompass many (if not all) of the features found in the most dominant transaction facilities in the industry today which include: Transarc Distributed Transaction Services; Digital DECdtm; ANSI SQL2 Transaction Features; OSF/1 Distributed Computing Environment (DCE) Transaction Services; Sybase, Oracle, Informix, ASK (Ingres); X/Open Distributed Transaction Processing Model; and Unix System Laboratories Tuxedo System. Specifically, the transaction capabilities of the preferred embodiment include: (1) Beginning transactions (i.e. begin a new root/nested transaction); (2) Committing transactions (i.e. complete an existing transaction and make permanent all changes to objects that occurred during the transaction); (3) Aborting transactions (i.e. stop an existing transaction and undo any changes that have occurred to objects during the transaction); (4) Starting transactions (i.e. start work on behalf of a transaction that was begun by another application); (5) End transactions (i.e. end work on behalf of a transaction that was begun by another application); (6) Preparing Transactions (i.e. prepare a distributed transaction prior to committing the transaction); (7) Transaction callback support (i.e. allow a user to supply a procedure to be called either directly before and immediately after the occurrence of a transaction-oriented event); (8) Dynamic Coordinator selection (i.e. dynamically change the coordinator/owner of a transaction); (9) Setting ANSI SQL2 isolation levels (i.e. set the isolation level behavior of a transaction); and (10) Setting ANSI SQL2 access modes (i.e. set the access mode behavior of a transaction).

Several important features of the transaction capabilities in the disclosed embodiment include the support of nested transactions and its accompanying locking facilities, the support of isolation levels, and support of access modes. Other features of the transaction capabilities in the disclosed embodiment include explicit initiation, transaction coordination, and transaction sharing. For example, the preferred embodiment of the invention maintains the requirement that each transaction is explicitly started by an application. Currently, there is no support for the implicit initiation of transactions as defined by the ANSI SQL89 database standards. By default, the application that begins a transaction is also said to be the coordinator of the transaction. The coordinator of a transaction is the only application that can prepare a transaction for completion or commit a transaction. In order for another application to prepare a transaction, the coordinator or the system administrator must set the other application as the coordinator. In addition, where more than one application is involved in the processing of a single transaction, the transaction is referred to as a shared transaction. The applications that participate in a shared transaction do not compete for concurrent access to objects even if the applications execute in parallel (i.e. on distinct systems), however, any application involved in a shared transaction may abort the transaction.

One of the important features of the transaction capabilities in the present invention is the support of a nested transaction. In describing the support of a nested transaction, the definition of a transaction is expanded to include the support of sub-transactions or transactions that execute within transactions. These sub-transactions are typically called nested transactions or child transactions (branch transactions in X/Open XA terminology). In addition, a child transaction may itself contain any number of its own child transactions in which first child transaction is called the parent transaction. The initial transaction is called the root or global transaction. A nested transaction maintains a unique relationship to its parent transaction and to other nested transactions associated with the root or global transaction. In the presently described system, each transaction (global and nested) is given a unique transaction identifier which is used when requesting services from the Transaction Service Facility. A transaction identifier for a nested transaction consists of the transaction identifier for the root transaction coupled with a unique transaction identifier (unique among all identifiers for nested transactions under the root transaction) for the nested transaction. The application that begins a nested transaction is considered to be the coordinator of the nested transaction. A parent transaction can successfully commit regardless of the outcome of any of its child transactions. In other words, if a child transaction aborts, the parent transaction may decide to either commit or abort. Nested transactions may commit independently. By default, nested transactions within the same global transaction share the same data space. This implies that nested transactions within a global transaction do not compete for access to objects. However, special services exist to force the competition for object access within nested transactions. The special services exist for situations where each nested transaction is being handled by distinct applications (e.g. cooperative design applications). A nested transaction may also be started in a special isolated mode in which the transaction will in fact compete for object access within the global transaction. If a child transaction commits but the its parent transaction aborts, then all updates/insertions executed by the child will be undone. In other words, a commit of a child transaction is dependent on the commits of its parent and the parents parent, etc.

Another important feature is the support of isolation levels. Isolation levels define the degree at which changes/operations are visible between concurrent transactions. Isolation levels have existed in the database arena since the early 1970s and are defined within the ANSI SQL database standards. A user is able to define the isolation behavior of transactions either globally (for a domain) or when beginning a transaction. In the present embodiment, there are four isolation levels supported by the transaction capabilities. These include Level 0, Level 1, Level 2, and Level 3. Level 0 is where the transaction essentially does not lock any accessed objects and hence all changes made by concurrently executing transactions are visible. Level 1 is where the transaction essentially does not READ lock accessed objects. This allows a transaction to read the un-committed updates of another transaction. Level 2 is where the transaction essentially un-locks accessed objects between accesses. In other words, the transaction may READ lock an accessed object but the READ lock will be released sometime during the transaction. As a result, if a transaction

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accesses an object and then re-accesses that object, there is no guarantee that the object will have the same state. Finally, Level 3 ensures serializable transactions.

The access mode defines the range of operations available to an application during a transaction. A user is able to define the access mode of a transaction either globally (for a domain) or when beginning a transaction. The two common types of access modes supported by the system include "read-only" and "read-write". As is well known in the art, the "read-only" access mode is where the transaction may only access objects and may not change an object's state. Conversely, the "read-write" access mode is where the transaction may access and change the state of an object.

QUEUE SERVICE

The Queue service provides the basic messaging capability for agents and associated services. In particular, the queue service provides distributed queues for agents. The queues are used for storing messages sent to agents for processing. A queue is also used for store and forward capabilities when an agent is not available to receive a message for reasons such as the host containing a selected service is unavailable. Within the present embodiment, queues can be created, modified, or deleted for any given agent through the use of the queue services. Moreover, it is the user who determines if an agent is to use a persistent queue or other queue (e.g., vendor-supplied queue) to store messages. A persistent queue is one in which the messages placed in that queue are stored on disk. The user can also manipulate the size of the queue, the general priority of the queue, a maximum time in which a message may reside in a queue, and whether the sender is notified when the message has been queued.

EVENT SERVICE

The Event service provides the ability to create, update, publish and subscribe to global or system defined events. The present system is constantly monitoring its environment and reacting accordingly. This is a powerful feature which allows agents, services and users to define reactions to certain events. For example, suppose that a marketing department wishes to be informed when a project has moved into the beta-testing phase. This request can be specified to the appropriate agent and service so that when the project changes to "beta-testing" mode, an electronic mail will be sent to the department making the request. These event services provides a means of describing behavior in the form of events-conditions-actions (ECAs). ECAs describe system recognized events that trigger the present system to determine if a particular event is of interest.

IDENTITY SERVICE

The Identity service provides name services to the objects within the distributed computing system. Specifically, the Identity Service supports the creation of object identifiers which are used to uniquely identify any object within the distributed computing system. The uniqueness of an identifier can be scoped according to the request of the caller. For example, a caller may need an identifier that is unique among all objects known within the distributed computing system or an identifier that is unique only to the computer host the caller is executing on. The scope of an identifier directly impacts the cost of initially allocating the identifier. Hence, a caller of the Identity Service should request a scope for the allocated identifier that reflects the intended use of the identifier.

WORKFLOW SERVICE

The Workflow service is responsible for initiating a process flow, defining activities and transitions, defining behavior of an activity, and completing the execution of a process flow. The Workflow Service provides users with the ability to execute tasks in an order defined by the user. In this manner, the workflow service allow users to automate selected business functions which in turn allows organizations to understand their processes, optimize their processes, and reduce inefficiencies.

Through the use of the above-identified system-based services, system developers can create advance service-based applications that concentrate on market-specific issues. In other words, the system-based services facilitate the development of market services that can function cooperatively with system-based services to accomplished specified tasks.

DATA SERVICE

The Data Service provides commonly utilized data management functions such as disk I/O and caching for a specific data site. Alternatively, the data services can provide its' services for an entire domain or partition. Specific capabilities of the preferred embodiment with respect to the area of data services and data migration are discussed in more detail in the paragraphs that follow.

Data residing within the distributed computing system must have the ability to be distributed anywhere within the system and replicated if necessary. Data migration, however, requires that any data elements utilized within the present system be identified by the system. Data element identification as well as data element associations and relationships are maintained within the system schema and service library. (See microfiche Appendix F) In many applications, the actual collection, storage, and dissemination of data is accomplished by selected services which are governed or controlled by one or more agents. The actual data residing within the present distributed computing system, however, is associated with selected services via attachments. Each of the selected data services within the present system should also include facilities for translating data migration requests into the underlying system calls that actually move the data to various locations.

The preferred embodiment of the present distributed computing system support is designed to two forms of data migration, namely, fragmentation and replication. The fragmentation form of data migration allows data of a certain class to be explicitly fragmented over sites within the enterprise. Replication allows copies of the data within a certain class to migrate through the enterprise.

The present system is designed to support both value based fragmentation and user specified fragmentation, both of which are generally known in the art. Value-based fragmentation is where objects are distributed according to value(s) within the object whereas User-specified fragmentation is where objects are distributed when they created or when they are explicitly migrated in accordance with well defined rules or process flows. Fragmentation is a useful feature of the present system because it allows localization of pertinent data and allows for localized interpretation of selected data. Fragmentation is also useful for load balancing, which balances data within a local environment to reduce resource contention.

The present distributed computing system also provides capabilities to replicate data of interest on sites throughout

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the distributed computing environment. Replication of data is initiated either externally by a user or internally by the system. External replication is done, for example, when a user is to be temporarily disconnected from the system. Internal replication is done in order to migrate the data closer to the source of consumption and to enhance the overall performance of the system. Replicating data to local sites (i.e. sites where data is utilized and consumed) typically provides faster access to data because access requests for replicated data will be satisfied by the most local site. Replicating data at local sites also provides data fault tolerance. If a site becomes unavailable, then the data at the particular site can be found on other sites and requests for such data are routed to the most appropriate and available site containing the replicated data. Replication of data is visible only to the system administrator who defines the replicated environment. User requests to manipulate data (i.e. access and update the data) are routed to the most appropriate site for processing without intervention by the user.

DIRECTORY SERVICE

The presently disclosed distributed computing system also provides a number of functions to retrieve information about agents, services, participants, queues, and other objects. A service called the Directory Service provides the information to other services via the messaging capabilities. The Directory Service shields the callers from the details as to how the data is stored or manipulated. In fact, the Directory Service shields the callers from all aspects of the messaging facility and reduces the manipulation of directory data to mere function calls. All data returned by the Directory Service is in the form of pre-defined data structures which are accessible to the service developer.

AUDIT/LOGGING SERVICE

The Audit/Logging service provides a variety of services which provides the ability to audit transactions or log information about transactions for either tracking, security, or recovery reasons. More specifically, logging is the ability of an agent or service to maintain a history of events on some persistent store. Logging is important in the support of transactions where the log is used at transaction abort time to understand what steps are necessary to undo previous work. For defined transactions, it is the responsibility of the agent or service to specify what information is to be logged and how that information is to be undone.

AGENTS

Services can only be accessed through an entity called an agent. Viewed another way, agents are entities which provide the service, and by doing so effectively control services. Agents are not to be viewed as conventional software process residing within the memory area within a computer host. Rather, an agent may permanently reside within a computer host or may reside there temporarily. An agent has mobility such that it may move throughout the distributed computing environment and an agent may disconnect/reconnect with the distributed computing environment. More importantly, the agents are intelligent in that they demonstrate a dynamic and autonomous behavior in providing the associated services on behalf of a user or another agent. An agent's behavior is preferably controlled both explicitly by a user or system administrator as well as implicitly. In other words, an agent's behavior is adapted to be controlled both by the computing environment in which it exists together with a particular set of user defined controls.

The internal structure **104** of an agent is viewed as containing several elements as shown in FIG. **9**. The elements defined as part of the internal structure of an agent include name **105**, originator **106**, version **107**, status **108**, identifier **109**, domain **110**, creation time **111**, type **112**, state **113**, description **114** and associations **115**. In addition each agent includes one or more auxiliary structures **118** (i.e. table structures) which provide prescribed information about the agent.

In the present embodiment of the system, there are many different auxiliary structures **118** defined for an agent. For example, an agent may include a defined structure which provides scheduling information for an agent. This scheduling structure **118***a* allows an agent to determine the scheduling constraints of its provided service such as when a service is available and how often the service is available.

There is also a Rules structure **118***b* which provides rule information for an agent which allows an agent to derive behavior based on the contents of a message or other system event.

Another agent related structure contained within the present system is a Security structure **118***c* which provides security information for an agent. The security information effects the contents of the messages coming into a service, coming out of a service and also determines access to the provided service.

Still another agent related structure contained within the present system is a scripting structure **118***d*. This structure provides script information for an agent which represents a general mechanism for programing the behavior of the agent on the provided service.

Yet another agent related structure deals with Attachments. The Attachments structure **118***e* provides attachment information for an agent which rides along with the messages that orginate from the provided service.

Two very important auxiliary structures associated with agents include an Agent Queue structure **118***f* and an Agent behavior structure **118***g*. As expected, the Agent behavior structure **118***g* consists of general behaviors associated with the agent and its service whereas the Agent Queue structure **118***f* provides queueing information for an agent including a definition of the queue assigned to the provided service.

Other agent related auxilliary structures **118** include tables containing Accounting Information, Connection Information (e.g. Disconnection and Reconnection), Resource Information, Conversation Information, Transaction Information, Transport information, Architecture Information, and, as detailed above, structures containing common and specific Service Information. All of the aforementioned structures **118** are defined in more detail in the microfiche Appendix F. Again, it should be appreciated by those persons skilled in the art that modifications to the internal structure of an agent can be made without sacrificing the advantages of the present system.

ADDITIONAL OBJECTS

The preferred embodiment of the distributed computing system also includes a variety of other objects besides agents and services. The miscellaneous objects are important elements of the present system and typically include entities such as computer hosts, users, sessions, domains, queues, process or work flows, transitions, and activities. The structure associated with most of these additional objects are identified in the system schema, and service library, attached as microfiche Appendix F.

The system schema includes the table definitions associated with agents, services, queues, domains, hosts,

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workflows, participating organizations and other aspects of the distributed computing system. The service library, on the other hand, reserves and defines system-based service names, domain names, and agent names. The service library also defines object identifier formats, object identifier codes as well as attribute handles. An attribute handle represents an object identifier for those languages which cannot handle byte streams (e.g. Microsoft Visual Basic) and thus cannot utilize true object identifiers.

More importantly, the service library provides detailed information concerning agents, services and other objects contained within the system schema and defines numerous other attributes and codes commonly used in the operation of the distributed computing system.

CONTROL OF SERVICES/AGENTS

Agents exert control over their associated services manipulating electronic messages between services. When two services are communicating with each other through messages, the services are said to be conversing or having a conversation. An agent can constrain the types of messages that might originate from the service it provides. In addition, it can constrain the types of messages that might be received from another service. This ability to control the conversations between services at a more abstract level than the service itself is extremely powerful. Controlling the conversation between services can ensure correctness of behavior, allow different conversations depending on the person who initiated the service, or ensure complete messages. Finally, the agent can augment a message from a service without having to modify the application code of the service.

There exist numerous manners in which an agent may examine or manipulate messages from its corresponding service. Specifically, an agent can return a message to the originator, re-route a message to another service or another agent, augment the content of a message, change or modify the content of a message, copy the message to another service for logging and auditing purposes, bifurcate a message into several messages, combine messages into a single message, hold a message for a definite or indefinite amount of time, or any similar form of manipulation.

Referring next to FIG. **10** which depicts an example of the use of agents in controlling services, specifically in the area of time scheduling. As illustrated in FIG. **10**, participants **120** access and invoke services **122**, **123**, **124** registered with the present computing system **125** through one or more agents **126**, **127**, **128**, **129** and **130**. This allows a service to appear to react differently depending on which agent provides the service **122** to the participant **120**. (Note that the participant is merely viewed as another service within the present computing system). The partially illustrated computing system **125** also includes a computer host **131** having a configuration database **132** attached to a computer network **133**. The illustrated system also includes a repository **134** which is accessed by the directory service **124** via its associated agent **127**. Each agent is shown with a message queue **136**, a defined behavior **137**, a schedule element **138** and/or attachments **139**. FIG. **10** shows a service **122** whose associated agents have imposed certain scheduling constraints such that the service **122** which can received messages between the hours of 8:00 and 12:00 if accessed through agent **128** but can only receive messages between the hours of 12:00 and 5:00 if accessed through agent **129**.

Agents are controlled both by the user as well as by the system itself. An individual user can exercise numerous types of control over agents including, for example, access control, execution or scheduling control, sequencing control, and control of the agent's distributed behavior. Access control includes the ability to designate which services or agents can request services from the controlled agent whereas sequencing control is the ability to determine when the agent is to provide its service (e.g. at which particular point within a defined process flow). Likewise, execution or scheduling control includes control over when and how long an agent is to execute. Finally, explicit control over an agent's distributed behavior includes determining whether an agent can provide its service anywhere in a computing environment, anywhere within a specified domain, or only at a specific site. User control is accomplished by manipulating the internal structure of the agent, including the associations, attachments and the many other attributes (See FIG. **9**).

The preferred embodiment of the computing system also provides a number of implicit controls over agents. These implicit controls support the overall goal of efficient performance throughout the entire computing environment. For example, if a service can be executed on a number of available systems, then the computer host that is impacted the least is selected to execute the service. Optionally, agents also maintain historical information about themselves in an auxiliary element which facilitates the present system to support implicit control over the agent. In particular, agents maintain information such as statistical information relating to the processing time required to execute an associated service; the frequency of requests (i.e. number of times the agent has executed within a specific time frame); and the information concerning the recent requests for services including the last service/agent to invoke or request the controlled service.

COMMUNICATION BETWEEN SERVICES/AGENTS

A central aspect of the present system is the messaging facilities within each service which supports the communication between services via the associated agents to accomplish specified tasks. FIG. **11** illustrates an example of how a message is sent between services.

In FIG. **11**, a computer host is shown containing a Bus Agent **140**, two agents **141**, **142** and their corresponding services **143**, **144**. As indicated above, services communicate only through corresponding agents which in turn communicate via their corresponding Bus Agents. As seen therein, service **143** identifies the destination or recipient of a message **145***a* by identifying the agent **142** corresponding to the destination service **144**. (Note that although the Bus Agent(s) **140** is also involved in the communication path between services, reference to the Bus Agent(s) **140** is omitted for clarity). The originating agent **141** is free to manipulate the original message **145***a* in accordance with a defined behavior **146**. The manipulated message **145***b* is then physically delivered from the originating agent **141** to the destination agent **142**. The destination agent **142** then further manipulates the electronic message **145***b*, in accordance with it's defined behavior **147**. As part of the defined behavior, the destination agent **142** changes or modifies the incoming message **145***b* such that the originator of the message is now identified as the agent **141** corresponding to the originating service **143**. The destination agent **142** then forwards the modified message **145***c* to the destination service **144**. Any replies **148** to the original message is then addressed to the originating agent **141** since the destination service **144** believes that agent **141** to be the originator of the message. In this manner the message path is never directly from one service to another service but is always controlled through the agents.

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Although there are a number of components and independent steps involved, the invoking of agents and communication between services runs comparatively fast. Moreover, in any service to service communication within the present invention there are at least four opportunities where control over message flow, message content and message destination are applied. These four additional points of control include the requesting service's agent, the Bus Agent associated with the requesting service's agent; the receiving service's agent; and the Bus Agent associated with the receiving agent. Furthermore, each of these points of control are adapted to demonstrate a different behavior such that the services appear to dynamically interact with one another.

Turning next to FIG. **12**, any message destined for an agent could be delivered in two ways. The message originating from service could be delivered from the originating agent **152** directly to a memory resident queue **153***a* for immediate consumption and manipulation by the destination agent **154** after which it is forwarded to the destination service **155**. The message could also be delivered from an agent **156** associated with the originating service **151** to a persistent queue **153***b* (sometimes known as a mailbox) for consumption and manipulation by the destination agent **154** at some later date. As seen in FIG. **12**, the persistent queue **153***b* may actually reside on a different host **157** than the host **158** on which the destination agent **154** resides or the host **159** on which the originating agent **156** resides so long as the hosts are connected to the communication network **160**. An originating service **151** that sends an electronic message to another service **155** is not concerned with where and how the message will be delivered. The destination agent **154** has its queue already defined as either being memory resident queue **153***a* or a persistent queue **153***b*. Hence, when addressing the message to a specific destination agent **154**, the destination queue is already determined.

Services are able to communicate through a messaging facility provided by an agent library and service library. The message facility provides an electronic mail-like service in which an agent sends a message to a recipient(s) (i.e. another service). The present system ensures that a message, once sent, will arrive at its destination. In addition, the present invention insures that if the message is fragmented, which is the case for large messages traveling through a LAN or WAN, the fragments will arrive in the correct order or at least appear that way to the recipient. In essence, this behavior mirrors some of the behavior of the TCP/IP connection-based network interface without the additional capabilities and expense of full TCP/IP support.

Turning now to FIGS. **13** and **14**, there is shown overly simplified flow charts of the messaging capabilities of the present invention with each step being generally represented by a block and corresponding reference numeral. FIG. **13** illustrates the steps involved in sending a message to a destination service **170**. The depicted process starts when a requesting service receives a request to send a message (block **171**) to another service (i.e. destination service). The next step is to determine whether the destination agent has been invoked (block **172**). If not, (NO branch of block **172**), the next step is to send a message to the Directory Service's Agent requesting that the Directory Service locate the destination agent and the destination agent's definition (block **174**). If the destination agent and it's definition are found (YES branch of block **176**), one must determine and locate the queue for the destination agent (block **178**). Since the destination agent is not invoked, the next step is to send the original message to the Queue Agent requesting the Queue Service to queue the message (block **180**). Once queued, another message is sent to the originating service (via the originating agent) the original message was successfully sent and the send message operation ends (block **182**). If, however, the destination agent and its definition are not located (NO branch of block **176**), an error message is returned to the originating service (via the originating agent) that the destination agent was not located (block **184**) after which the send message operation ends (block **186**).

Finally, where the destination agent is already invoked (YES branch of block **172**), security constraints are applied by the originating agent (block **188**). The originating agent then proceeds to manipulate the content of the message in accordance with prescribed rules and defined behaviors (block **190**). Once the manipulation is complete, the message is forwarded to the Bus Agent (block **192**) for further manipulation and physical transmission of the message to the destination service (via the destination agent) which completes the send message operation (block **186**).

FIG. **14** is a flow chart illustrating the steps involved in receiving a message from an originating service **200**. The process initiates with the receipt of a request to wait for a message (block **202**). The next step is to determine the location of the message queue associated with the receiving agent (block **204**). Once located, the queue is examined to determine whether there are any messages in the queue (block **206**). If not, (NO branch of block **206**), the receiving agent waits a prescribed period of time while continually checking to see if any messages have been received in the queue (block **208**). If the receiving agent has determined that the prescribed waiting time has expired, another message is generated and returned to the caller that the waiting period has expired without having received the original message (block **210**). At this point, the process no longer waits for the message thus ending the receive message operation (block **212**). However, as soon as there are messages appearing in the queue of the receiving agent, (YES branch of block **206**), the process the determines whether the queue is an in-memory queue (block **214**) and if so, returns a message identifier to the caller designating the location of the message (block **216**). If, however, the queue is not an in-memory queue (NO branch of block **214**), a message is sent to the Queue Agent to retrieve the message (block **218**) and then proceed to return a message identifier to the caller designating the location of the message (block **216**). As soon as the message identifier is returned to the caller, the receive message operation ends (block **212**).

As seen from FIGS. **13** and **14**, the messaging capabilities of the present system employ several alternative models of communication. Basically, the present system supports both a push and pull model of communication. A requesting service can always invoke another service (destination service) and then communicate with that destination service with electronic messages. As defined above, a message is a formatted string of data or information that travels through the distributed computing system, particularly between services. This provides real-time behavior by ensuring that a message will not end up residing in a message queue for some undetermined amount of time. This type of behavior is considered push model since the requesting service is pushing the message to a destination service.

A service can also send messages to a message queue in which a recipient service can pull work out of the queue at its convenience. This type of behavior is considered a pull model since a service pulls work to do from its message queue. Each agent identified within the present system has its own message queue. The service provided by that agent

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uses the agent's queue for messaging. A message queue is merely a place where messages destined for a particular service are collected for retrieval. The present system allows the users to manipulate the behavior of a particular queue. For example, the maximum number of entries in the queue, the ordering of entries in a queue, the maximum time an entry may reside in a queue, and whether the queue is secure or not are all behaviors that are manipulated by the user.

The various models of communication are broadly depicted in FIGS. 15*a* and 15*b*. As seen therein, the messaging capabilities of the present system preferably operate on the premise that a requesting service knows, or can readily determine, the identity of the destination service to which it needs to send a message. In addition, the requesting service must further determine whether to invoke a push model of communication or a pull model of communication.

If the push model of communication is selected, the process initiates six basic steps for communication in the push model **220**. As seen in FIG. 15*a*, the first step in the push model **220** involves a service launching a destination service and corresponding agent to which communication will occur (block **221**). The destination service and corresponding agent may reside on the same or different computer. The next step is for the requesting service to initialize one or more messages (block **222**). The requesting service then populates the individual messages (block **224**) and subsequently sends each message to the destination service (block **226**). Upon receipt of the message by the destination service, the services acts on or processes the request. Concurrently, the requesting service may continue providing its service while awaiting a reply or may cease providing its service until a reply is received (block **228**). As soon as a reply is received, the requesting service acts on the reply (block **229**). The reply process is essentially another messaging process where the services reverse roles (i.e. the original requesting service is the new destination service while the original destination service is the new requesting service, although the electronic message representing the reply need not be an actual request for services).

Alternatively, FIG. 15*b* shows the four basic steps of communication in the pull model 230. Where the push model of communication is not selected, the default communication mode is the pull model. In this case, the requesting service invokes a pull model 230 of communication by initializing one or more messages having a selected destination service (block **231**). In the pull model of communication, the requesting service does not need to be aware of whether the destination service is available to receive messages or not. The requesting service then populates the individual messages (block **233**) and sends each message to the message queue corresponding to the destination agent (block **235**). As the message is sent, the requesting service continues working by providing it's services (block **237**). When available, the destination service retrieves the messages from the message queue associated with its corresponding agent and acts on the request.

APPLICATION INTERFACE

One of the primary objectives of the present computing system is to provide services to address and solve specific user defined problems. Such services are referred to as Application-based services or market services. Such market services may augment existing vendor applications by providing interconnectivity between the vendor application and other services. Market services may also be developed to perform specific tasks or functions needed by the participant. In either event, service developers require various tools in order to develop customized services and develop applications through the cooperative behavior of many services.

The present system contemplates providing many of the developers tools via a plurality of application interfaces which invoke certain capabilities of the present system. Included among these capabilities are the ability to create, modify, or delete services, agents and other objects. In addition, the present system provides application interfaces to support many different transaction capabilities, messaging capabilities, work flow capabilities, parallel processing capabilities and other capabilities commonly found in the related art distributed computing systems. A partial listing of the application interfaces, including a description, syntax, parameters, and replies are provided in Appendix G. Advantageously, the present system does not require the service developer to learn a proprietary language in order to build services. Market services are developed in whatever language the developer chooses. Developers may actually construct distributed systems which contain market services that were built from a number of different vendor products and a number of different languages but which utilizes enough basic services (i.e. system services) to allow the various market services to cooperate. In particular, the present system imposes a vendor independent messaging capability on all developed services which facilitates communication between the services to accomplish the intended tasks. More importantly, the present system is built using the same basic services provided to developers. In other words, the present system is built within itself and can be readily modified by developers to be consistent with whatever standards and requirements are necessary. For example, the preferred embodiment of the present system is built using the C programming language. If, however, a participant using such embodiment has an organizational requirement to utilize only the ADA programming language in all applications and services it develops. The present system allows developers or other users to modify or replace any number of the basic or system services with equivalent services developed in the ADA programming language, without affecting the functionality/operation of the system. In fact, the participant can maintain a system configuration developed in a number of languages.

CONFIGURING THE SYSTEM AND INVOKING AGENTS

If the system has not previously been established, the participant selects a computer host as the initial starting site. The processor within the computer host is used to merely initialize the system and is not necessarily used or viewed as a central site for the system. Once a computer host is selected, the initialization of the system begins by defining all known participants, hosts, services, agents, workflows, and other objects that are to be included in the distributed computing system. In addition, these and other participants, hosts, services, agents, and objects can be subsequently added to the system, removed from the system, or otherwise modified within the present system. Once configured, the functional operation of the present system is described as essentially including three basic processes. The basic processes include (1) invoking agents and launching the associated services; (2) cooperatively performing prescribed tasks through the sending and receiving of electronic messages between services via their associated agents; and (3) detaching agents and the associated services from the system. The prescribed tasks can be defined, for example as a workflow or can be defined and developed by individual participants as the need arises.

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FIGS. 16 and 17 are flow charts depicting the steps involved in the launching of an agent and associated service and the process of starting a workflow, respectively. As with the messaging capabilities of the present system, the process of invoking and launching objects operate on the premise that a requesting individual or service knows, or can readily determine, the identity of the workflow, agent and/or service that is to be invoked or started.

The process of invoking an agent (FIG. 16) and launching the associated service 250 begins with the receipt of a request to invoke a particular agent (block 252). The next step is to send a message to the agent associated with the Directory Service requesting that the Directory Service locate the agent to be invoked and it's definition (block 254). If the agent to be invoked and it's definition are not found (NO branch of block 256), an error message is returned indicating that the agent to be invoked was not located (block 258) and the process terminates (block 260). If, however, the agent that is to be invoked is found (YES branch of block 256), the various constraints (e.g. scheduling constraints, security constraints, etc.) must be checked (block 262). If it is determined that the request to invoke the agent violates one or more of the constraints (NO branch of block 264), a determination is made as to whether the request can be honored at a later time (block 266). If the request cannot be honored at a later time (NO branch of block 266), an error message is generated and forwarded back to the original requestor indicating that the request to invoke the identified agent is denied (block 270), at which point the process is complete (block 260). If the request can be honored at a later time (YES branch of block 266), the request to invoke the agent is sent to a queue (block 268) where the request is further processed at a later time. In other words, the original message is sent to the Queue Agent requesting the Queue Service to queue the message. Once the message is sent to the Queue Agent the invocation process is complete (block 260).

On the other hand, if it is determined that the request to invoke the agent does not violate any of the constraints (YES branch of block 264), the next step is to locate the service provided by the invoked agent (block 272). If the service is not located (NO branch of block 274), then an error message is sent back to the original requestor indicating that the invoked agent does not provide a service (block 276), at which point the process is complete (block 260). Conversely, if a service associated with the invoked agent is located (YES branch of block 274), then a message is sent to the Bus Agent controlling the invoked agent to launch the located service (block 278) and wait for a reply message (block 280). If the reply message indicates that the service was not successfully launched (NO branch of block 282), an error message is returned to the original requestor indicating that the service could not be launched (block 284) and the process ends (block 260). However, if the reply message indicates that the service was successfully launched (YES branch of block 282), a return message including the invocation identifier is sent to the caller (block 286). Having successfully returned the invocation identifier to the caller, the process for invoking an 20 agent and launching the appropriate service is complete (block 260).

Similar to the process of invoking an agent, the process for starting a workflow (FIG. 17) 290 begins with the receipt of a request to start a particular workflow (block 291). The next step is to send a message to the agent associated with the Directory Service requesting that the Directory Service locate the workflow object (block 292). If the workflow to be started and it's definition are not found (NO branch of block 293), an error message is returned indicating that the workflow does not exist (block 294) and the process terminates (block 300). If, however, the definition of the workflow to be started is found (YES branch of block 293), the agent controlling the first activity defined within the workflow is invoked (block 295) in a manner similar to that described with reference to FIG. 16. The next step in the process is to wait for the activity agent to return a case identifier (block 296). If the Activity Agent does not return a case identifier (NO branch of block 297), a error message is returned to the caller indicating that the workflow was not started (block 298) after which the process terminates (block 300). If, however, the Activity Agent returns a case identifier (YES branch of block 297), a return message including the case identifier is sent to the caller (block 299). Having successfully returned the case identifier to the caller, the process is complete (block 300).

As detailed in the above-discussion, whenever a message cannot be delivered, either because the agent controlling a requested service was unable to be located, the agent is unable to be invoked, the workflow is unable to be started, or the service is unavailable, an error message is returned to the requesting service indicating the problem. As the error message is sent back to the original requesting service, each agent and Bus Agent along the message path is provided an opportunity to manipulate and control the message. For example, an agent processing an error message may discard the error message and attempt to locate an alternative service via another agent or may modify the original request and resubmit it to the intended recipient.

CREATION AND DEPLOYMENT OF SERVICES

The present embodiment of the invention supports a number of computation and communication paradigms for service development. Using a small number of constructs, developers are able to create powerful services. Some of the paradigms possible for service development are Master-Slave, Fault-Tolerance, Load Balancing, and Cooperative. In the Master-Slave paradigm, a service can launch one or more slave services and send each slave a task to accomplish. The master service can then wait for the slave services to complete processing. In the Fault-Tolerance paradigm, a service can replicate its tasks to other services to keep buddy services. A buddy service would continue to synchronize with the original service until some point when it was necessary for the buddy service to take on the responsibilities of the original service (i.e. when the original service fails). In the Load-Balancing paradigm, a service can distribute its tasks to one or more services which are executing throughout the network. The originating service can then monitor and process results from the other services. Finally, in the Cooperative paradigm, one or more services can create a dialog through message passing in which the services collaborate to accomplish a task. Since the present embodiment of the invention does not enforce a call/return paradigm, more intelligence can be designed into an service. This would not be the case if the service would have to be designed into a number of software procedures.

The following paragraphs help describe the general format and basic functionality of services. However, the service developer is certainly not restricted to the examples and paradigms described herein.

The functional capabilities of a service includes, as a minimum, the ability to: (1) attach itself to the invention; (2) initialize, populate, and send messages; (3) wait for messages; and (4) detach itself from the invention. In the

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preferred embodiment, the capability to attach the service to the invention is accomplished by invoking the function esbAttachToBus( ) which makes the service and associated agent visible to other services and also initializes internal structures required to process messages. Conversely, the function esbDetachFromBus( ) is used to detach the service from the invention which makes the service unusable by other services and frees the memory used to support the service (See Appendix G). The other basic capabilities of a service involve messaging. The basic communication paradigm in the present system are electronic messages which consist of a stream of data bytes and which are typically constructed by the developer using an Application Programming Interface.

The following is example of service development which may help to clarify the format and functionality of a service. The sample service being developed is a software based service written in the C programming language and references a number of functions that are found in the Appendices. The example leaves out any error processing:

```
ESB_OBJHDL          msgId;
ESB_INT32           msgFlags;
esbTypeName         agentName;
ESB_OBJHDL          agentId;
ESB_OBJHDL          recvMsgId;
ESB_OBJHDL          destAgentId;
ESB_CHAR            retName[30];
ESB_INT32           type;
esbArgValue         argValue;
ESB_INT32           valLen;
/*
* Attach ourselves to the system.
*/
esbAttachToBus( "SampleApplication");
/*
* Launch the agent which is to provide the service
* we need. We won't specify a host so let the
* system pick the host. The parameter 'agentId'
* will contain the handle to the invoked agent.
*/
agentName.name = "doMyWork";
esbInvokeAgent( &agentName, &agentId, NULL, NULL,
NULL);
/*
* Create a new message. We don't want our message
* to be encoded so request RAW encoding
*/
ESB_SET_FLAG( &msgFlags, ESB_MSG_RAW);
esbNewMessage( &msgId, &msgFlags);
/*
* We plan to send a message to our launched agent.
*/
esbAddRecipient( &msgId, agentId);
/*
* Populate the message and send it.
*/
esbAddArg( msgId, "operation", ESB_
INTEGER_TYPE, GRAB_INFO, NULL);
esbSendMessage( msgId, NULL, ESB_PRIO_LOW, ESB_
SEND_ASYNC);
/*
* Wait for a success response.
*/
esbReceiveMessage( &destAgentId, NULL, NULL,
&recvMsgId, NULL);
/*
* Slurp up the response message.
*/
esbGetNextArg( retName, &type, &argValue, &valLen);
if (argValue.val.longVal != ESB_SUCCESS)
return( someErrorprocessing());
/* Time to go home. */
esbDetachFromBus();
```

In the above example, the developed service uses the esbReceiveMessage( ) function to wait on messages from other services. Once a message is received, the service must retrieve the argument-value pairs that represent the message. The present embodiment of the invention provides a function to retrieve the next argument-value pair from the message without the service having to know ahead of time which argument-value pair is available. The function, esbGetNextArg( ), retrieves the next argument-value pair and indicates not only the type, length, and value of the argument but also the argument name. A service will loop on the function esbGetNextArg( ) while processing the individual values. The following loop is an example:

```
while (esbGetNextArg( msgId, namep, typep, argValue, lenp) !=
ESB_NO_MORE_ARGS)
{ if (!strcmp( namep, "operation"))
opCode = argValue.val.intVal;
else
if (!strcmp( namep, "queue"))
queueType = argValue.val.byteVal; }
```

The above loop indicates that the recipient is only interested in the argument-value pairs with the argument names of "operation" and "queue". All other argument-value pairs are discarded. Realize that once a pair is discarded, they cannot be retrieved again so it is important to anticipate a argument-value pair (although it is not important to anticipate the order of the argument pairs). The argvalue parameter in the above example is a pointer to a special structure that contains a union of all supported data types as defined in the system schema and service library.

All services provided by the present embodiment of the invention communicate via messages. A developer will typically construct a message that is known to be acceptable to a service and then send that message to the service. In a number of cases, the system provides a function interface to services in which the functions are responsible for constructing messages and sending the messages to a service. For example, the present invention provides a service called the Directory Service which provides information about objects under the control of the system. The Directory Service is a software service which knows how to communicate with the data store that ultimately stores the object information (for example, a Sybase database). Since the Directory Service will be one of the most common services used by a developer, the present invention provides function interfaces to the Directory Service. The function interfaces are responsible for taking a request and constructing proper messages and arguments to communicate with the Directory Service. This alleviates some of the development tedium in communicating with commonly used services.

From the foregoing, it should be appreciated that the present invention thus provides a method and architecture for the creation, control and deployment services within a computing environment. The method and architecture allows adaptive communication between services via the associated agents to accomplish specified tasks. The adaptive communication between services is accomplished through commonly utilized Messaging facilities within each service coupled with message manipulation capabilities within the agents associated with each service. While the invention herein disclosed has been described by means of specific embodiments and processes, numerous modifications and variations can be made thereto by those skilled in the art without departing from the scope of the invention as set forth in the claims or sacrificing all its material advantages.

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What is claimed is:

1. A distributed computing system comprising:

a plurality of computer hosts;

a communication network for exchanging information and data between said computer hosts;

a plurality of services associated with said computer hosts, each of said services adapted to perform a prescribed function in response to the receipt of an electronic message, said plurality of services further adapted to cooperatively perform one or more tasks; and

a plurality of agents executing on said computers, wherein each of said services are operatively associated with one or more of said agents and said agents are adapted to control said associated services by manipulating said electronic messages directed to and originating from said associated service;

wherein said services cooperatively perform said tasks by exchanging said electronic messages across said communication network via associated agents.

2. The distributed computing system of claim 1 further comprising a repository data store for identifying said agents, said services, said computer hosts, and the associations therebetween.

3. The distributed computing system of claim 1 wherein each host includes a configuration data store for maintaining information about the configuration of the distributed computing system as it relates to said computer host.

4. The distributed computing system of claim 1 further comprising one or more devices adapted for providing a service, said devices connected to the communication network and adapted to exchange information and data throughout said distributed computing system.

5. The distributed computing system of claim 1 wherein said services include software-based services executing on said computer hosts and said distributed computing system further comprises an agent library for providing selected facilities for said software-based services executing on said computer hosts.

6. The distributed computing system of claim 1 wherein said agents include:

host agents operatively executing on each of said computer hosts; and

service agents operatively associated with one more of said services and further operating under the control of one of said host agents;

wherein said host agents exercise control of said associated service agents by further manipulating said electronic messages passing through said service agents.

7. The distributed computing system of claim 6 wherein one of said host agents and one of said associated service agents are executing on separate computer hosts.

8. The distributed computing system of claim 6 wherein one of said host agents and one of said associated service agents are executing on the same computer host.

9. The distributed computing system of claim 6 wherein one of said host agents is associated with more than one of said service agents.

10. The distributed computing system of claim 6 wherein one of said host agents and one or more of said associated service agents are embedded within a software-based service.

11. The distributed computing system of claim 1 wherein one of said agents is associated with more than one of said services.

12. The distributed computing system of claim 1 wherein one of said services is associated with more than one of said agents.

13. The distributed computing system of claim 1 further comprising one or more partitions, each partition including:

a plurality of services associated with said computer hosts; and

a plurality of agents operatively associated with one or more of said services included within said entity, said agents adapted to control said associated services by manipulating said electronic messages directed to and originating from said associated service.

14. The distributed computing system of claim 1 wherein each of said agents further include:

an identification element for identifying said agent;

a means for associating said agent with one or more services; and

one or more auxiliary elements for defining a behavior of said agent with respect to each associated service;

wherein said auxiliary elements govern the manipulation of messages directed to and originating from said associated service.

15. The distributed computing system of claim 14 wherein each of said agents further includes a queue which provides queuing information for said agent.

16. The distributed computing system of claim 1 wherein each of said services further include:

a first identification element for identifying said service;

a second identification element for identifying a type of service embodied by said service;

a means for associating said service with one or more agents; and

a means for receiving and sending electronic messages via said associated agents; and

a means to perform said prescribed function in response to the receipt of said electronic message.

17. The distributed computing system of claim 1 wherein said plurality of services includes a transaction service for governing transactions within the distributed computing system, said transaction service comprises:

means for identifying concurrency behavior;

means for identifying transaction behavior;

means for ensuring accurate semantics are utilized during transactions; and

means for defining the scope of the transactions, wherein said services are able to define the scope of the work to be performed.

18. The distributed computing system of claim 1 wherein said plurality of services includes a queue service for handling messages sent to a destination agent and associated service, said queue service comprises:

means for storing messages sent to said destination agent until said destination agent retrieves said messages; and

means for forwarding messages when said destination agent and associated service are unavailable to retrieve messages.

19. The distributed computing system of claim 1 wherein said plurality of services includes an identity service for uniquely identifying objects throughout the distributed computing system such that said objects can be located.

20. The distributed computing system of claim 1 wherein said plurality of services includes an event service comprising:

means for defining an event within the distributed computing system; and

means for subscribing objects to defined events such that said objects react to certain events in a prescribed manner.

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21. The distributed computing system of claim 1 wherein said plurality of services includes a workflow service, said workflow service comprises:

means for defining a process flow, said process flows including one or more activities operating on one or more work items; and

means for initiating a process flow;

wherein said workflow service facilitates the performance of prescribed tasks in a prescribed sequence.

22. The distributed computing system of claim 1 wherein said plurality of services includes a directory service adapted to retrieve information about defined objects contained within the distributed computing system.

23. An agent for controlling services in a service-based distributed computing environment, each service is adapted for performing a prescribed function, said services are further adapted to cooperatively perform various tasks by sending and receiving electronic messages, said agent comprising:

an identification element for uniquely identifying said agent across said distributed computing environment;

a means for associating said agent with one or more services; and

one or more auxiliary elements for defining a behavior of said agent with respect to each associated service;

wherein said agents are adapted to control the execution and operation of said associated service in accordance with said defined behavior through the manipulation of messages directed to and originating from said associated service.

24. The agent for controlling services in a service-based distributed computing environment of claim 23 wherein said auxiliary elements further include a queue which provides queuing information for said agent.

25. The agent for controlling services in a service-based distributed computing environment of claim 23 wherein said auxiliary elements further include a schedule element which identifies scheduling constraints of said associated service.

26. The agent for controlling services in a service-based distributed computing environment of claim 23 wherein said auxiliary elements further include a security element which provides security and access constraints of said agent and associated service.

27. The agent for controlling services in a service-based distributed computing environment of claim 23 wherein said auxiliary elements further include a scripting which provides script information for an agent which represents a general mechanism for programing the behavior of said agent and said associated service.

28. The agent for controlling services in a service-based distributed computing environment of claim 23 wherein said auxiliary elements further includes a rule element which provides rule information for an agent thereby allowing an agent to derive behavior based on the contents of an electronic message.

29. The agent for controlling services in a service-based distributed computing environment of claim 23 wherein said auxiliary elements further includes a behavior element which defines general behaviors associated with said agent and said associated service.

30. A distributed computing system comprising:

a communication network;

a plurality of computer hosts adapted for exchanging information and data across said communication network;

wherein each computer host includes a computer readable memory configured with specific physical properties that represent one or more computer application-based services, each of said services adapted to perform a prescribed function in response to the receipt of an electronic message, said services further adapted to cooperatively perform one or more tasks; and

wherein each of said computer readable memory is further configured with specific physical properties that represent one or more agents operatively associated with said services such that said agents are adapted to control said associated services by manipulating said electronic messages directed to and originating from said associated service;

wherein said services cooperatively perform said tasks by exchanging said electronic messages across said communication network via associated agents.

* * * * *

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#3

UNITED STATES PATENT AND TRADEMARK OFFICE

COMMISSIONER FOR PATENTS
UNITED STATES PATENT AND TRADEMARK OFFICE
WASHINGTON, D.C. 20231
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APPLICATION NUMBER	FILING/RECEIPT DATE	FIRST NAMED	NT	ATTORNEY DOCKET NUMBER
09/703,427	10/31/2000	Blaine D. Gaither		10008316-1

OIPE JC131 FEB 05 2001 PATENT & TRADEMARK OFFICE

CONFIRMATION NO. 2980

FORMALITIES LETTER



5679845

022879
HEWLETT PACKARD COMPANY
P O BOX 272400
INTELLECTUAL PROPERTY ADMINISTRATION
FORT COLLINS, CO 80527-2400

Date Mailed: 01/15/2001

NOTICE TO FILE MISSING PARTS OF NONPROVISIONAL APPLICATION

FILED UNDER 37 CFR 1.53(b)

Filing Date Granted

An application number and filing date have been accorded to this application. The item(s) indicated below, however, are missing. Applicant is given TWO MONTHS from the date of this Notice within which to file all required items and pay any fees required below to avoid abandonment. Extensions of time may be obtained by filing a petition accompanied by the extension fee under the provisions of 37 CFR 1.136(a).

- The oath or declaration is unsigned.
- To avoid abandonment, a late filing fee or oath or declaration surcharge as set forth in 37 CFR 1.16(e) of $130 for a non-small entity, must be submitted with the missing items identified in this letter.

- **The balance due by applicant is $ 130.**

A copy of this notice MUST be returned with the reply.

T-6

Customer Service Center
Initial Patent Examination Division (703) 308-1202
PART 2 - COPY TO BE RETURNED WITH RESPONSE

02/09/2001 SDENBOB1 00000004 082025 09703427
01 FC:105 130.00 CH

HEWLETT-PACKARD COMPANY
Intellectual Property Administration
P. O. Box 272400
Fort Collins, Colorado 80527-2400

SECTOR 3

PATENT APPLICATION

ATTORNEY DOCKET NO. 10008316-1

OIPE JC131
FEB 05 2001
PATENT & TRADEMARK OFFICE

IN THE
UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s): Blaine D. Gaither, et al.

Serial No.: 09/703,427 **Examiner:** not assigned

Filing Date: Oct. 31, 2000 **Group Art Unit:** 2133

Title: A Method And Apparatus For Passing Messages Using A Fault Tolerant Storage System

COMMISSIONER FOR PATENTS
Washington, D.C. 20231

TRANSMITTAL LETTER FOR SUBMITTAL OF MISSING PARTS

Sir:

This is in response to a Notice to File Missing Parts of Application under 37 CFR 1.53(f) mailed on 01/15/2001. Enclosed is a copy of said Notice and the following documents and fees to complete the filing requirements of the above-identified application.

(X) Executed Declaration and Power of Attorney. The above-identified application is the same application which the inventor executed by signing the enclosed declaration.

( ) Statutory basic filing fee ( ) Utility $710.00 ( ) Design $320.00

( ) Additional claim fees of $

(X) Missing Parts Surcharge $130.00

( ) A Petition for Extension of Time for reply to Notice of Missing Parts is attached.

( )	one month	$110.00
( )	two months	$390.00
( )	three months	$890.00
( )	four months	$1390.00

Please charge to Deposit Account **08-2025** the sum of **$130.00**. At any time during the pendency of this application, please charge any fees required or credit any overpayment to Deposit Account **08-2025** pursuant to 37 CFR 1.25.

(X) A duplicate copy of this transmittal letter is enclosed.

Respectfully submitted,

Blaine D. Gaither, et al.

By _____

David A. Plettner

Attorney/Agent for Applicant(s)
Reg. No. **36,241**

Date: **Jan. 31, 2001**

Telephone No.: **(408) 447-3013**

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to: Commissioner for Patents, Washington, D.C. 20231.

Date of Deposit: **Jan. 31, 2001**

Typed Name: **Jerome Dechant**

Signature: Jerome Dechant

Rev 10/00 (MisParts)

PATENT APPLICATION #3

DECLARATION AND POWER OF ATTORNEY FOR PATENT APPLICATION

OIPE JC31 FEB 05 2001 PATENT & TRADEMARK OFFICE

ATTORNEY DOCKET NO. 10008316-1

As a below named inventor, I hereby declare that:

My residence/post office address and citizenship are as stated below next to my name;

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

A Method And Apparatus For Passing Messages Using A Fault Tolerant Storage System

the specification of which is attached hereto unless the following box is checked:

(X) was filed on **Oct. 31, 2000** as US Application Serial No. or PCT International Application Number **09/703,427** and was amended on _____ (if applicable).

I hereby state that I have reviewed and understood the contents of the above-identified specification, including the claims, as amended by any amendment(s) referred to above. I acknowledge the duty to disclose all information which is material to patentability as defined in 37 CFR 1.56.

Foreign Application(s) and/or Claim of Foreign Priority

I hereby claim foreign priority benefits under Title 35, United States Code Section 119 of any foreign application(s) for patent or inventor(s) certificate listed below and have also identified below any foreign application for patent or inventor(s) certificate having a filing date before that of the application on which priority is claimed:

COUNTRY	APPLICATION NUMBER	DATE FILED	PRIORITY CLAIMED UNDER 35 U.S.C. 119
N/A			YES: ___ NO: ___
			YES: ___ NO: ___

Provisional Application

I hereby claim the benefit under Title 35, United States Code Section 119(e) of any United States provisional application(s) listed below:

APPLICATION SERIAL NUMBER	FILING DATE
N/A	

U. S. Priority Claim

I hereby claim the benefit under Title 35, United States Code, Section 120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code Section 112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, Section 1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

APPLICATION SERIAL NUMBER	FILING DATE	STATUS (patented/pending/abandoned)
N/A		

POWER OF ATTORNEY:

As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith:

Customer Number 022879

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Send Correspondence to:	Direct Telephone Calls To:
HEWLETT-PACKARD COMPANY Intellectual Property Administration P.O. Box 272400 Fort Collins, Colorado 80527-2400	David A Plettner (408) 447-3013

I hereby 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 issued thereon.

Full Name of Inventor: Blaine D. Gaither **Citizenship:** US

Residence: 1600 Serramonte Drive, Fort Collins, CO 80524-1718

Post Office Address: Same as residence

Blaine D Gaither
Inventor's Signature

1-26-01
Date

Rev 10/00 (DecPwr) (Use Page Two For Additional Inventor(s) Signature(s)) Page 1 of 2

DECLARATION AND POWER OF ATTORNEY FOR PATENT APPLICATION (continued)

ATTORNEY DOCKET NO. 10008316-1

Full Name of # 2 joint inventor: Bret A. McKee Citizenship: US

Residence: 1712 Ridgewood Road, Fort Collins, CO 80526

Post Office Address: Same as residence

Inventor's Signature _____ Date 1/30/01

Full Name of # 3 joint inventor: _____ Citizenship: _____

Residence: _____

Post Office Address: _____

Inventor's Signature _____ Date _____

Full Name of # 4 joint inventor: _____ Citizenship: _____

Residence: _____

Post Office Address: _____

Inventor's Signature _____ Date _____

Full Name of # 5 joint inventor: _____ Citizenship: _____

Residence: _____

Post Office Address: _____

Inventor's Signature _____ Date _____

Full Name of # 6 joint inventor: _____ Citizenship: _____

Residence: _____

Post Office Address: _____

Inventor's Signature _____ Date _____

Full Name of # 7 joint inventor: _____ Citizenship: _____

Residence: _____

Post Office Address: _____

Inventor's Signature _____ Date _____

Full Name of # 8 joint inventor: _____ Citizenship: _____

Residence: _____

Post Office Address: _____

Inventor's Signature _____ Date _____

SAP - Exhibit 1102
SAP v. Valtrus et al. - IPR2025-00420
Page 583 of 704

UNITED STATES PATENT AND TRADEMARK OFFICE

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APPLICATION NUMBER	FILING/RECEIPT DATE	FIRST NAMED APPLICANT	ATTORNEY DOCKET NUMBER
09/703,427	10/31/2000	Blaine D. Gaither	10008316-1

CONFIRMATION NO. 2980

022879
HEWLETT PACKARD COMPANY
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FORT COLLINS, CO 80527-2400

FORMALITIES LETTER

OC000000005679845

Date Mailed: 01/15/2001

NOTICE TO FILE MISSING PARTS OF NONPROVISIONAL APPLICATION

FILED UNDER 37 CFR 1.53(b)

Filing Date Granted

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- The oath or declaration is unsigned.
- To avoid abandonment, a late filing fee or oath or declaration surcharge as set forth in 37 CFR 1.16(e) of $130 for a non-small entity, must be submitted with the missing items identified in this letter.

- **The balance due by applicant is $ 130.**

A copy of this notice MUST be returned with the reply.

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11-02-00

A

HEWLETT-PACKARD COMPANY
Intellectual Property Administration
P. O. Box 272400
Fort Collins, Colorado 80527-2400

PATENT APPLICATION

ATTORNEY DOCKET NO. 10008316-1

10/31/00 JC992 U.S. PTO

IN THE U.S. PATENT AND TRADEMARK OFFICE
Patent Application Transmittal Letter

jc925 U.S. PTO 09/703427 10/31/00

COMMISSIONER FOR PATENTS
Washington, D.C. 20231

Sir:

Transmitted herewith for filing under 37 CFR 1.53(b) is a(n): (X) Utility ( ) Design
(X) original patent application,
( ) continuation-in-part application

INVENTOR(S): **Blaine D. Gaither, et al.**

TITLE: **A Method And Apparatus For Passing Messages Using A Fault Tolerant Storage System**

Enclosed are:

(X) The Declaration and Power of Attorney. ( ) signed (X) unsigned or partially signed

(X) 10 sheets of drawings (one set) ( ) Associate Power of Attorney

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A METHOD AND APPARATUS FOR PASSING MESSAGES USING A FAULT TOLERANT STORAGE SYSTEM

CROSS REFERENCE TO RELATED APPLICATION

This application contains subject matter related to a co-pending application entitled "A Fault Tolerant Storage System Having an Interconnection Fabric That Also Carries Network Traffic" by Blaine D. Gaither et al., which has been assigned Hewlett-Packard Docket Number 10001666-1. This application is hereby incorporated by reference, is assigned to the same assignee as the present application, and was filed on October 31, 2000, which is also the date on which the present application was filed.

FIELD OF THE INVENTION

The present invention relates to messaging between computer systems. More specifically, the present invention relates to a messaging architecture wherein messages are transmitted over the interconnection fabric of a fault tolerant storage system and are stored within the fault tolerant storage system.

DESCRIPTION OF THE RELATED ART

In the art of computing, a distributed application is an application that is separated into two or more parts, such as a client application on a first computer system and a server application on a second computer system, with the two computers coupled together via a network. As used herein, the term "client" refers to an entity that requests a service, and the term "server" refers to the entity that fulfills the request. The entity can be a an application, *i.e.*, a client application or a server application, or the entity can be a computer system coupled to a network, *i.e.*, a client computer system or a server computer system. Computer systems coupled to a network may also be referred to as "nodes". The meaning of these terms will be apparent from the contexts in which the terms are used.

Consider, for example, a distributed application that allows a customer to order a product over the Internet from an on-line retailer. The customer accesses the distributed

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application using a web browser. The web browser communicates over the Internet with a web server, which provides the customer with a catalog of products that can be ordered, and provides a "shopping basket" that allows the customer to select the products that the customer wishes to purchase.

Assume that the customer decides to complete the order, and pay for the order with a credit card. The web server must communicate as a client with a server application that verifies that the credit card is valid, and posts the purchase to the customer's credit card account. The web server must also communicate with an application that delivers the order to the warehouse so the order can be shipped. In addition, the web server may communicate with an inventory control application to verify that the products ordered are in stock, and to order replacement inventory from the vendor. If the customer checks back latter to view the status of the order, the web server may communicate with an application maintained by the shipping company to provide the customer with a tracking number.

This is a very simple example, and a typical distributed application may be much more complex. However, even in this simple example one can see that designing a distributed application is very complex. Perhaps the most complex task faced by a distributed application developer is ensuring that all the disparate applications that comprise the distributed application communicate in a seamless and reliable manner.

To ensure that all applications communicate seamlessly and reliably in a distributed application, the application designer may use a middleware product that distributes applications across multiple platforms, databases, and operating systems using message-based communications and, if desired, distributed transaction processing. Middleware products are used with client/server applications to distribute processing among multiple servers, manage distributed transactions, and integrate multiple database platforms. Middleware systems are sometimes known in the art as "on-line transaction processing" (OLTP) systems. One such system is Bea Tuxedo®, which is a product of BEA Systems, Inc.

To facilitate communication between disparate applications, Bea Tuxedo® provides an application designer with a series of messaging paradigms. These messaging paradigms

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are conversational communication, event-based communication, queue-based communication, request/reply communication, and unsolicited communication.

Conversational communication allows messages to be exchanged between clients and servers in a manner analogous to human conversation. This form of communication is implemented using inter-process communication (IPC) message queues. IPC message queues are typically implemented in transient memory areas, and are typically provided by the underlying operating system and are used for communication between clients and servers. IPC message queues can be used to pass messages between client and server applications operating on the same computer system or on separate computer systems coupled by a network.

Just as in a conversation between two people, a number of messages pass back and forth between the client and server until a conclusion is reached. Over the course of the communication, both sides "remember" the point (or state) of the conversation so that relatively long operations, such as ad hoc queries, reports, and file transfers, can be supported. Note that the context of any particular message is interpreted in view the previous messages comprising the conversation.

Event-based communication uses an event broker to transfer messages. The event broker provides a communication paradigm in which message suppliers can post messages for message subscribers. Because client and server processes that use the event broker communicate with one another based on a set of subscriptions, this paradigm is also known in the art as publish-and-subscribe communication. The event broker acts like a newspaper delivery person who delivers newspapers only to customers who have paid for a subscription. Event generators inform the event broker of events (such as changes and problems) as they occur. This process is called posting an event. The event broker then matches the name of the event to an event name associated with a list of subscribers, and notifies each subscriber on the list of the event by passing a message to the subscriber. Communication between the suppliers, subscribers, and event broker is provided by IPC message queues.

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Queue-based communication requires persistent storage of data. Queue-based communication allows any client or server to store messages in queues, and guarantees that any stored message will be delivered to the destination. Queues can be ordered as last-in first-out (LIFO) or first-in first-out (FIFO), or on the basis of time or priority. A collection of queues is administered and referred to as a single entity known as a queue space.

Queue-based communication is appropriate when communication can occur in a time-independent fashion. Time-independence is a characteristic of programs that operate independently from one another and do not need to synchronize their communications simultaneously. Time-independent programs synchronize with each other by leaving messages in application queues. Because queued messages are stored using persistent media, such as a hard disk drive, queue-based communication is highly reliable and messages can even be delivered after failures, such as power outages or network interruptions.

Even though queue-based messages pass through persistent storage, server applications and client applications enqueue and dequeue messages by sending the messages to a queue administrator. The queue administrator can reside on the same computer as either the server or client application, or can reside on a third server.

Request/reply communication is also implemented using inter-process communication (IPC) message queues. Each server is assigned an IPC message queue called a request queue, and each client is assigned an IPC message queue called a reply queue. Accordingly, a client application can send requests to the server by putting those requests on the server's queue, and then check and retrieve messages from the server by retrieving messages from its own reply queue.

Request/reply communication is typically carried out in either a synchronous mode or an asynchronous mode. In a synchronous mode, a client sends a request to a server, which performs the requested action while the client waits. The server then sends the reply to the client, which receives the reply. In asynchronous mode, the client does not wait for a server to complete a service request before the client undertakes other tasks. Rather, after issuing a request, the client performs additional tasks (which may include issuing more

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requests to the server). When a reply to the first request is available, the client retrieves it from its reply queue.

Unsolicited communication is a type of communication that allows a client or server to receive a message that it never requested, thereby making it possible for applications to receive notification of application-specific events as they occur without having to request notification. Unsolicited messages can be sent to a single server node or client node, or be broadcast to a group of nodes. For example, a server may alert a single client that the account about which the client is inquiring has been closed, or a server may send a message to all the clients to notifying the clients that the server will be shut down for maintenance at a specific time. In addition, unsolicited messages can be sent either with or without guaranteed delivery. Unsolicited messages are sent using IPC message queues.

As can be seen from the discussion above, some of these messaging paradigms, such as request/reply communication, use transient media, such as network connections and system memory, to pass messages between clients and servers. On the other hand, queue-based communication delivers messages using persistent media, such as a hard disk drive.

In most distributed applications, availability is very important. Consider the example above, if the application that processes credit card transactions suffers a failure, the customer will not be able to purchase products. Similarly, if the web server can not communicate with the inventory control application, the web server can not inform the customer whether the product is in stock.

To ensure that a distributed application has a high rate of availability, it is important to make each component that hosts the distributed application as reliable and fault-tolerant as possible. As discussed above, messaging is critical in a distributed application, and two components critical in the communication of messages are the persistent storage media, such as the hard drives, and the transient communication network. Accordingly, a designer of a distributed application will often specify that the application be implemented using highly reliable and fault tolerant interconnection fabrics and storage systems.

Several interconnection fabrics are available to provide guaranteed delivery of packets. For example, ServerNet® is a system interconnect architecture available from

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Compaq Computer Corporation. ServerNet® hardware ensures data integrity using multiple techniques. For example, command link integrity isolates single-bit errors, cyclic redundancy checks maintain both data and control integrity of transfers crossing the interconnect fabric, and hardware protocol acknowledgments ensure that end-to-end reliable data transfer has occurred. In addition, ServerNet® is capable of providing a high level of availability by incorporating spare alternate paths within a primary interconnection fabric, and providing a fully redundant secondary interconnect fabric with redundant secondary attachments to network nodes. Similar interconnection fabrics are available from other vendors, such as the Coupling Facility provided by IBM Corporation. While interconnection fabrics such as ServerNet® and the Coupling Facility are fast, highly reliable, and fault tolerant, they are also very expensive.

A fault tolerant storage systems (FTSS), such as the SureStore® XP512 Disk Array, which is a product of Hewlett-Packard Company, guarantees the availability and integrity of files stored by the FTSS. Fault tolerant storage systems are also available from other companies, such as Hitachi Data Systems Corporation and EMC Corporation.

Typically an FTSS is coupled to a server using a high-speed interface, such as an Ultra160 SCSI interface, a fiber channel interface, or an enterprise system connectivity (ESCON) interface. Such systems are highly reliable and fault tolerant. For example, the SureStore® XP512 Disk Array uses a fault-tolerant, redundant architecture that ensures there is no single point-of-failure, and has a mean time between failure (MTBF) of 2.5 million hours, or alternatively 285 years. Such systems are also incredibly fast. A single fiber channel port can support transfer rates of 100 megabytes per second, and ports can be ganged together to increase transfer rates even further. Moreover, the internal crossbar architecture of the XP512 has a bandwidth of 6.4 gigabytes per second.

Figure 1 shows such a highly reliable fault-tolerant prior art system 58, which may be used to host a distributed application. System 10 comprises computer systems 12, 14, 16, 18, 20, and 22, and fault tolerant storage system (FTSS) 24. Computer systems 12, 14, 16, 18, 20, and 22 are coupled to FTSS 24 via FTSS interconnection fabric 28 to carry file I/O transactions between the computer systems and FTSS 24. Typically, interconnection

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fabric 28 couples each computer system directly to the FTSS, but does not directly couple the computer systems to each other. In addition, computer systems 12, 14, 16, 18, 20, and 22 are coupled to together by highly reliable, fault tolerant network interconnection fabric 26 to carry messages between the computer systems.

Note that interconnection fabrics 26 and 28 are both highly reliable and fault tolerant. Accordingly, a customer configuring a system such as that shown in Figure 1 ends up paying for two interconnection fabrics. Furthermore, interconnection fabric 26 does not include any type of persistent storage. If a client suffers some type of error after receiving a message, the client is not able to request retransmission of the message from fabric 26. What is needed in the art is a practical way for a customer to use the same highly reliable and fault tolerant interconnection fabric to carry both file I/O transactions and messaging traffic, and also allowing a client to request retransmission of messages.

SUMMARY OF THE INVENTION

The present invention is a method and apparatus for passing messages between server and client applications using a fault tolerant storage system (FTSS). The interconnection fabric that couples the FTSS to the computer systems that host the client and server applications may also be used to carry messages. In accordance with the present invention, a networked system capable of hosting a distributed application includes a plurality of computer systems coupled to an FTSS via an FTSS interconnection fabric. The FTSS not only processes file-related I/O transactions, but also carries message traffic. In addition, the FTSS includes several message agents to facilitate message transfer in a reliable and fault tolerant manner. The message agents include a conversational communication agent, an event-based communication agent, a queue-based communication agent, a request/reply communication agent, and an unsolicited communication agent.

The highly reliable and fault tolerant nature of the FTSS ensures that the FTSS can guarantee delivery of a message transmitted from a sending computer system to a destination

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computer system. As soon as a message is received by the FTSS from a sending computer system, the message is committed to a nonvolatile write cache. Thereafter, the message is written to a redundant array of independent disks (RAID) of the FTSS, and processed by one of the message agents.

The present invention enhances the reliability and fault tolerance of messaging in several ways. First, messages may be transmitted between nodes using the FTSS interconnection fabric, which is highly reliable and fault tolerant. Since many systems that host distributed applications already include an FTSS, using the FTSS fabric instead of a less reliable network media, such as Ethernet, increases availability of the distributed application without the customer having to incur additional hardware costs.

Second, in the prior art, several messaging paradigms use agents that operate on separate servers. By moving these agents to the FTSS, availability is increased because the FTSS is typically more reliable than the servers to which it is coupled. Furthermore, since the FTSS is being used to pass messages anyway, providing the agents in the FTSS eliminates the need to route the messages to a separate server, thereby allowing the messages to be processed faster.

Finally, several prior art messaging paradigms pass interprocess communication messages directly between nodes in a transient manner. In the present invention, these messages pass through the FTSS and are stored in and retained by the FTSS, thereby allowing any application to "rollback" to a known point and retrieve lost messages from the FTSS.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 shows a highly reliable fault-tolerant prior art system that may be used to host a distributed application.

Figure 2 shows a highly reliable fault-tolerant system in accordance with the present invention that may be used to host a distributed application.

Figure 3 is a block diagram of a prior art computer system that illustrates how messages are processed.

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Figure 4 is a block diagram of a computer system having a middleware product that passes messages to another computer system via a fault tolerant storage system (FTSS), in accordance with the present invention.

Figure 5 is a block diagram of an FTSS that passes messages between client and server nodes via communication agents, in accordance with the present invention.

Figure 6 is a block diagram illustrating a conversational communication agent provided in the FTSS of Figure 5.

Figure 7 is a block diagram illustrating an event-based communication agent provided in the FTSS of Figure 5.

Figure 8 is a block diagram illustrating a queue-based communication agent provided in the FTSS of Figure 5.

Figure 9 is a block diagram illustrating a request/reply communication agent provided in the FTSS of Figure 5.

Figure 10 is a block diagram illustrating an unsolicited communication agent provided in the FTSS of Figure 5.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present invention is a method and apparatus for passing messages between server and client applications using a fault tolerant storage system (FTSS). The interconnection fabric that couples the FTSS to the computer systems that host the client and server applications may also be used to carry messages.

Figure 2 shows a networked system 30 in accordance with the present invention. Networked system 30 may be used to host a distributed application, such as an on-line store accessible from the Internet. System 30 includes computer systems 32, 34, 36, 38, 40, and 42, fault tolerant storage system (FTSS) 44, and FTSS interconnection fabric 46. Although only computer systems are shown in Figure 2, those skilled in the art will recognize that other network nodes may be coupled to FTSS 44 via fabric 46, such as printers, scanners, backup

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systems, and the like. Although not shown in Figure 2, computer systems 32, 34, 36, 38, 40, and 42 may be coupled to each other and to other computers via another interconnection fabric, such as an Ethernet network, which in turn may be coupled to the Internet via a gateway.

Typically, interconnection fabric 46 will be comprised of high-speed interfaces and related cabling used to connect computer systems to storage systems, such as small computer system interfaces (SCSI), fiber channel interfaces, or enterprise system connectivity (ESCON) interfaces. In a typical FTSS, these interfaces tend to connect each computer system directly to the FTSS, but do not connect the computer systems to each other.

In accordance with the present invention, FTSS 44 not only processes file-related I/O transactions, but also carries message traffic. In addition, FTSS 44 includes several message agents to facilitate message transfer in a reliable and fault tolerant manner, as described below. The highly reliable and fault tolerant nature of FTSS 44 ensures that FTSS 44 can guarantee delivery of a message transmitted from a sending computer system to a destination computer system. To see how this is accomplished, first consider a typical FTSS, such as the SureStore® XP512 Disk Array, which is a product of Hewlett-Packard Company. The XP512 has a battery-protected fully redundant nonvolatile write cache that can range in size from 2 gigabytes to 32 gigabytes. As soon as a message is received by FTSS 44 from a sending computer system, the message is committed to the nonvolatile write cache. Thereafter, the message is written to a redundant array of independent disks (RAID) of FTSS 44, and processed by one of the message agents.

Before considering the present invention in greater detail, first consider how messages that are transmitted between network nodes are processed in a prior art computer using a middleware product such Bea Tuxedo®, which is a product of BEA Systems, Inc. Figure 3 shows a prior art computer system 48. Client and server applications that use middleware messaging are represented by block 50. These applications pass messages to other nodes using an application-to-transaction monitor interface (ATMI), which is represented by block 52 and is part of middleware product 53. The ATMI provides a series of functions that may be called

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by the client and server applications to pass messages, as will be described in greater detail below.

The messaging paradigms supported by middleware product 53 are represented by block 54. The conversational communication paradigm is represented by block 56, the event-based communication paradigm is represented by block 58, the queue-based communication paradigm is represented by block 60, the request/reply communication paradigm is represented by block 62, and the unsolicited communication paradigm is represented by block 64. Block 54 communicates with the I/O services of the operating system, which are represented by block 55, to transmit messages. Figure 3 illustrates how messages are transmitted between network nodes. Accordingly, block 54 communicates with network I/O block 68 to send and receive messages from other network nodes via network fabric 70.

In accordance with the present invention, Figure 4 shows how middleware product 76 is modified in computer system 32 of Figure 2, as well as the other computer systems shown in Figure 2, to pass messages via FTSS 44. Similar to prior art Figure 3, client and server applications that use middleware messaging are represented by block 72. These applications pass messages to other nodes using an application-to-transaction monitor interface (ATMI), which is represented by block 74 and is part of middleware product 76. Note that all the function calls available in prior art ATMI 52 in Figure 3 are available in ATMI 74, thereby providing complete compatibility with prior art applications.

The messaging paradigms supported by middleware product 76 are represented by block 78. The conversational communication paradigm is represented by block 80, the event-based communication paradigm is represented by block 82, the queue-based communication paradigm is represented by block 84, the request/reply communication paradigm is represented by block 86, and the unsolicited communication paradigm is represented by block 88. Block 78 communicates with the I/O services of the operating system, which are represented by block 90, to transmit messages. However, unlike messaging paradigms block 54 of Figure 3, block 78 has been modified to pass messages between computer systems coupled to FTSS 44 by

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communicating with message agents in FTSS 44. Accordingly, block 78 communicates with fault tolerant storage block 94 of file I/O block 92, which is provided by operating system I/O services 90.

The communication between block 78 and FTSS 44 can be accomplished several ways. For example, a series of directories can be defined on FTSS 44 to store incoming and outgoing messages as files. Using this technique, block 78 can pass messages to FTSS 44 by writing messages as files into the appropriate directory of FTSS 44. Another way to accomplish this communication is to use the techniques disclosed in a co-pending application entitled "A Fault Tolerant Storage System Having an Interconnection Fabric That Also Carries Network Traffic" by Blaine D. Gaither et al., which is incorporated by reference above. This application teaches how a network protocol stack can be modified to route all network traffic between nodes coupled to the FTSS via the FTSS interconnection fabric. Using the techniques taught in this application, each message agent in FTSS 44 can be assigned an address, and block 78 can communicate with the network protocol stack to transmit the messages to FTSS 44. If this technique is used, the messages would first pass through the network protocol stack before being processed by fault tolerant storage block 94. Those skilled in the art will understand how to adapt the teachings herein to pass messages from messaging paradigms bock 78 to FTSS 44.

In accordance with the present invention, Figure 5 illustrates how FTSS 44 can be modified to support messaging. In Figure 5, FTSS 44 includes file operations unit 96, which processes file I/O requests in a manner similar to the prior art. Incoming file data is first committed to non-volatile write cache 98, and is then stored in RAID 100. Outgoing file data is retrieved from RAID 100, and then transmitted to the node that requested the file data.

Messaging agents block 102 includes several messaging agents that support the messaging paradigms described above. Accordingly, messaging agents block 102 includes conversational communication agent 104, event-based communication agent 106, queue-based communication agent 108, request/reply communication agent 110, and unsolicited communication agent 112.

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In the following discussion, the communication agents will be described in greater detail. A variety of queues and other data structures will be illustrated. All of these data structures are stored in fault tolerant storage, such as RAID 100 and/or nonvolatile write cache 98. In addition, all incoming messages are immediately stored in fault tolerant storage. Furthermore, the communication agents retain old message transactions for some time after the message transactions are complete. In some of the figures discussed below, old transactions will be illustrated, while in other figures, retention of the old transactions is assumed. Saving the old transactions allows any node engaged in messaging to recover from an error by "rolling back" to a known point in the message transaction, and reconstructing the transaction. Transactions can eventually be deleted using some mechanism known in the art, such as an expiration date and time or a FIFO queue. Since a typical FTSS can be configured with terabytes of data, the FTSS is will suited for retaining old message transactions.

Figure 6 is a diagram illustrating conversational communication agent 104. Before discussing agent 104 in greater detail, first consider the relevant ATMI function calls provided by block 74 in Figure 4 that support conversational communication in a Bea Tuxedo® system. The C programing language version of these function calls will be discussed below, however analogous function calls are available in other languages, such as COBOL and Java.

The function *tpconnect()* is used to begin a conversation with another node, and the function *tpdiscon()* is used to end the conversation. To send a message in the conversation, the function *tpsend()* is used, and to receive a message in the conversation, the function *tprecv()* is used.

Figure 6 illustrates conversation communication agent 104. Agent 104 includes a conversation manager 114, open conversations 116, and closed conversations 118. When a client node calls *tpconnect()* to open a conversation with a server node, conversation manager 114 creates an open conversation 116. When either node calls *tpsend()*, the message in the conversation is stored in the appropriate open conversation 116, and is transmitted to the other node. Since the message is transmitted to the other node by manager

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114, when the other node calls the function *tprecv()*, the message is provided locally to program that called the *tprecv()* function. However, if the other node suffered some type of error or failure that caused it to lose the message, the message can still be retrieved from the appropriate open conversation 116. When either node calls *tpdiscon()*, the conversation is closed and is moved to closed conversations 118, and is retained for a period of time, as discussed above. Accordingly, either node can "rollback" to a known point by accessing open conversations 116 or closed conversations 118. Note that in the prior art, conversations occurred directly between the client and server in a transient manner. By providing conversational communication agent 104 in FTSS 44, reliability and fault tolerance are increased because conversations are also retained in FTSS 44.

Figure 7 is a diagram illustrating event-based communication agent 106. Before discussing agent 106 in greater detail, first consider the relevant ATMI function calls provided by block 74 in Figure 4 that support event-based communication.

The function *tpsubscribe()* allows a client to subscribe to receive certain types of event messages, and the function *tpunsubscribe()* allows the client to unsubscribe. The function *tppost()* allows a server to post an event message.

In Figure 7, event-based communication agent 106 includes an event broker 120, which includes a subscription manager 122, and event queues 124. Subscription manager 122 maintains lists of clients that have subscribed to certain events using the *tpsubscribe()* function call. When a server posts an event message using the *tppost()* function call, the message is posted in the appropriate event queue 124, and is relayed to all client nodes that have subscribed to the event. If a particular client suffers some type of error or other failure, the client can access event broker 120 to retrieve any event messages corresponding to events to which it has subscribed. In the prior art, an event broker was also provided on a server. However, the present invention increases reliability and fault tolerance by providing the event broker in FTSS 44. In a typical distributed application that includes an FTSS, the FTSS will typically be more reliable and fault tolerant than the servers coupled to the FTSS.

Figure 8 is a diagram illustrating queue-based communication agent 108. For reasons that will be come apparent below, this type of messaging is also known in the art as "store

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and forward" messaging. Before discussing agent 108 in greater detail, first consider the relevant ATMI function calls provided by block 74 in Figure 4 that support queue-based communication. The function *tpenqueu()* enqueues a message to a message queue and the function *tpdequeue()* dequeues a message from the message queue.

In Figure 8, a client application on computer system 32 of Figure 2 seeks to execute a service of a server application on computer 38. First, the client calls the *tpenqueue()* function, which passes the service message to queue-based communication agent 108 on FTSS 44. Queue unit 126 enqueues the service message in queue space 130. Forwarding unit 128 dequeues the service message and forwards the message to the server application on computer system 38. Forwarding unit 128 communicates with the server application using request/reply communication, which will be described in greater detail below with reference to Figure 9. Accordingly, forwarding unit 128 executed a *tpcall()* function to transmit the service message to computer system 38. The server application processes the service message and forms a client reply message, and returns the client reply message to forwarding unit 128 by calling a *tpreturn()* function. Forwarding unit 128 enqueues the client reply message in queue space 130. Sometime thereafter, the client application on computer system 32 calls the *tpdequeu()* function to retrieve the client reply message. Queue unit 126 retrieves the client reply message from queue space 130 and transmits the message to the client application of computer system 32.

In the prior art, a queue-based communication manager was also provided on a server. However, the present invention increases reliability and fault tolerance by providing the queue-based communication manager in FTSS 44. As mentioned above, in a typical distributed application that includes an FTSS, the FTSS will typically be more reliable and fault tolerant than the servers coupled to the FTSS.

Figure 9 is a diagram illustrating request/reply communication agent 110. Before discussing agent 110 in greater detail, first consider the relevant ATMI function calls provided by block 74 in Figure 4 that support queue-based communication. The function *tpcall()* is used to initiate a synchronous request/reply transaction to a service, and the function *tpascall()* is used to initiate an asynchronous request to a service. After the service

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is executed, the server application calls *tpreturn()* to return the reply message. As discussed above, in synchronous mode, a client sends a request to a server, which performs the requested action while the client waits. The server then sends the reply to the client, which receives the reply. In asynchronous mode, the client does not wait for a server to complete a service request before the client undertakes other tasks. Accordingly, a reply is implied with a *tpcall()* function in synchronous mode. In asynchronous mode, a reply is received by calling the *tpgetrply()* function. An asynchronous request can also be cancelled by calling the *tpcancel()* function.

As discussed above, prior art request/reply communication is also implemented using transient inter-process communication (IPC) message queues. Each server is assigned an IPC message queue called a request queue, and each client is assigned an IPC message queue called a reply queue. Accordingly, a client application can send requests to the server by putting those requests on the server's queue, and then check and retrieve messages from the server by retrieving messages from its own reply queue. The present invention provides request/reply communication with additional reliability and fault tolerance by replicating each IPC message queue in FTSS 44, and storing the contents of the IPC message queues in RAID 100 and/or nonvolatile write cache 98 of Figure 5

In Figure 9, request/reply communication agent 110 maintains a request and reply queue for each request and reply queue present on a computer system configured to transmit messages between network nodes. Accordingly, request queue 132 and reply queue 134 correspond to queues in computer system 32, and request queue 136 and reply queue 138 correspond to queues in computer system 42. Router 140 routes the messages between the queues.

For example, assume that a client application on computer system 32 calls the *tpcall()* or *tpascall()* function to send a request message to a server application on computer system 42. The request message is transmitted to request queue 132. Router 140 receives the request message and routes it to request queue 136, and in turn the request message is transmitted to the server application on computer system 42. The server application processes the request message and calls the *tpreturn()* function to transmit the reply message

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back to the client application. The reply message is enqueued in reply queue 138. Router 140 routes the reply message to reply queue 134, and the reply message is retrieved by the client application in computer system 32.

Note that the method used to process messages in Figure 9 can be applied to any type of inter-process communication. By intercepting and storing IPC messages within FTSS 44, an application can easily recover from an error or other type of failure by accessing agent 110 to receive messages from the queues.

Figure 10 is a diagram illustrating unsolicited communication agent 112. Before discussing agent 112 in greater detail, first consider the relevant ATMI function calls provided by block 74 in Figure 4 that support event-based communication. The function *tpnotify()* sends an unsolicited message to a single client and *tpbroadcast()* sends a message to several clients. Note that unsolicited communication is similar to event-based communication, except that there is no subscription function.

In Figure 10, unsolicited communication agent 112 includes an unsolicited message manager 142 and unsolicited message queue 114. When a server calls the *tpnotify()* or *tpbroadcast()* function, the message is posted in queue 144, and is relayed to the appropriate nodes. If a particular client suffers some type of error or other failure, the client can access unsolicited message manager 142 to retrieve any relevant unsolicited messages.

The present invention enhances the reliability and fault tolerance of messaging in several ways. First, messages may be transmitted between nodes using FTSS interconnection fabric 46 of Figure 2. Fabric 46 is highly reliable and fault tolerant. Since many systems that host distributed applications already include an FTSS, using fabric 46 instead of a less reliable network media, such as Ethernet, increases availability of the distributed application without the customer having to incur additional hardware costs.

Second, in the prior art, several messaging paradigms, such as queue-based communication and event based communication, use agents that operate on separate servers. By moving these agents to the FTSS, availability is increased because the FTSS is typically more reliable than the servers to which it is coupled. Furthermore, since the FTSS is being

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used to pass messages anyway, providing the agents in the FTSS eliminates the need to route the messages to a separate server, thereby allowing the messages to be processed faster.

Finally, several prior art messaging paradigms, such as conversational communication and request/reply communication, pass IPC messages directly between nodes in a transient manner. In the present invention, these IPC messages pass through the FTSS and are stored in and retained by the FTSS, thereby allowing any application to "rollback" to a known point and retrieve lost IPC messages from the FTSS.

Although the present invention has been described with reference to preferred embodiments, workers skilled in the art will recognize that changes may be made in form and detail without departing from the spirit and scope of the invention.

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WHAT IS CLAIMED IS:

1. A method of transmitting messages between a first node and a second node, wherein the first and second nodes are each coupled to a fault tolerant storage system (FTSS), the method comprising:

transmitting a message from the first node to a communication agent in the FTSS;

storing the message in a data structure in highly reliable fault-tolerant storage media of the FTSS;

processing the message at the FTSS in accordance with a messaging paradigm; and

transmitting the message from the FTSS to the second node.

2. The method of claim 1 wherein the messaging paradigm is a request/reply communication paradigm, and:

transmitting a message from the first node to a communication agent in the FTSS comprises:

transmitting a request message from the first node to a request/reply communication agent in the FTSS;

storing the message in a data structure in highly reliable fault-tolerant storage media of the FTSS comprises:

storing the request message in a request queue in highly reliable fault-tolerant storage media of the FTSS;

processing the message at the FTSS in accordance with a messaging paradigm comprises:

retrieving the request message from the request queue; and

transmitting the message from the FTSS to the second node comprises:

transmitting the request message from the FTSS to a service on the second node;

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and the method further comprises:

executing the service on the second node using the request message as an input and providing a reply message as an output;

transmitting the reply message from the second node to the request/reply communication agent in the FTSS;

storing the reply message in a reply queue in highly reliable fault-tolerant storage media of the FTSS;

retrieving the reply message from the reply queue; and

transmitting the reply message from the FTSS to the first node.

3. The method of claim 1 wherein the messaging paradigm is a conversational communication paradigm, and:

transmitting a message from the first node to a communication agent in the FTSS comprises:

transmitting a connect message from the first node to a conversational communication agent in the FTSS;

processing the message at the FTSS in accordance with a messaging paradigm comprises:

opening a conversation queue in highly reliable fault-tolerant storage media of the FTSS;

storing the message in a data structure in highly reliable fault-tolerant storage media of the FTSS comprises:

storing the connect message in the conversation queue; and

transmitting the message from the FTSS to the second node comprises:

transmitting the connect message from the FTSS to the second node.

4. The method of claim 3 and further comprising:

transmitting a send message from the first node to the conversational communication agent in the FTSS;

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storing the send message in the conversation queue;

transmitting the send message to from the FTSS to a service on the second node;

executing the service in the second node using the send message as an input and providing a receive message as an output;

transmitting the receive message from the second node to the conversational communication agent in the FTSS;

storing the receive message in the conversation queue; and

transmitting the receive message to the first node.

5. The method of claim 3 and further comprising:

transmitting a disconnect message from the first node to the conversational communication agent in the FTSS;

closing the conversation queue; and

transmitting the disconnect message to the second node.

6. The method of claim 1 wherein the messaging paradigm is an event-based communication paradigm, and:

transmitting a message from the first node to a communication agent in the FTSS comprises:

transmitting a post message from the first node to an event-based communication agent in the FTSS;

processing the message at the FTSS in accordance with a messaging paradigm comprises:

accessing a subscription manager to determine whether any nodes have subscribed to receive the event represented by the post message;

storing the message in a data structure in highly reliable fault-tolerant storage media of the FTSS comprises:

storing the post message in an event queue in highly reliable fault-tolerant storage media of the FTSS; and

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transmitting the message from the FTSS to the second node comprises:

transmitting the post message from the FTSS to the second node if the second node has subscribed to receive the event represented by the post message.

7. The method of claim 6 and further comprising:

transmitting a subscribe message from the second node to the event-based communication manager in the FTSS, wherein the subscribe message includes an event; and

accessing the subscription manager to record that the second node has subscribed to receive post messages associated with the event.

8. The method of claim 6 and further comprising:

transmitting an unsubscribe message from the second node to the event-based communication manager in the FTSS, wherein the unsubscribe message includes an event; and

accessing the subscription manager to record that the second node should no longer receive post messages associated with the event.

9. The method of claim 1 wherein the messaging paradigm is a queue-based communication paradigm, and:

transmitting a message from the first node to a communication agent in the FTSS comprises:

transmitting an enqueue message from the first node to a queue-based communication agent in the FTSS;

storing the message in a data structure in highly reliable fault-tolerant storage media of the FTSS comprises:

storing the enqueue message in a queue space in highly reliable fault-tolerant storage media of the FTSS;

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processing the message at the FTSS in accordance with a messaging paradigm comprises:

retrieving the enqueue message from the queue space only if the second node is available; and

transmitting the message from the FTSS to the second node comprises:

transmitting the enqueue message from the FTSS to a service on the second node only if the second node is available;

and the method further comprises:

executing the service on the second node using the enqueue message as an input and providing a dequeue message as an output;

transmitting the dequeue message from the second node to the queue-based communication agent in the FTSS;

storing the dequeue message in the queue space;

retrieving the dequeue message from the queue space; and

transmitting the dequeue message from the FTSS to the first node.

10. The method of claim 1 wherein the messaging paradigm is an unsolicited communication paradigm, and:

transmitting a message from the first node to a communication agent in the FTSS comprises:

transmitting a broadcast message from the first node to an unsolicited communication agent in the FTSS;

processing the message at the FTSS in accordance with a messaging paradigm comprises:

accessing determining which nodes should receive the broadcast message based on the broadcast message;

storing the message in a data structure in highly reliable fault-tolerant storage media of the FTSS comprises:

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storing the broadcast message in an unsolicited message queue in highly reliable fault-tolerant storage media of the FTSS; and

transmitting the message from the FTSS to the second node comprises:

transmitting the post message from the FTSS to all nodes that should receive the broadcast message.

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A METHOD AND APPARATUS FOR PASSING MESSAGES USING A FAULT TOLERANT STORAGE SYSTEM

ABSTRACT OF THE DISCLOSURE

A method and apparatus pass messages between server and client applications using a fault tolerant storage system (FTSS). The interconnection fabric that couples the FTSS to the computer systems that host the client and server applications may also be used to carry messages. A networked system capable of hosting a distributed application includes a plurality of computer systems coupled to an FTSS via an FTSS interconnection fabric. The FTSS not only processes file-related I/O transactions, but also includes several message agents to facilitate message transfer in a reliable and fault tolerant manner. The message agents include a conversational communication agent, an event-based communication agent, a queue-based communication agent, a request/reply communication agent, and an unsolicited communication agent. The highly reliable and fault tolerant nature of the FTSS ensures that the FTSS can guarantee delivery of a message transmitted from a sending computer system to a destination computer system. As soon as a message is received by the FTSS from a sending computer system, the message is committed to a nonvolatile fault tolerant write cache. Thereafter, the message is written to a redundant array of independent disks (RAID) of the FTSS, and processed by one of the message agents.

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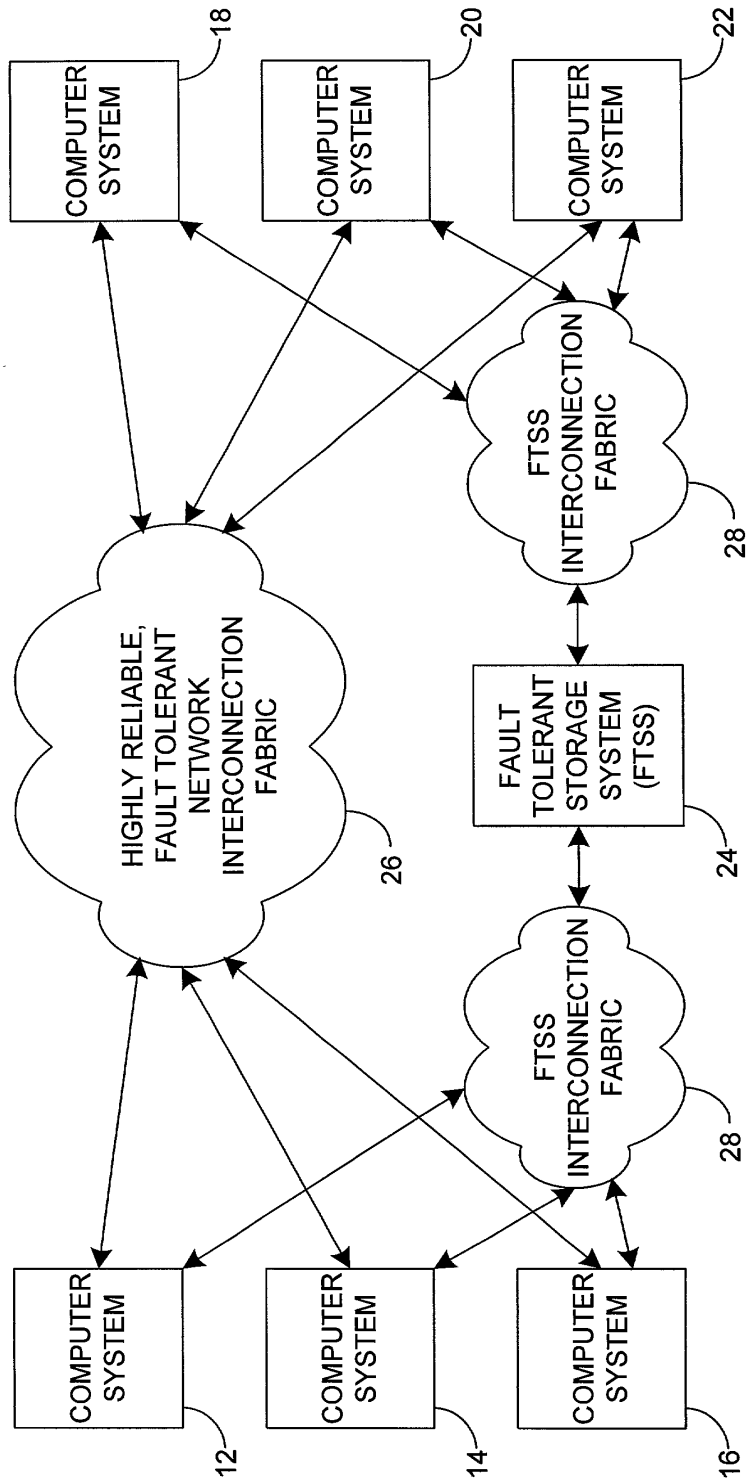


FIG. 1
(PRIOR ART)

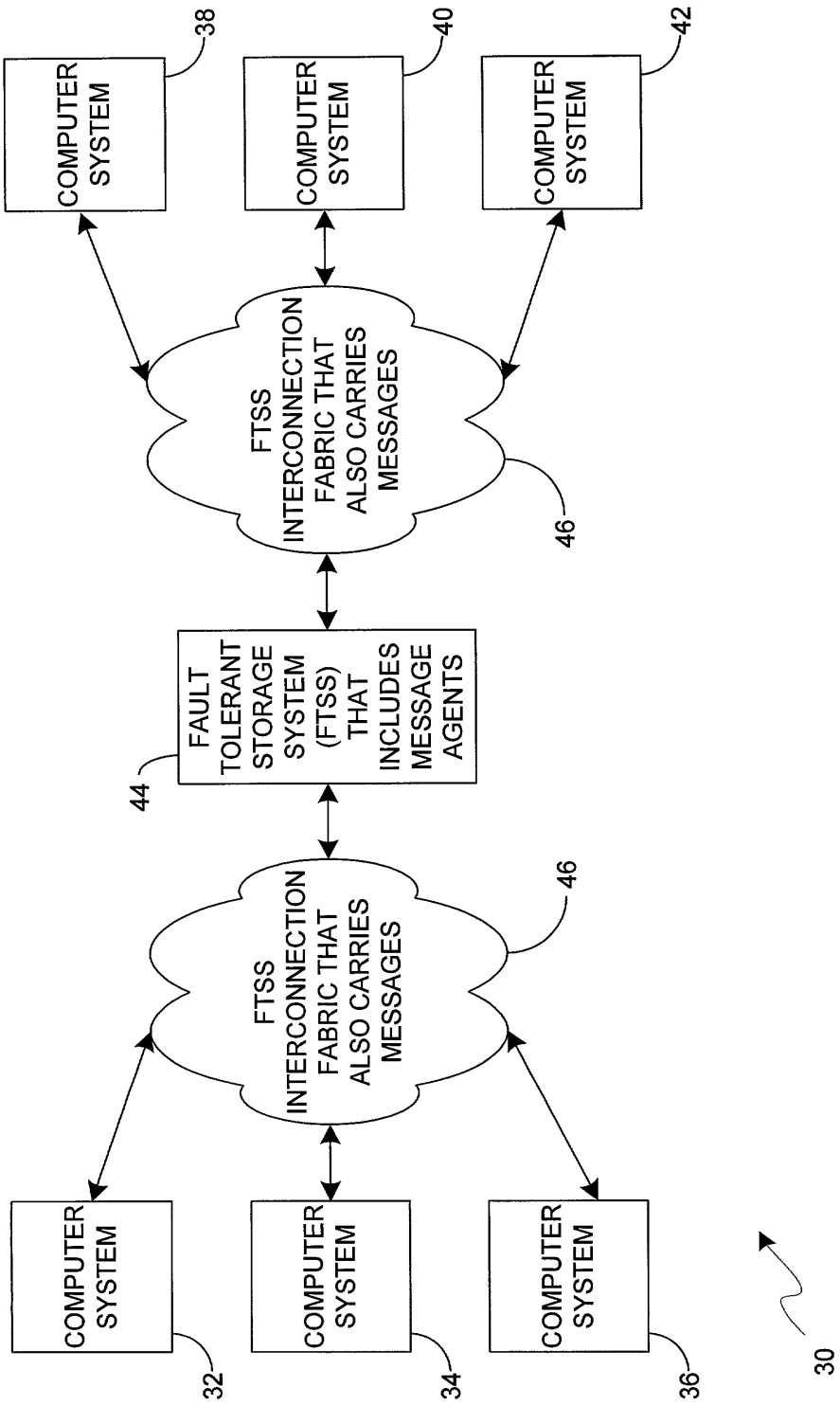

COMPUTER SYSTEM
38
COMPUTER SYSTEM
40
COMPUTER SYSTEM
42
FTSS INTERCONNECTION FABRIC THAT ALSO CARRIES MESSAGES
46
FAULT TOLERANT STORAGE SYSTEM (FTSS) THAT INCLUDES MESSAGE AGENTS
44
FTSS INTERCONNECTION FABRIC THAT ALSO CARRIES MESSAGES
46
COMPUTER SYSTEM
32
COMPUTER SYSTEM
34
COMPUTER SYSTEM
36
30

FIG. 2

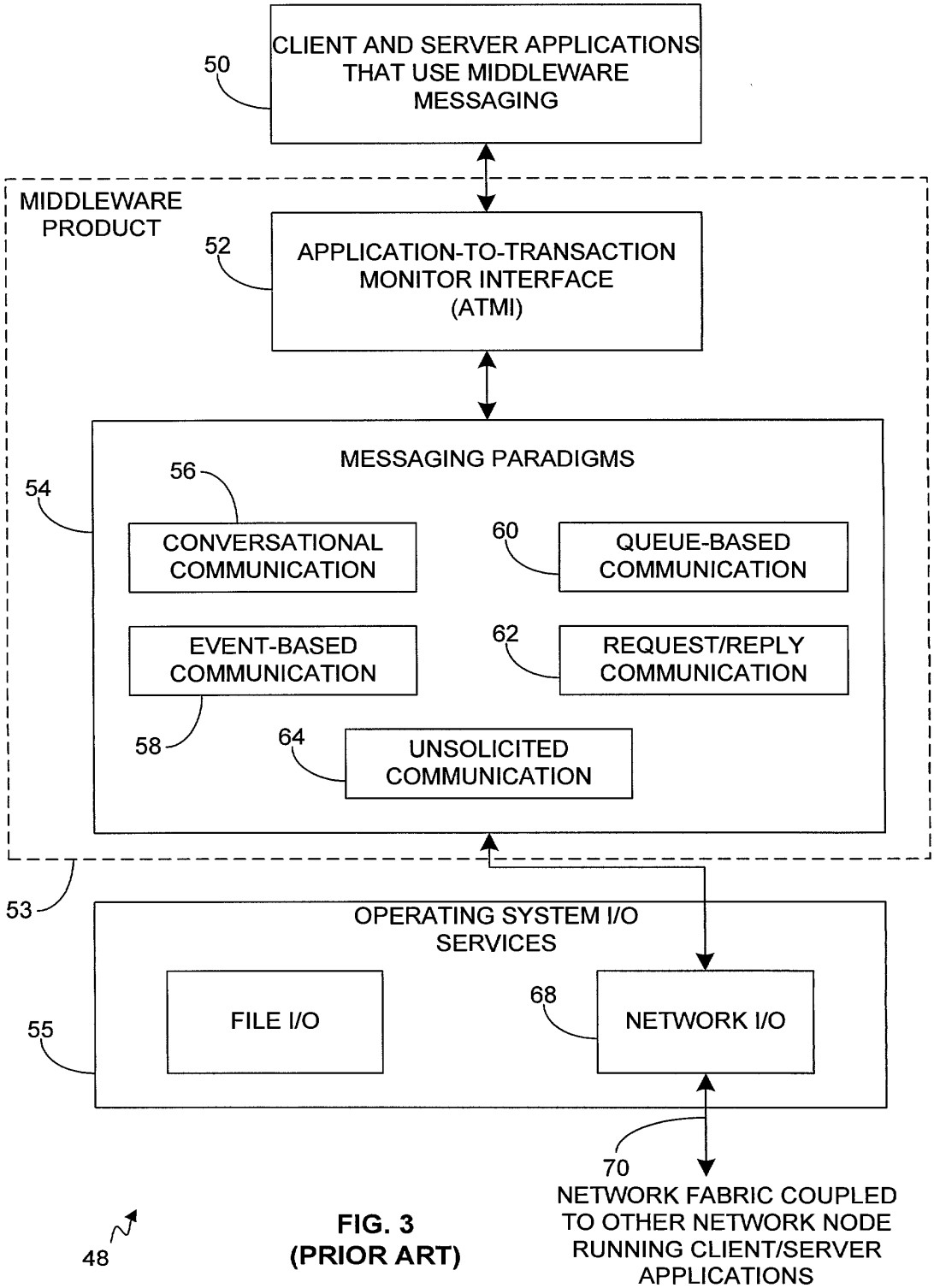


FIG. 3
(PRIOR ART)

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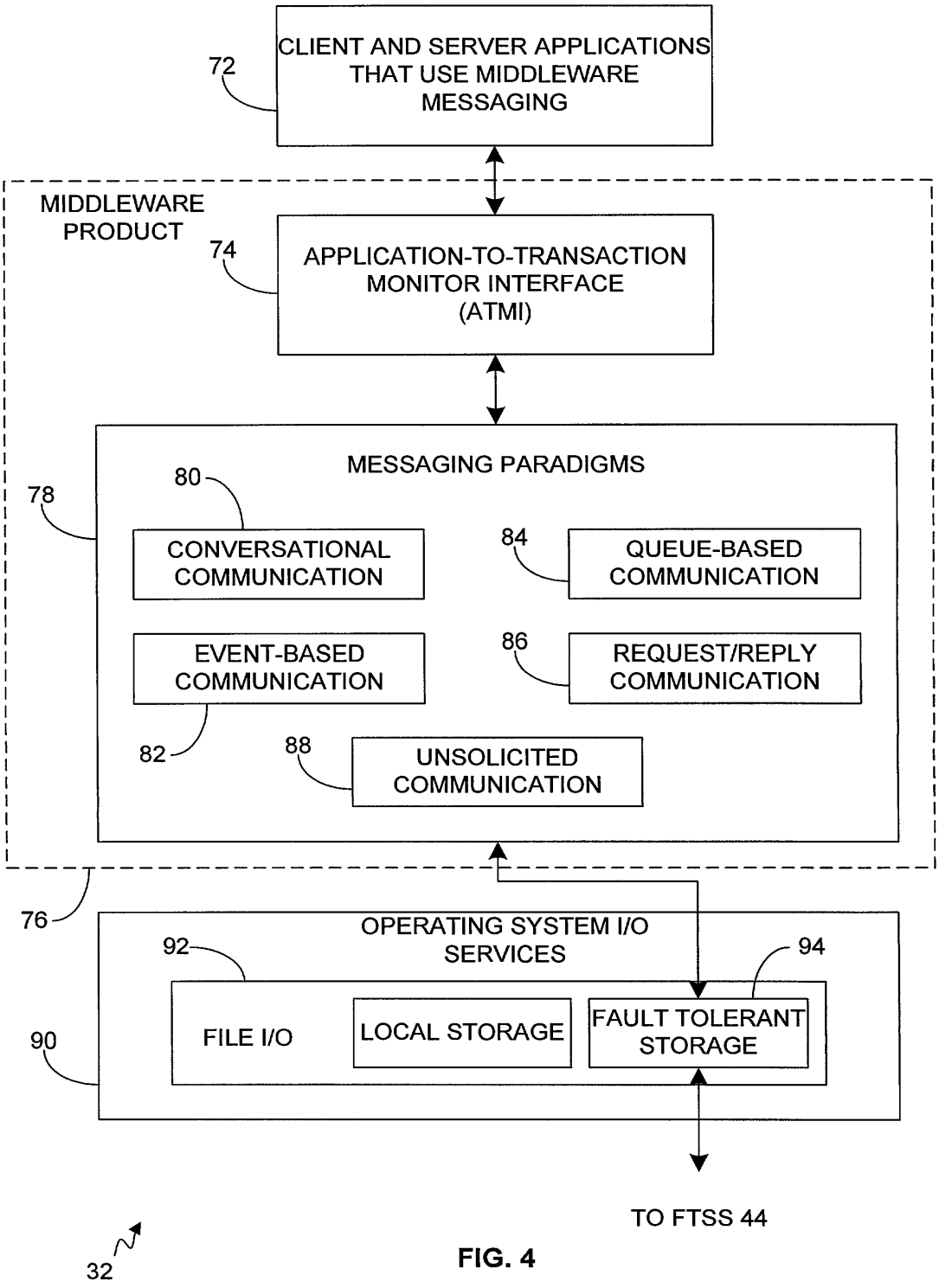

CLIENT AND SERVER APPLICATIONS THAT USE MIDDLEWARE MESSAGING
72
MIDDLEWARE PRODUCT
APPLICATION-TO-TRANSACTION MONITOR INTERFACE (ATMI)
74
MESSAGING PARADIGMS
80
78
CONVERSATIONAL COMMUNICATION
84
QUEUE-BASED COMMUNICATION
EVENT-BASED COMMUNICATION
86
REQUEST/REPLY COMMUNICATION
82
88
UNSOLICITED COMMUNICATION
76
OPERATING SYSTEM I/O SERVICES
92
94
FILE I/O
LOCAL STORAGE
FAULT TOLERANT STORAGE
90
TO FTSS 44
32

FIG. 4

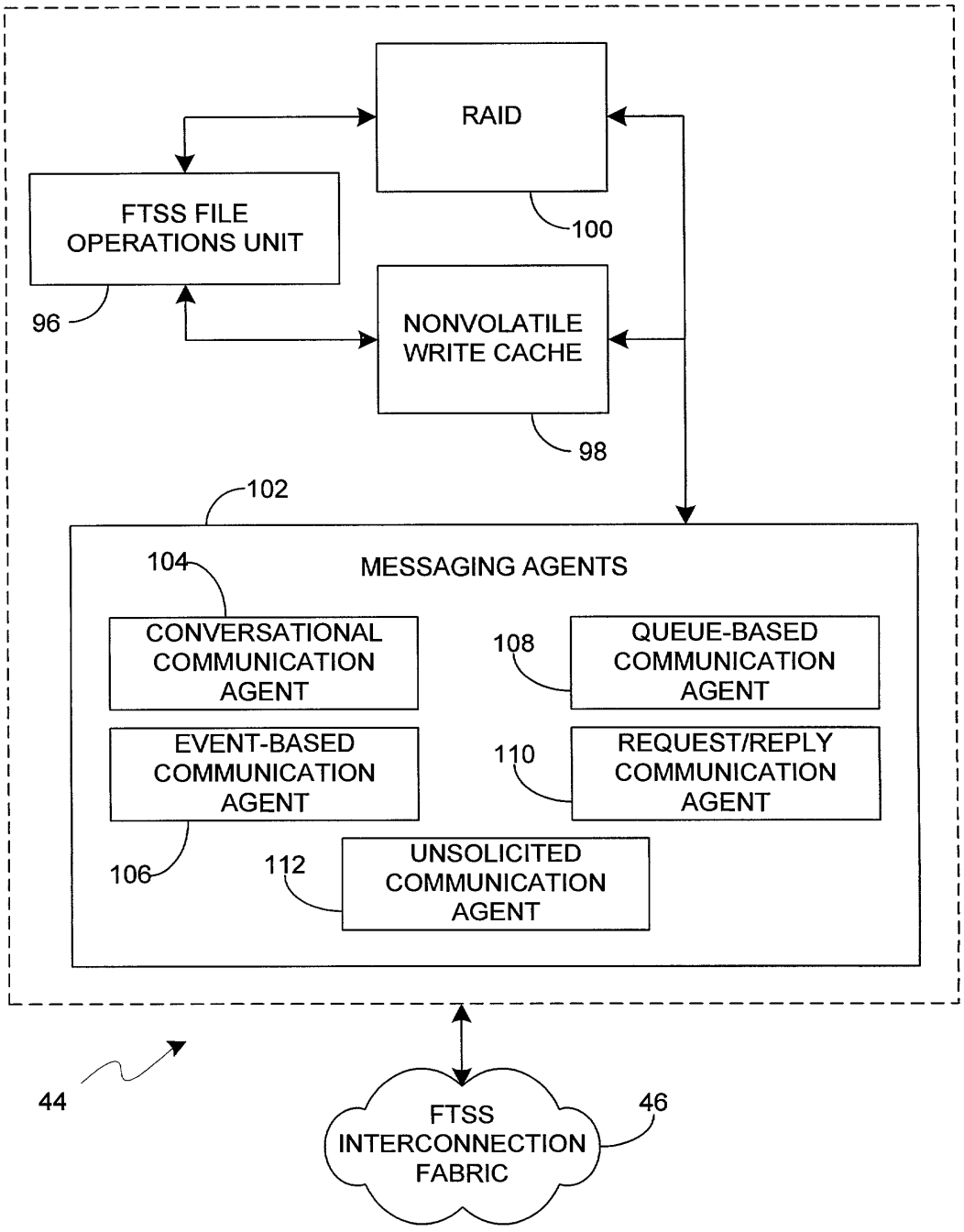

RAID
100
FTSS FILE OPERATIONS UNIT
96
NONVOLATILE WRITE CACHE
98
102
MESSAGING AGENTS
104
CONVERSATIONAL COMMUNICATION AGENT
108
QUEUE-BASED COMMUNICATION AGENT
EVENT-BASED COMMUNICATION AGENT
110
REQUEST/REPLY COMMUNICATION AGENT
106
112
UNSOLICITED COMMUNICATION AGENT
44
FTSS INTERCONNECTION FABRIC
46

FIG. 5

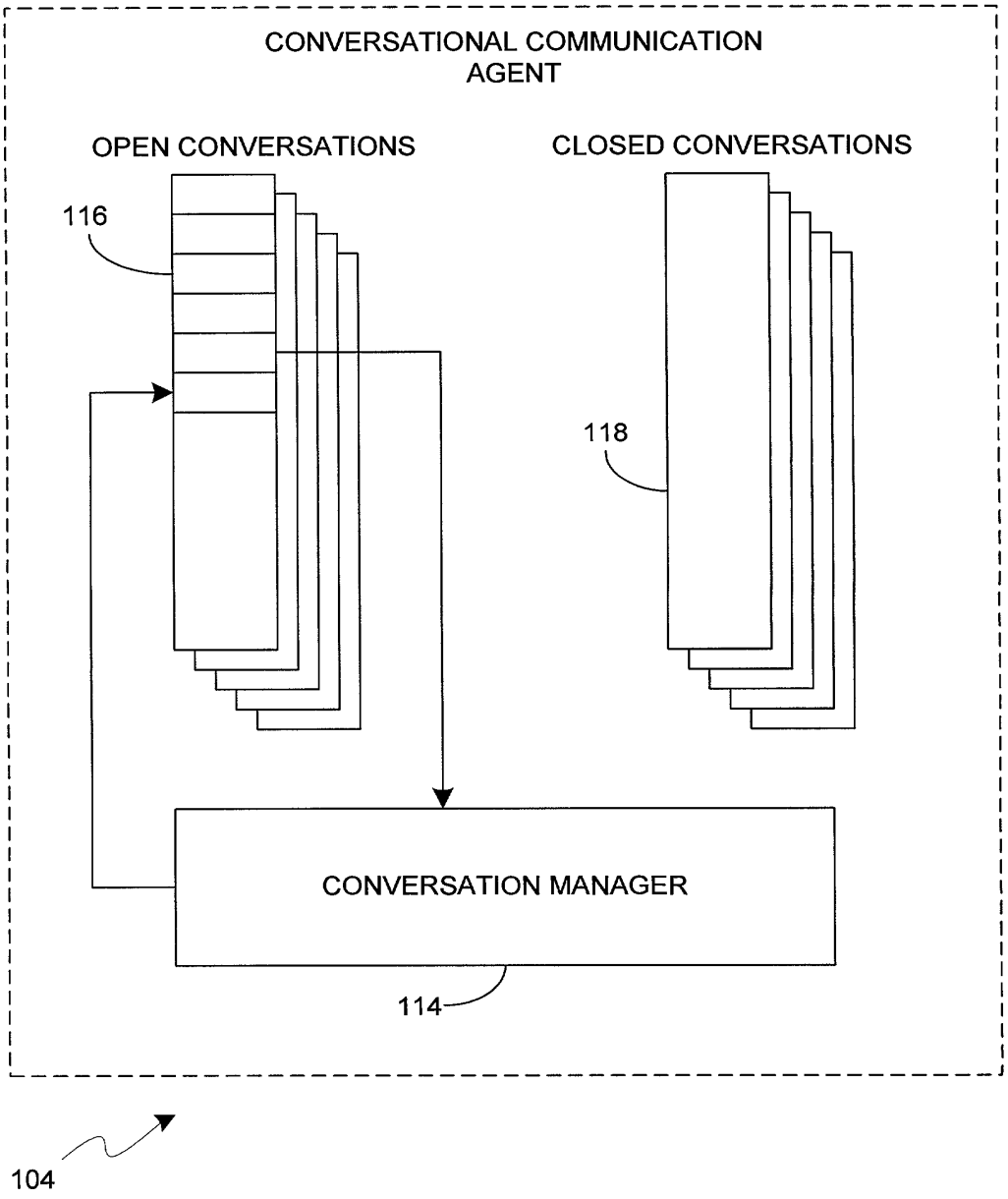

CONVERSATIONAL COMMUNICATION AGENT
OPEN CONVERSATIONS
CLOSED CONVERSATIONS
116
118
CONVERSATION MANAGER
114
104

FIG. 6

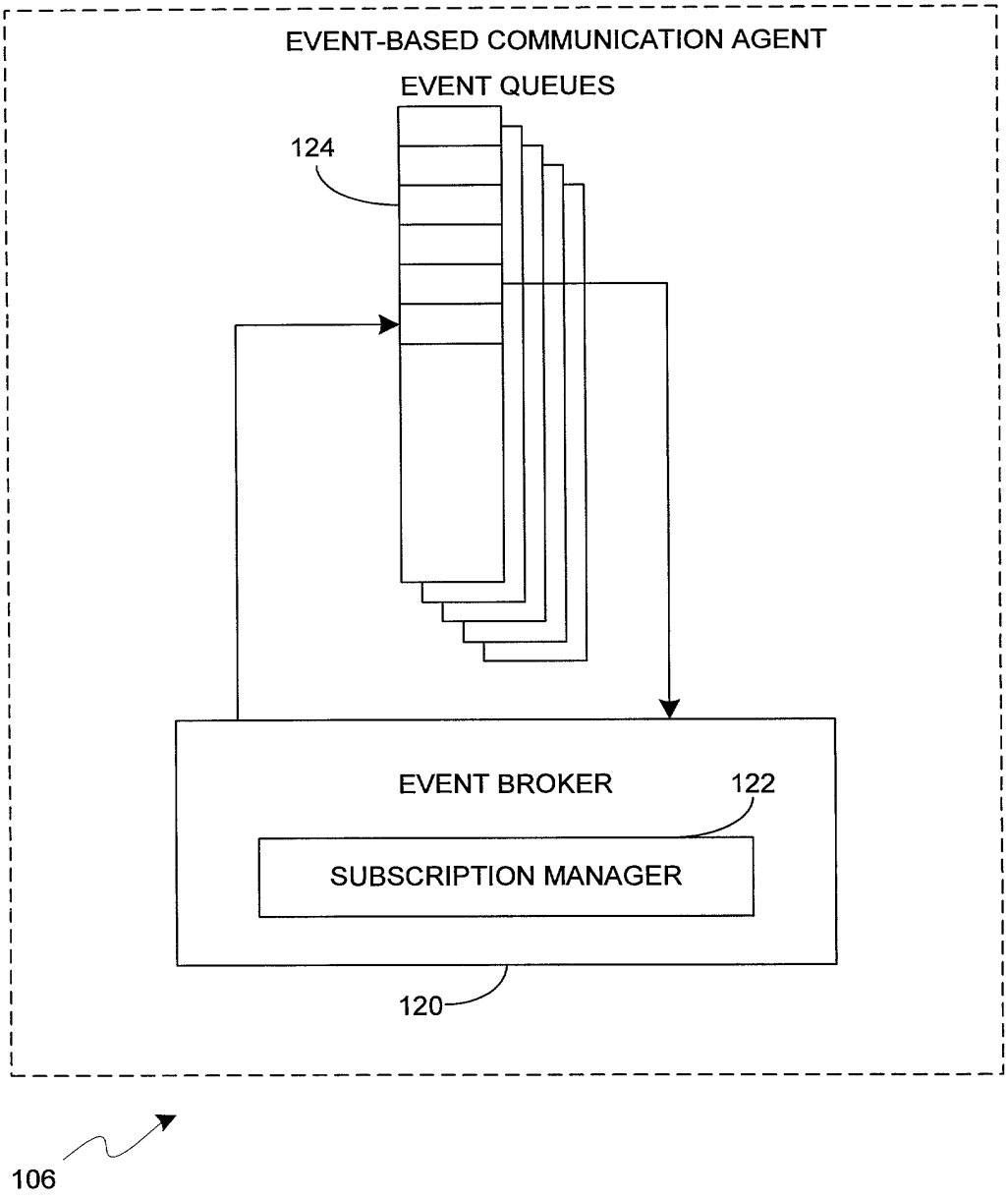


FIG. 7

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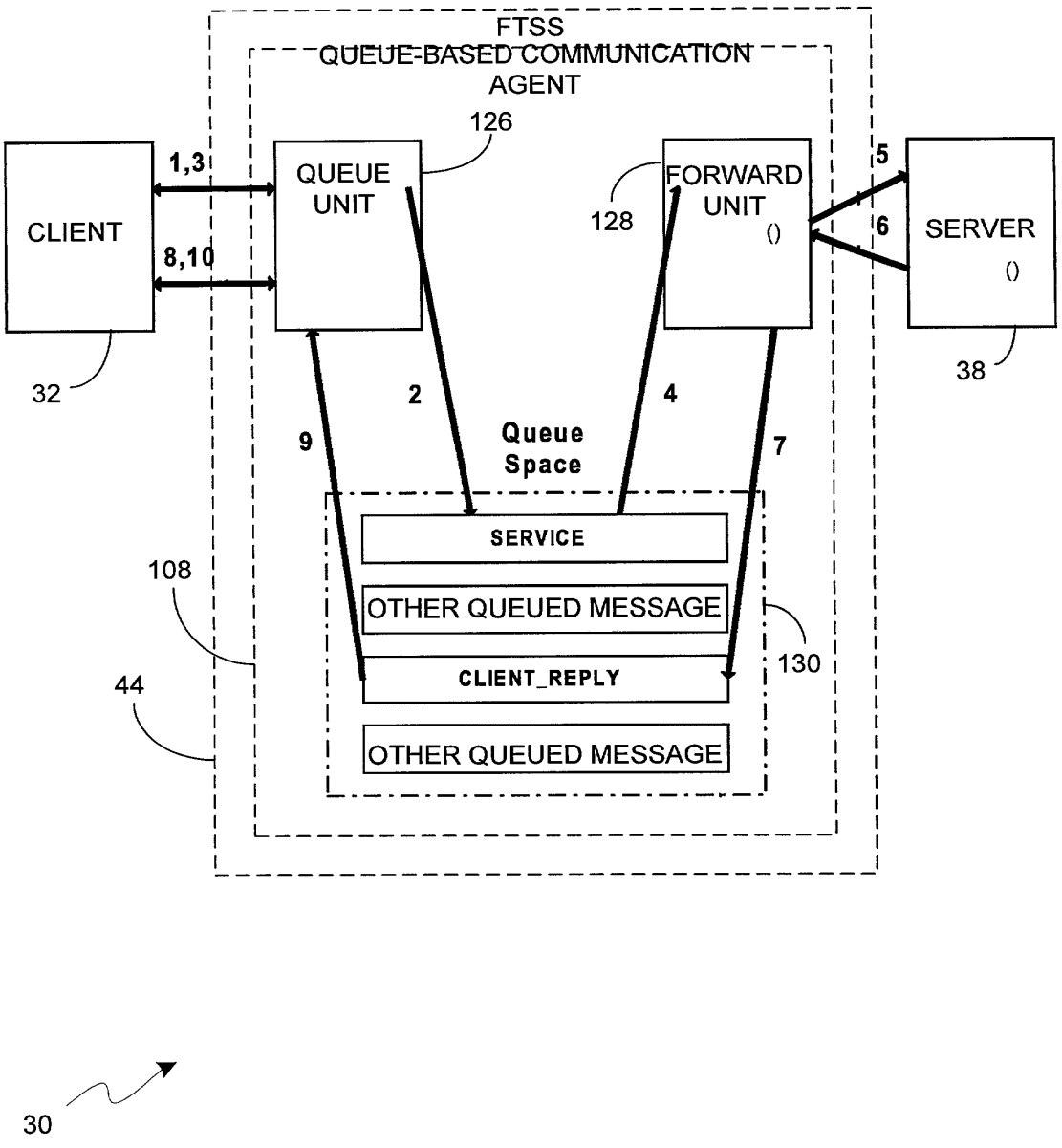

FTSS
QUEUE-BASED COMMUNICATION AGENT
126
CLIENT
1,3
8,10
QUEUE UNIT
FORWARD UNIT
128
5
6
SERVER
32
38
2
4
9
7
Queue Space
SERVICE
OTHER QUEUED MESSAGE
CLIENT_REPLY
OTHER QUEUED MESSAGE
108
130
44
30

FIG. 8

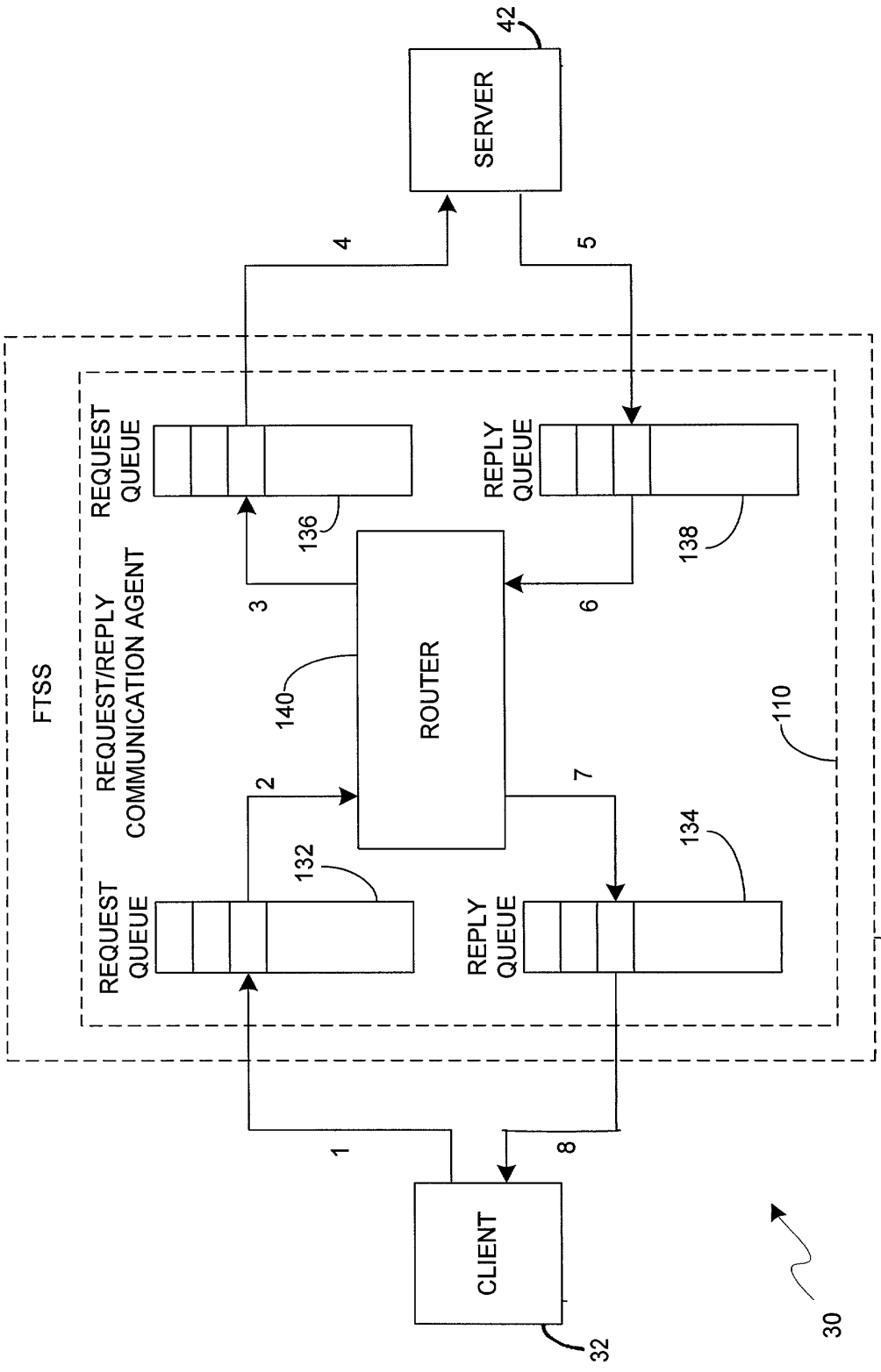

SERVER
42
4
5
FTSS
REQUEST/REPLY
COMMUNICATION AGENT
REQUEST
QUEUE
REPLY
QUEUE
136
138
3
6
ROUTER
140
110
2
7
132
134
REQUEST
QUEUE
REPLY
QUEUE
44
1
8
CLIENT
32
30

FIG. 9

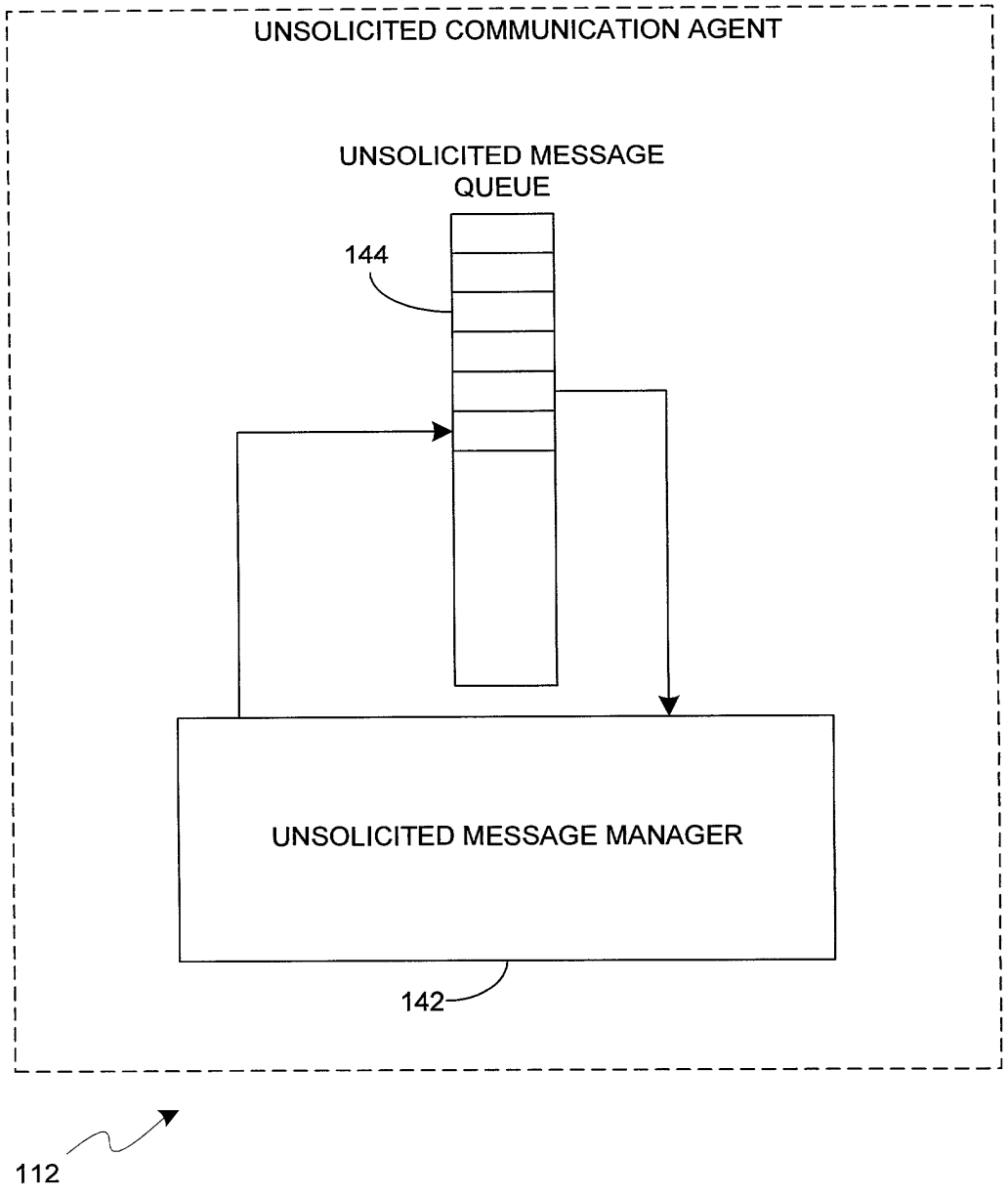


FIG. 10

Attorney Docket No. 2003P00328US

DECLARATION AND POWER OF ATTORNEY FOR PATENT APPLICATION

ATTORNEY DOCKET NO. 10008316-1

As a below named inventor, I hereby declare that:

My residence/post office address and citizenship are as stated below next to my name;

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

A Method And Apparatus For Passing Messages Using A Fault Tolerant Storage System

the specification of which is attached hereto unless the following box is checked:

( ) was filed on _____ as US Application Serial No. or PCT International Application Number _____ and was amended on _____ (if applicable).

I hereby state that I have reviewed and understood the contents of the above-identified specification, including the claims, as amended by any amendment(s) referred to above. I acknowledge the duty to disclose all information which is material to patentability as defined in 37 CFR 1.56.

Foreign Application(s) and/or Claim of Foreign Priority

I hereby claim foreign priority benefits under Title 35, United States Code Section 119 of any foreign application(s) for patent or inventor(s) certificate listed below and have also identified below any foreign application for patent or inventor(s) certificate having a filing date before that of the application on which priority is claimed:

COUNTRY	APPLICATION NUMBER	DATE FILED	PRIORITY CLAIMED UNDER 35 U.S.C. 119
			YES: ___ NO: ___
			YES: ___ NO: ___

Provisional Application

I hereby claim the benefit under Title 35, United States Code Section 119(e) of any United States provisional application(s) listed below:

APPLICATION SERIAL NUMBER	FILING DATE

U. S. Priority Claim

I hereby claim the benefit under Title 35, United States Code, Section 120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code Section 112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, Section 1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

APPLICATION SERIAL NUMBER	FILING DATE	STATUS (patented/pending/abandoned)

POWER OF ATTORNEY:

As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith:

Customer Number 022879

Place Customer Number Bar Code Label here

Send Correspondence to:	**Direct Telephone Calls To:**
HEWLETT-PACKARD COMPANY	
Intellectual Property Administration	**David A. Plettner**
P.O. Box 272400	
Fort Collins, Colorado 80527-2400	**(408) 447-3013**

I hereby 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 issued thereon.

Full Name of Inventor: Blaine D. Gaither **Citizenship:** US

Residence: 1600 Serramonte Drive, Fort Collins, CO 80524-1718

Post Office Address: Same as residence

_____ _____

Inventor's Signature **Date**

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DECLARATION AND POWER OF ATTORNEY FOR PATENT APPLICATION (continued)

ATTORNEY DOCKET NO. 10008316-1

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Residence: 1712 Ridgewood Road, Fort Collins, CO 80526

Post Office Address: Same as residence

Inventor's Signature _____ Date _____

Full Name of # 3 joint inventor: _____ Citizenship: _____

Residence: _____

Post Office Address: _____

Inventor's Signature _____ Date _____

Full Name of # 4 joint inventor: _____ Citizenship: _____

Residence: _____

Post Office Address: _____

Inventor's Signature _____ Date _____

Full Name of # 5 joint inventor: _____ Citizenship: _____

Residence: _____

Post Office Address: _____

Inventor's Signature _____ Date _____

Full Name of # 6 joint inventor: _____ Citizenship: _____

Residence: _____

Post Office Address: _____

Inventor's Signature _____ Date _____

Full Name of # 7 joint inventor: _____ Citizenship: _____

Residence: _____

Post Office Address: _____

Inventor's Signature _____ Date _____

Full Name of # 8 joint inventor: _____ Citizenship: _____

Residence: _____

Post Office Address: _____

Inventor's Signature _____ Date _____

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11-02-00

A

HEWLETT-PACKARD COMPANY
Intellectual Property Administration
P. O. Box 272400
Fort Collins, Colorado 80527-2400

PATENT APPLICATION

ATTORNEY DOCKET NO. 10008316-1

10/31/00 JC992 U.S. PTO

IN THE U.S. PATENT AND TRADEMARK OFFICE
Patent Application Transmittal Letter

jc925 U.S. PTO 09/703427 10/31/00

COMMISSIONER FOR PATENTS
Washington, D.C. 20231

Sir:

Transmitted herewith for filing under 37 CFR 1.53(b) is a(n): (X) Utility ( ) Design
(X) original patent application,
( ) continuation-in-part application

INVENTOR(S): **Blaine D. Gaither, et al.**

TITLE: **A Method And Apparatus For Passing Messages Using A Fault Tolerant Storage System**

Enclosed are:

(X) The Declaration and Power of Attorney. ( ) signed (X) unsigned or partially signed

(X) 10 sheets of drawings (one set) ( ) Associate Power of Attorney

( ) Form PTO-1449 ( ) Information Disclosure Statement and Form PTO-1449

( ) Priority document(s) ( ) (Other) _____ (fee $_____)

CLAIMS AS FILED BY OTHER THAN A SMALL ENTITY				
(1) FOR	(2) NUMBER FILED	(3) NUMBER EXTRA	(4) RATE	(5) TOTALS
TOTAL CLAIMS	10 — 20	0	X $18	$ 0
INDEPENDENT CLAIMS	1 — 3	0	X $80	$ 0
ANY MULTIPLE DEPENDENT CLAIMS	0		$270	$ 0
BASIC FEE: Design ($320.00); Utility ($710.00)				$ 710
TOTAL FILING FEE				$ 710
OTHER FEES				$
TOTAL CHARGES TO DEPOSIT ACCOUNT				$ 710

Charge $ 710 to Deposit Account 08-2025. At any time during the pendency of this application, please charge any fees required or credit any over payment to Deposit Account 08-2025 pursuant to 37 CFR 1.25. Additionally please charge any fees to Deposit Account 08-2025 under 37 CFR 1.16, 1.17,1.19, 1.20 and 1.21. A duplicate copy of this sheet is enclosed.

"Express Mail" label no. EL442083072US

Date of Deposit Oct. 31, 2000

I hereby certify that this is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 CFR 1.10 on the date indicated above and is addressed to: Commissioner for Patents, Washington, D.C. 20231

By _____

Typed Name: **Jerome Dechant**

Respectfully submitted,

Blaine D. Gaither, et al.

By _____

David A. Plettner

Attorney/Agent for Applicant(s)
Reg. No. **36,241**
Date: **Oct. 31, 2000**
Telephone No.: **(408) 447-3013**

Rev 10/00 (TransNew)

- Attach as First Page to Transmitted Papers -

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A METHOD AND APPARATUS FOR PASSING MESSAGES USING A FAULT TOLERANT STORAGE SYSTEM

CROSS REFERENCE TO RELATED APPLICATION

This application contains subject matter related to a co-pending application entitled "A Fault Tolerant Storage System Having an Interconnection Fabric That Also Carries Network Traffic" by Blaine D. Gaither et al., which has been assigned Hewlett-Packard Docket Number 10001666-1. This application is hereby incorporated by reference, is assigned to the same assignee as the present application, and was filed on October 31, 2000, which is also the date on which the present application was filed.

FIELD OF THE INVENTION

The present invention relates to messaging between computer systems. More specifically, the present invention relates to a messaging architecture wherein messages are transmitted over the interconnection fabric of a fault tolerant storage system and are stored within the fault tolerant storage system.

DESCRIPTION OF THE RELATED ART

In the art of computing, a distributed application is an application that is separated into two or more parts, such as a client application on a first computer system and a server application on a second computer system, with the two computers coupled together via a network. As used herein, the term "client" refers to an entity that requests a service, and the term "server" refers to the entity that fulfills the request. The entity can be a an application, *i.e.*, a client application or a server application, or the entity can be a computer system coupled to a network, *i.e.*, a client computer system or a server computer system. Computer systems coupled to a network may also be referred to as "nodes". The meaning of these terms will be apparent from the contexts in which the terms are used.

Consider, for example, a distributed application that allows a customer to order a product over the Internet from an on-line retailer. The customer accesses the distributed

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application using a web browser. The web browser communicates over the Internet with a web server, which provides the customer with a catalog of products that can be ordered, and provides a "shopping basket" that allows the customer to select the products that the customer wishes to purchase.

Assume that the customer decides to complete the order, and pay for the order with a credit card. The web server must communicate as a client with a server application that verifies that the credit card is valid, and posts the purchase to the customer's credit card account. The web server must also communicate with an application that delivers the order to the warehouse so the order can be shipped. In addition, the web server may communicate with an inventory control application to verify that the products ordered are in stock, and to order replacement inventory from the vendor. If the customer checks back latter to view the status of the order, the web server may communicate with an application maintained by the shipping company to provide the customer with a tracking number.

This is a very simple example, and a typical distributed application may be much more complex. However, even in this simple example one can see that designing a distributed application is very complex. Perhaps the most complex task faced by a distributed application developer is ensuring that all the disparate applications that comprise the distributed application communicate in a seamless and reliable manner.

To ensure that all applications communicate seamlessly and reliably in a distributed application, the application designer may use a middleware product that distributes applications across multiple platforms, databases, and operating systems using message-based communications and, if desired, distributed transaction processing. Middleware products are used with client/server applications to distribute processing among multiple servers, manage distributed transactions, and integrate multiple database platforms. Middleware systems are sometimes known in the art as "on-line transaction processing" (OLTP) systems. One such system is Bea Tuxedo®, which is a product of BEA Systems, Inc.

To facilitate communication between disparate applications, Bea Tuxedo® provides an application designer with a series of messaging paradigms. These messaging paradigms

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are conversational communication, event-based communication, queue-based communication, request/reply communication, and unsolicited communication.

Conversational communication allows messages to be exchanged between clients and servers in a manner analogous to human conversation. This form of communication is implemented using inter-process communication (IPC) message queues. IPC message queues are typically implemented in transient memory areas, and are typically provided by the underlying operating system and are used for communication between clients and servers. IPC message queues can be used to pass messages between client and server applications operating on the same computer system or on separate computer systems coupled by a network.

Just as in a conversation between two people, a number of messages pass back and forth between the client and server until a conclusion is reached. Over the course of the communication, both sides "remember" the point (or state) of the conversation so that relatively long operations, such as ad hoc queries, reports, and file transfers, can be supported. Note that the context of any particular message is interpreted in view the previous messages comprising the conversation.

Event-based communication uses an event broker to transfer messages. The event broker provides a communication paradigm in which message suppliers can post messages for message subscribers. Because client and server processes that use the event broker communicate with one another based on a set of subscriptions, this paradigm is also known in the art as publish-and-subscribe communication. The event broker acts like a newspaper delivery person who delivers newspapers only to customers who have paid for a subscription. Event generators inform the event broker of events (such as changes and problems) as they occur. This process is called posting an event. The event broker then matches the name of the event to an event name associated with a list of subscribers, and notifies each subscriber on the list of the event by passing a message to the subscriber. Communication between the suppliers, subscribers, and event broker is provided by IPC message queues.

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Queue-based communication requires persistent storage of data. Queue-based communication allows any client or server to store messages in queues, and guarantees that any stored message will be delivered to the destination. Queues can be ordered as last-in first-out (LIFO) or first-in first-out (FIFO), or on the basis of time or priority. A collection of queues is administered and referred to as a single entity known as a queue space.

Queue-based communication is appropriate when communication can occur in a time-independent fashion. Time-independence is a characteristic of programs that operate independently from one another and do not need to synchronize their communications simultaneously. Time-independent programs synchronize with each other by leaving messages in application queues. Because queued messages are stored using persistent media, such as a hard disk drive, queue-based communication is highly reliable and messages can even be delivered after failures, such as power outages or network interruptions.

Even though queue-based messages pass through persistent storage, server applications and client applications enqueue and dequeue messages by sending the messages to a queue administrator. The queue administrator can reside on the same computer as either the server or client application, or can reside on a third server.

Request/reply communication is also implemented using inter-process communication (IPC) message queues. Each server is assigned an IPC message queue called a request queue, and each client is assigned an IPC message queue called a reply queue. Accordingly, a client application can send requests to the server by putting those requests on the server's queue, and then check and retrieve messages from the server by retrieving messages from its own reply queue.

Request/reply communication is typically carried out in either a synchronous mode or an asynchronous mode. In a synchronous mode, a client sends a request to a server, which performs the requested action while the client waits. The server then sends the reply to the client, which receives the reply. In asynchronous mode, the client does not wait for a server to complete a service request before the client undertakes other tasks. Rather, after issuing a request, the client performs additional tasks (which may include issuing more

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requests to the server). When a reply to the first request is available, the client retrieves it from its reply queue.

Unsolicited communication is a type of communication that allows a client or server to receive a message that it never requested, thereby making it possible for applications to receive notification of application-specific events as they occur without having to request notification. Unsolicited messages can be sent to a single server node or client node, or be broadcast to a group of nodes. For example, a server may alert a single client that the account about which the client is inquiring has been closed, or a server may send a message to all the clients to notifying the clients that the server will be shut down for maintenance at a specific time. In addition, unsolicited messages can be sent either with or without guaranteed delivery. Unsolicited messages are sent using IPC message queues.

As can be seen from the discussion above, some of these messaging paradigms, such as request/reply communication, use transient media, such as network connections and system memory, to pass messages between clients and servers. On the other hand, queue-based communication delivers messages using persistent media, such as a hard disk drive.

In most distributed applications, availability is very important. Consider the example above, if the application that processes credit card transactions suffers a failure, the customer will not be able to purchase products. Similarly, if the web server can not communicate with the inventory control application, the web server can not inform the customer whether the product is in stock.

To ensure that a distributed application has a high rate of availability, it is important to make each component that hosts the distributed application as reliable and fault-tolerant as possible. As discussed above, messaging is critical in a distributed application, and two components critical in the communication of messages are the persistent storage media, such as the hard drives, and the transient communication network. Accordingly, a designer of a distributed application will often specify that the application be implemented using highly reliable and fault tolerant interconnection fabrics and storage systems.

Several interconnection fabrics are available to provide guaranteed delivery of packets. For example, ServerNet® is a system interconnect architecture available from

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Compaq Computer Corporation. ServerNet® hardware ensures data integrity using multiple techniques. For example, command link integrity isolates single-bit errors, cyclic redundancy checks maintain both data and control integrity of transfers crossing the interconnect fabric, and hardware protocol acknowledgments ensure that end-to-end reliable data transfer has occurred. In addition, ServerNet® is capable of providing a high level of availability by incorporating spare alternate paths within a primary interconnection fabric, and providing a fully redundant secondary interconnect fabric with redundant secondary attachments to network nodes. Similar interconnection fabrics are available from other vendors, such as the Coupling Facility provided by IBM Corporation. While interconnection fabrics such as ServerNet® and the Coupling Facility are fast, highly reliable, and fault tolerant, they are also very expensive.

A fault tolerant storage systems (FTSS), such as the SureStore® XP512 Disk Array, which is a product of Hewlett-Packard Company, guarantees the availability and integrity of files stored by the FTSS. Fault tolerant storage systems are also available from other companies, such as Hitachi Data Systems Corporation and EMC Corporation.

Typically an FTSS is coupled to a server using a high-speed interface, such as an Ultra160 SCSI interface, a fiber channel interface, or an enterprise system connectivity (ESCON) interface. Such systems are highly reliable and fault tolerant. For example, the SureStore® XP512 Disk Array uses a fault-tolerant, redundant architecture that ensures there is no single point-of-failure, and has a mean time between failure (MTBF) of 2.5 million hours, or alternatively 285 years. Such systems are also incredibly fast. A single fiber channel port can support transfer rates of 100 megabytes per second, and ports can be ganged together to increase transfer rates even further. Moreover, the internal crossbar architecture of the XP512 has a bandwidth of 6.4 gigabytes per second.

Figure 1 shows such a highly reliable fault-tolerant prior art system 58, which may be used to host a distributed application. System 10 comprises computer systems 12, 14, 16, 18, 20, and 22, and fault tolerant storage system (FTSS) 24. Computer systems 12, 14, 16, 18, 20, and 22 are coupled to FTSS 24 via FTSS interconnection fabric 28 to carry file I/O transactions between the computer systems and FTSS 24. Typically, interconnection

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fabric 28 couples each computer system directly to the FTSS, but does not directly couple the computer systems to each other. In addition, computer systems 12, 14, 16, 18, 20, and 22 are coupled to together by highly reliable, fault tolerant network interconnection fabric 26 to carry messages between the computer systems.

Note that interconnection fabrics 26 and 28 are both highly reliable and fault tolerant. Accordingly, a customer configuring a system such as that shown in Figure 1 ends up paying for two interconnection fabrics. Furthermore, interconnection fabric 26 does not include any type of persistent storage. If a client suffers some type of error after receiving a message, the client is not able to request retransmission of the message from fabric 26. What is needed in the art is a practical way for a customer to use the same highly reliable and fault tolerant interconnection fabric to carry both file I/O transactions and messaging traffic, and also allowing a client to request retransmission of messages.

SUMMARY OF THE INVENTION

The present invention is a method and apparatus for passing messages between server and client applications using a fault tolerant storage system (FTSS). The interconnection fabric that couples the FTSS to the computer systems that host the client and server applications may also be used to carry messages. In accordance with the present invention, a networked system capable of hosting a distributed application includes a plurality of computer systems coupled to an FTSS via an FTSS interconnection fabric. The FTSS not only processes file-related I/O transactions, but also carries message traffic. In addition, the FTSS includes several message agents to facilitate message transfer in a reliable and fault tolerant manner. The message agents include a conversational communication agent, an event-based communication agent, a queue-based communication agent, a request/reply communication agent, and an unsolicited communication agent.

The highly reliable and fault tolerant nature of the FTSS ensures that the FTSS can guarantee delivery of a message transmitted from a sending computer system to a destination

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computer system. As soon as a message is received by the FTSS from a sending computer system, the message is committed to a nonvolatile write cache. Thereafter, the message is written to a redundant array of independent disks (RAID) of the FTSS, and processed by one of the message agents.

The present invention enhances the reliability and fault tolerance of messaging in several ways. First, messages may be transmitted between nodes using the FTSS interconnection fabric, which is highly reliable and fault tolerant. Since many systems that host distributed applications already include an FTSS, using the FTSS fabric instead of a less reliable network media, such as Ethernet, increases availability of the distributed application without the customer having to incur additional hardware costs.

Second, in the prior art, several messaging paradigms use agents that operate on separate servers. By moving these agents to the FTSS, availability is increased because the FTSS is typically more reliable than the servers to which it is coupled. Furthermore, since the FTSS is being used to pass messages anyway, providing the agents in the FTSS eliminates the need to route the messages to a separate server, thereby allowing the messages to be processed faster.

Finally, several prior art messaging paradigms pass interprocess communication messages directly between nodes in a transient manner. In the present invention, these messages pass through the FTSS and are stored in and retained by the FTSS, thereby allowing any application to "rollback" to a known point and retrieve lost messages from the FTSS.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 shows a highly reliable fault-tolerant prior art system that may be used to host a distributed application.

Figure 2 shows a highly reliable fault-tolerant system in accordance with the present invention that may be used to host a distributed application.

Figure 3 is a block diagram of a prior art computer system that illustrates how messages are processed.

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Figure 4 is a block diagram of a computer system having a middleware product that passes messages to another computer system via a fault tolerant storage system (FTSS), in accordance with the present invention.

Figure 5 is a block diagram of an FTSS that passes messages between client and server nodes via communication agents, in accordance with the present invention.

Figure 6 is a block diagram illustrating a conversational communication agent provided in the FTSS of Figure 5.

Figure 7 is a block diagram illustrating an event-based communication agent provided in the FTSS of Figure 5.

Figure 8 is a block diagram illustrating a queue-based communication agent provided in the FTSS of Figure 5.

Figure 9 is a block diagram illustrating a request/reply communication agent provided in the FTSS of Figure 5.

Figure 10 is a block diagram illustrating an unsolicited communication agent provided in the FTSS of Figure 5.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present invention is a method and apparatus for passing messages between server and client applications using a fault tolerant storage system (FTSS). The interconnection fabric that couples the FTSS to the computer systems that host the client and server applications may also be used to carry messages.

Figure 2 shows a networked system 30 in accordance with the present invention. Networked system 30 may be used to host a distributed application, such as an on-line store accessible from the Internet. System 30 includes computer systems 32, 34, 36, 38, 40, and 42, fault tolerant storage system (FTSS) 44, and FTSS interconnection fabric 46. Although only computer systems are shown in Figure 2, those skilled in the art will recognize that other network nodes may be coupled to FTSS 44 via fabric 46, such as printers, scanners, backup

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systems, and the like. Although not shown in Figure 2, computer systems 32, 34, 36, 38, 40, and 42 may be coupled to each other and to other computers via another interconnection fabric, such as an Ethernet network, which in turn may be coupled to the Internet via a gateway.

Typically, interconnection fabric 46 will be comprised of high-speed interfaces and related cabling used to connect computer systems to storage systems, such as small computer system interfaces (SCSI), fiber channel interfaces, or enterprise system connectivity (ESCON) interfaces. In a typical FTSS, these interfaces tend to connect each computer system directly to the FTSS, but do not connect the computer systems to each other.

In accordance with the present invention, FTSS 44 not only processes file-related I/O transactions, but also carries message traffic. In addition, FTSS 44 includes several message agents to facilitate message transfer in a reliable and fault tolerant manner, as described below. The highly reliable and fault tolerant nature of FTSS 44 ensures that FTSS 44 can guarantee delivery of a message transmitted from a sending computer system to a destination computer system. To see how this is accomplished, first consider a typical FTSS, such as the SureStore® XP512 Disk Array, which is a product of Hewlett-Packard Company. The XP512 has a battery-protected fully redundant nonvolatile write cache that can range in size from 2 gigabytes to 32 gigabytes. As soon as a message is received by FTSS 44 from a sending computer system, the message is committed to the nonvolatile write cache. Thereafter, the message is written to a redundant array of independent disks (RAID) of FTSS 44, and processed by one of the message agents.

Before considering the present invention in greater detail, first consider how messages that are transmitted between network nodes are processed in a prior art computer using a middleware product such Bea Tuxedo®, which is a product of BEA Systems, Inc. Figure 3 shows a prior art computer system 48. Client and server applications that use middleware messaging are represented by block 50. These applications pass messages to other nodes using an application-to-transaction monitor interface (ATMI), which is represented by block 52 and is part of middleware product 53. The ATMI provides a series of functions that may be called

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by the client and server applications to pass messages, as will be described in greater detail below.

The messaging paradigms supported by middleware product 53 are represented by block 54. The conversational communication paradigm is represented by block 56, the event-based communication paradigm is represented by block 58, the queue-based communication paradigm is represented by block 60, the request/reply communication paradigm is represented by block 62, and the unsolicited communication paradigm is represented by block 64. Block 54 communicates with the I/O services of the operating system, which are represented by block 55, to transmit messages. Figure 3 illustrates how messages are transmitted between network nodes. Accordingly, block 54 communicates with network I/O block 68 to send and receive messages from other network nodes via network fabric 70.

In accordance with the present invention, Figure 4 shows how middleware product 76 is modified in computer system 32 of Figure 2, as well as the other computer systems shown in Figure 2, to pass messages via FTSS 44. Similar to prior art Figure 3, client and server applications that use middleware messaging are represented by block 72. These applications pass messages to other nodes using an application-to-transaction monitor interface (ATMI), which is represented by block 74 and is part of middleware product 76. Note that all the function calls available in prior art ATMI 52 in Figure 3 are available in ATMI 74, thereby providing complete compatibility with prior art applications.

The messaging paradigms supported by middleware product 76 are represented by block 78. The conversational communication paradigm is represented by block 80, the event-based communication paradigm is represented by block 82, the queue-based communication paradigm is represented by block 84, the request/reply communication paradigm is represented by block 86, and the unsolicited communication paradigm is represented by block 88. Block 78 communicates with the I/O services of the operating system, which are represented by block 90, to transmit messages. However, unlike messaging paradigms block 54 of Figure 3, block 78 has been modified to pass messages between computer systems coupled to FTSS 44 by

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communicating with message agents in FTSS 44. Accordingly, block 78 communicates with fault tolerant storage block 94 of file I/O block 92, which is provided by operating system I/O services 90.

The communication between block 78 and FTSS 44 can be accomplished several ways. For example, a series of directories can be defined on FTSS 44 to store incoming and outgoing messages as files. Using this technique, block 78 can pass messages to FTSS 44 by writing messages as files into the appropriate directory of FTSS 44. Another way to accomplish this communication is to use the techniques disclosed in a co-pending application entitled "A Fault Tolerant Storage System Having an Interconnection Fabric That Also Carries Network Traffic" by Blaine D. Gaither et al., which is incorporated by reference above. This application teaches how a network protocol stack can be modified to route all network traffic between nodes coupled to the FTSS via the FTSS interconnection fabric. Using the techniques taught in this application, each message agent in FTSS 44 can be assigned an address, and block 78 can communicate with the network protocol stack to transmit the messages to FTSS 44. If this technique is used, the messages would first pass through the network protocol stack before being processed by fault tolerant storage block 94. Those skilled in the art will understand how to adapt the teachings herein to pass messages from messaging paradigms bock 78 to FTSS 44.

In accordance with the present invention, Figure 5 illustrates how FTSS 44 can be modified to support messaging. In Figure 5, FTSS 44 includes file operations unit 96, which processes file I/O requests in a manner similar to the prior art. Incoming file data is first committed to non-volatile write cache 98, and is then stored in RAID 100. Outgoing file data is retrieved from RAID 100, and then transmitted to the node that requested the file data.

Messaging agents block 102 includes several messaging agents that support the messaging paradigms described above. Accordingly, messaging agents block 102 includes conversational communication agent 104, event-based communication agent 106, queue-based communication agent 108, request/reply communication agent 110, and unsolicited communication agent 112.

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In the following discussion, the communication agents will be described in greater detail. A variety of queues and other data structures will be illustrated. All of these data structures are stored in fault tolerant storage, such as RAID 100 and/or nonvolatile write cache 98. In addition, all incoming messages are immediately stored in fault tolerant storage. Furthermore, the communication agents retain old message transactions for some time after the message transactions are complete. In some of the figures discussed below, old transactions will be illustrated, while in other figures, retention of the old transactions is assumed. Saving the old transactions allows any node engaged in messaging to recover from an error by "rolling back" to a known point in the message transaction, and reconstructing the transaction. Transactions can eventually be deleted using some mechanism known in the art, such as an expiration date and time or a FIFO queue. Since a typical FTSS can be configured with terabytes of data, the FTSS is will suited for retaining old message transactions.

Figure 6 is a diagram illustrating conversational communication agent 104. Before discussing agent 104 in greater detail, first consider the relevant ATMI function calls provided by block 74 in Figure 4 that support conversational communication in a Bea Tuxedo® system. The C programing language version of these function calls will be discussed below, however analogous function calls are available in other languages, such as COBOL and Java.

The function *tpconnect()* is used to begin a conversation with another node, and the function *tpdiscon()* is used to end the conversation. To send a message in the conversation, the function *tpsend()* is used, and to receive a message in the conversation, the function *tprecv()* is used.

Figure 6 illustrates conversation communication agent 104. Agent 104 includes a conversation manager 114, open conversations 116, and closed conversations 118. When a client node calls *tpconnect()* to open a conversation with a server node, conversation manager 114 creates an open conversation 116. When either node calls *tpsend()*, the message in the conversation is stored in the appropriate open conversation 116, and is transmitted to the other node. Since the message is transmitted to the other node by manager

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114, when the other node calls the function *tprecv()*, the message is provided locally to program that called the *tprecv()* function. However, if the other node suffered some type of error or failure that caused it to lose the message, the message can still be retrieved from the appropriate open conversation 116. When either node calls *tpdiscon()*, the conversation is closed and is moved to closed conversations 118, and is retained for a period of time, as discussed above. Accordingly, either node can "rollback" to a known point by accessing open conversations 116 or closed conversations 118. Note that in the prior art, conversations occurred directly between the client and server in a transient manner. By providing conversational communication agent 104 in FTSS 44, reliability and fault tolerance are increased because conversations are also retained in FTSS 44.

Figure 7 is a diagram illustrating event-based communication agent 106. Before discussing agent 106 in greater detail, first consider the relevant ATMI function calls provided by block 74 in Figure 4 that support event-based communication.

The function *tpsubscribe()* allows a client to subscribe to receive certain types of event messages, and the function *tpunsubscribe()* allows the client to unsubscribe. The function *tppost()* allows a server to post an event message.

In Figure 7, event-based communication agent 106 includes an event broker 120, which includes a subscription manager 122, and event queues 124. Subscription manager 122 maintains lists of clients that have subscribed to certain events using the *tpsubscribe()* function call. When a server posts an event message using the *tppost()* function call, the message is posted in the appropriate event queue 124, and is relayed to all client nodes that have subscribed to the event. If a particular client suffers some type of error or other failure, the client can access event broker 120 to retrieve any event messages corresponding to events to which it has subscribed. In the prior art, an event broker was also provided on a server. However, the present invention increases reliability and fault tolerance by providing the event broker in FTSS 44. In a typical distributed application that includes an FTSS, the FTSS will typically be more reliable and fault tolerant than the servers coupled to the FTSS.

Figure 8 is a diagram illustrating queue-based communication agent 108. For reasons that will be come apparent below, this type of messaging is also known in the art as "store

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and forward" messaging. Before discussing agent 108 in greater detail, first consider the relevant ATMI function calls provided by block 74 in Figure 4 that support queue-based communication. The function *tpenqueu()* enqueues a message to a message queue and the function *tpdequeue()* dequeues a message from the message queue.

In Figure 8, a client application on computer system 32 of Figure 2 seeks to execute a service of a server application on computer 38. First, the client calls the *tpenqueue()* function, which passes the service message to queue-based communication agent 108 on FTSS 44. Queue unit 126 enqueues the service message in queue space 130. Forwarding unit 128 dequeues the service message and forwards the message to the server application on computer system 38. Forwarding unit 128 communicates with the server application using request/reply communication, which will be described in greater detail below with reference to Figure 9. Accordingly, forwarding unit 128 executed a *tpcall()* function to transmit the service message to computer system 38. The server application processes the service message and forms a client reply message, and returns the client reply message to forwarding unit 128 by calling a *tpreturn()* function. Forwarding unit 128 enqueues the client reply message in queue space 130. Sometime thereafter, the client application on computer system 32 calls the *tpdequeu()* function to retrieve the client reply message. Queue unit 126 retrieves the client reply message from queue space 130 and transmits the message to the client application of computer system 32.

In the prior art, a queue-based communication manager was also provided on a server. However, the present invention increases reliability and fault tolerance by providing the queue-based communication manager in FTSS 44. As mentioned above, in a typical distributed application that includes an FTSS, the FTSS will typically be more reliable and fault tolerant than the servers coupled to the FTSS.

Figure 9 is a diagram illustrating request/reply communication agent 110. Before discussing agent 110 in greater detail, first consider the relevant ATMI function calls provided by block 74 in Figure 4 that support queue-based communication. The function *tpcall()* is used to initiate a synchronous request/reply transaction to a service, and the function *tpascall()* is used to initiate an asynchronous request to a service. After the service

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is executed, the server application calls *tpreturn()* to return the reply message. As discussed above, in synchronous mode, a client sends a request to a server, which performs the requested action while the client waits. The server then sends the reply to the client, which receives the reply. In asynchronous mode, the client does not wait for a server to complete a service request before the client undertakes other tasks. Accordingly, a reply is implied with a *tpcall()* function in synchronous mode. In asynchronous mode, a reply is received by calling the *tpgetrply()* function. An asynchronous request can also be cancelled by calling the *tpcancel()* function.

As discussed above, prior art request/reply communication is also implemented using transient inter-process communication (IPC) message queues. Each server is assigned an IPC message queue called a request queue, and each client is assigned an IPC message queue called a reply queue. Accordingly, a client application can send requests to the server by putting those requests on the server's queue, and then check and retrieve messages from the server by retrieving messages from its own reply queue. The present invention provides request/reply communication with additional reliability and fault tolerance by replicating each IPC message queue in FTSS 44, and storing the contents of the IPC message queues in RAID 100 and/or nonvolatile write cache 98 of Figure 5

In Figure 9, request/reply communication agent 110 maintains a request and reply queue for each request and reply queue present on a computer system configured to transmit messages between network nodes. Accordingly, request queue 132 and reply queue 134 correspond to queues in computer system 32, and request queue 136 and reply queue 138 correspond to queues in computer system 42. Router 140 routes the messages between the queues.

For example, assume that a client application on computer system 32 calls the *tpcall()* or *tpascall()* function to send a request message to a server application on computer system 42. The request message is transmitted to request queue 132. Router 140 receives the request message and routes it to request queue 136, and in turn the request message is transmitted to the server application on computer system 42. The server application processes the request message and calls the *tpreturn()* function to transmit the reply message

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back to the client application. The reply message is enqueued in reply queue 138. Router 140 routes the reply message to reply queue 134, and the reply message is retrieved by the client application in computer system 32.

Note that the method used to process messages in Figure 9 can be applied to any type of inter-process communication. By intercepting and storing IPC messages within FTSS 44, an application can easily recover from an error or other type of failure by accessing agent 110 to receive messages from the queues.

Figure 10 is a diagram illustrating unsolicited communication agent 112. Before discussing agent 112 in greater detail, first consider the relevant ATMI function calls provided by block 74 in Figure 4 that support event-based communication. The function *tpnotify()* sends an unsolicited message to a single client and *tpbroadcast()* sends a message to several clients. Note that unsolicited communication is similar to event-based communication, except that there is no subscription function.

In Figure 10, unsolicited communication agent 112 includes an unsolicited message manager 142 and unsolicited message queue 114. When a server calls the *tpnotify()* or *tpbroadcast()* function, the message is posted in queue 144, and is relayed to the appropriate nodes. If a particular client suffers some type of error or other failure, the client can access unsolicited message manager 142 to retrieve any relevant unsolicited messages.

The present invention enhances the reliability and fault tolerance of messaging in several ways. First, messages may be transmitted between nodes using FTSS interconnection fabric 46 of Figure 2. Fabric 46 is highly reliable and fault tolerant. Since many systems that host distributed applications already include an FTSS, using fabric 46 instead of a less reliable network media, such as Ethernet, increases availability of the distributed application without the customer having to incur additional hardware costs.

Second, in the prior art, several messaging paradigms, such as queue-based communication and event based communication, use agents that operate on separate servers. By moving these agents to the FTSS, availability is increased because the FTSS is typically more reliable than the servers to which it is coupled. Furthermore, since the FTSS is being

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used to pass messages anyway, providing the agents in the FTSS eliminates the need to route the messages to a separate server, thereby allowing the messages to be processed faster.

Finally, several prior art messaging paradigms, such as conversational communication and request/reply communication, pass IPC messages directly between nodes in a transient manner. In the present invention, these IPC messages pass through the FTSS and are stored in and retained by the FTSS, thereby allowing any application to "rollback" to a known point and retrieve lost IPC messages from the FTSS.

Although the present invention has been described with reference to preferred embodiments, workers skilled in the art will recognize that changes may be made in form and detail without departing from the spirit and scope of the invention.

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WHAT IS CLAIMED IS:

1. A method of transmitting messages between a first node and a second node, wherein the first and second nodes are each coupled to a fault tolerant storage system (FTSS), the method comprising:

transmitting a message from the first node to a communication agent in the FTSS;

storing the message in a data structure in highly reliable fault-tolerant storage media of the FTSS;

processing the message at the FTSS in accordance with a messaging paradigm; and

transmitting the message from the FTSS to the second node.

2. The method of claim 1 wherein the messaging paradigm is a request/reply communication paradigm, and:

transmitting a message from the first node to a communication agent in the FTSS comprises:

transmitting a request message from the first node to a request/reply communication agent in the FTSS;

storing the message in a data structure in highly reliable fault-tolerant storage media of the FTSS comprises:

storing the request message in a request queue in highly reliable fault-tolerant storage media of the FTSS;

processing the message at the FTSS in accordance with a messaging paradigm comprises:

retrieving the request message from the request queue; and

transmitting the message from the FTSS to the second node comprises:

transmitting the request message from the FTSS to a service on the second node;

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and the method further comprises:

executing the service on the second node using the request message as an input and providing a reply message as an output;

transmitting the reply message from the second node to the request/reply communication agent in the FTSS;

storing the reply message in a reply queue in highly reliable fault-tolerant storage media of the FTSS;

retrieving the reply message from the reply queue; and

transmitting the reply message from the FTSS to the first node.

3. The method of claim 1 wherein the messaging paradigm is a conversational communication paradigm, and:

transmitting a message from the first node to a communication agent in the FTSS comprises:

transmitting a connect message from the first node to a conversational communication agent in the FTSS;

processing the message at the FTSS in accordance with a messaging paradigm comprises:

opening a conversation queue in highly reliable fault-tolerant storage media of the FTSS;

storing the message in a data structure in highly reliable fault-tolerant storage media of the FTSS comprises:

storing the connect message in the conversation queue; and

transmitting the message from the FTSS to the second node comprises:

transmitting the connect message from the FTSS to the second node.

4. The method of claim 3 and further comprising:

transmitting a send message from the first node to the conversational communication agent in the FTSS;

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storing the send message in the conversation queue;

transmitting the send message to from the FTSS to a service on the second node;

executing the service in the second node using the send message as an input and providing a receive message as an output;

transmitting the receive message from the second node to the conversational communication agent in the FTSS;

storing the receive message in the conversation queue; and

transmitting the receive message to the first node.

5. The method of claim 3 and further comprising:

transmitting a disconnect message from the first node to the conversational communication agent in the FTSS;

closing the conversation queue; and

transmitting the disconnect message to the second node.

6. The method of claim 1 wherein the messaging paradigm is an event-based communication paradigm, and:

transmitting a message from the first node to a communication agent in the FTSS comprises:

transmitting a post message from the first node to an event-based communication agent in the FTSS;

processing the message at the FTSS in accordance with a messaging paradigm comprises:

accessing a subscription manager to determine whether any nodes have subscribed to receive the event represented by the post message;

storing the message in a data structure in highly reliable fault-tolerant storage media of the FTSS comprises:

storing the post message in an event queue in highly reliable fault-tolerant storage media of the FTSS; and

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transmitting the message from the FTSS to the second node comprises:

transmitting the post message from the FTSS to the second node if the second node has subscribed to receive the event represented by the post message.

7. The method of claim 6 and further comprising:

transmitting a subscribe message from the second node to the event-based communication manager in the FTSS, wherein the subscribe message includes an event; and

accessing the subscription manager to record that the second node has subscribed to receive post messages associated with the event.

8. The method of claim 6 and further comprising:

transmitting an unsubscribe message from the second node to the event-based communication manager in the FTSS, wherein the unsubscribe message includes an event; and

accessing the subscription manager to record that the second node should no longer receive post messages associated with the event.

9. The method of claim 1 wherein the messaging paradigm is a queue-based communication paradigm, and:

transmitting a message from the first node to a communication agent in the FTSS comprises:

transmitting an enqueue message from the first node to a queue-based communication agent in the FTSS;

storing the message in a data structure in highly reliable fault-tolerant storage media of the FTSS comprises:

storing the enqueue message in a queue space in highly reliable fault-tolerant storage media of the FTSS;

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processing the message at the FTSS in accordance with a messaging paradigm comprises:

retrieving the enqueue message from the queue space only if the second node is available; and

transmitting the message from the FTSS to the second node comprises:

transmitting the enqueue message from the FTSS to a service on the second node only if the second node is available;

and the method further comprises:

executing the service on the second node using the enqueue message as an input and providing a dequeue message as an output;

transmitting the dequeue message from the second node to the queue-based communication agent in the FTSS;

storing the dequeue message in the queue space;

retrieving the dequeue message from the queue space; and

transmitting the dequeue message from the FTSS to the first node.

10. The method of claim 1 wherein the messaging paradigm is an unsolicited communication paradigm, and:

transmitting a message from the first node to a communication agent in the FTSS comprises:

transmitting a broadcast message from the first node to an unsolicited communication agent in the FTSS;

processing the message at the FTSS in accordance with a messaging paradigm comprises:

accessing determining which nodes should receive the broadcast message based on the broadcast message;

storing the message in a data structure in highly reliable fault-tolerant storage media of the FTSS comprises:

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storing the broadcast message in an unsolicited message queue in highly reliable fault-tolerant storage media of the FTSS; and

transmitting the message from the FTSS to the second node comprises:

transmitting the post message from the FTSS to all nodes that should receive the broadcast message.

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A METHOD AND APPARATUS FOR PASSING MESSAGES USING A FAULT TOLERANT STORAGE SYSTEM

ABSTRACT OF THE DISCLOSURE

A method and apparatus pass messages between server and client applications using a fault tolerant storage system (FTSS). The interconnection fabric that couples the FTSS to the computer systems that host the client and server applications may also be used to carry messages. A networked system capable of hosting a distributed application includes a plurality of computer systems coupled to an FTSS via an FTSS interconnection fabric. The FTSS not only processes file-related I/O transactions, but also includes several message agents to facilitate message transfer in a reliable and fault tolerant manner. The message agents include a conversational communication agent, an event-based communication agent, a queue-based communication agent, a request/reply communication agent, and an unsolicited communication agent. The highly reliable and fault tolerant nature of the FTSS ensures that the FTSS can guarantee delivery of a message transmitted from a sending computer system to a destination computer system. As soon as a message is received by the FTSS from a sending computer system, the message is committed to a nonvolatile fault tolerant write cache. Thereafter, the message is written to a redundant array of independent disks (RAID) of the FTSS, and processed by one of the message agents.

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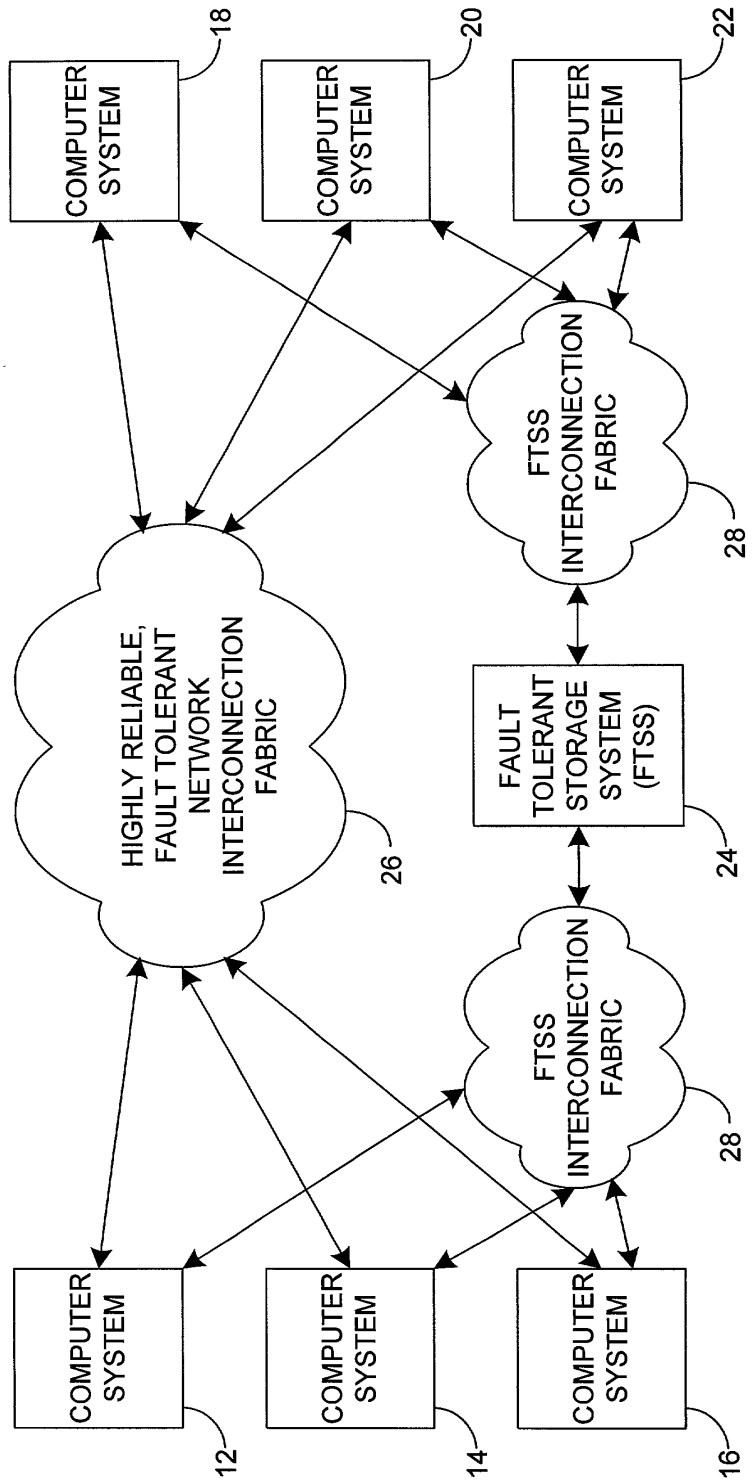


FIG. 1
(PRIOR ART)

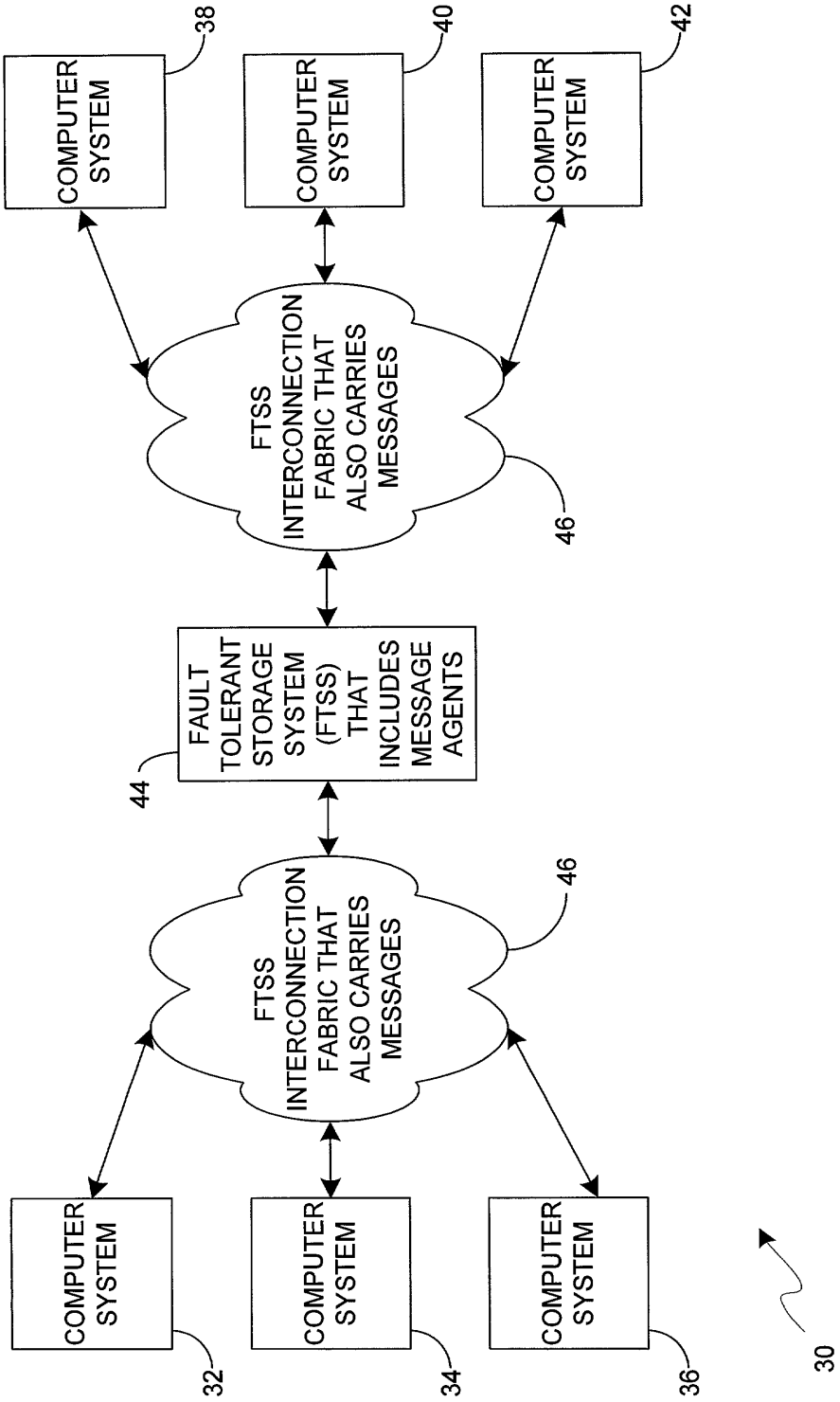

COMPUTER SYSTEM
38
COMPUTER SYSTEM
40
COMPUTER SYSTEM
42
FTSS INTERCONNECTION FABRIC THAT ALSO CARRIES MESSAGES
46
FAULT TOLERANT STORAGE SYSTEM (FTSS) THAT INCLUDES MESSAGE AGENTS
44
FTSS INTERCONNECTION FABRIC THAT ALSO CARRIES MESSAGES
46
COMPUTER SYSTEM
32
COMPUTER SYSTEM
34
COMPUTER SYSTEM
36
30

FIG. 2

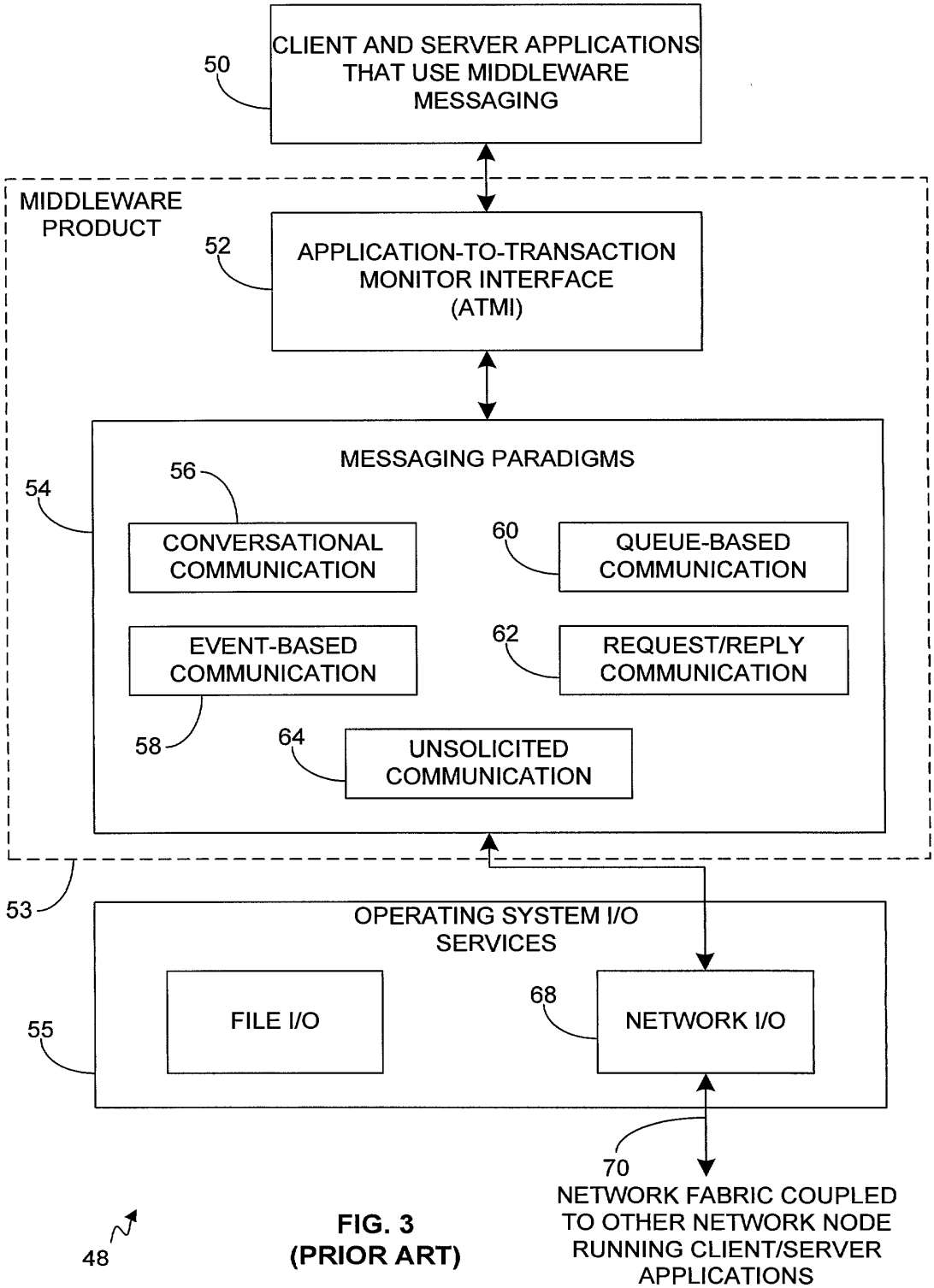


FIG. 3
(PRIOR ART)

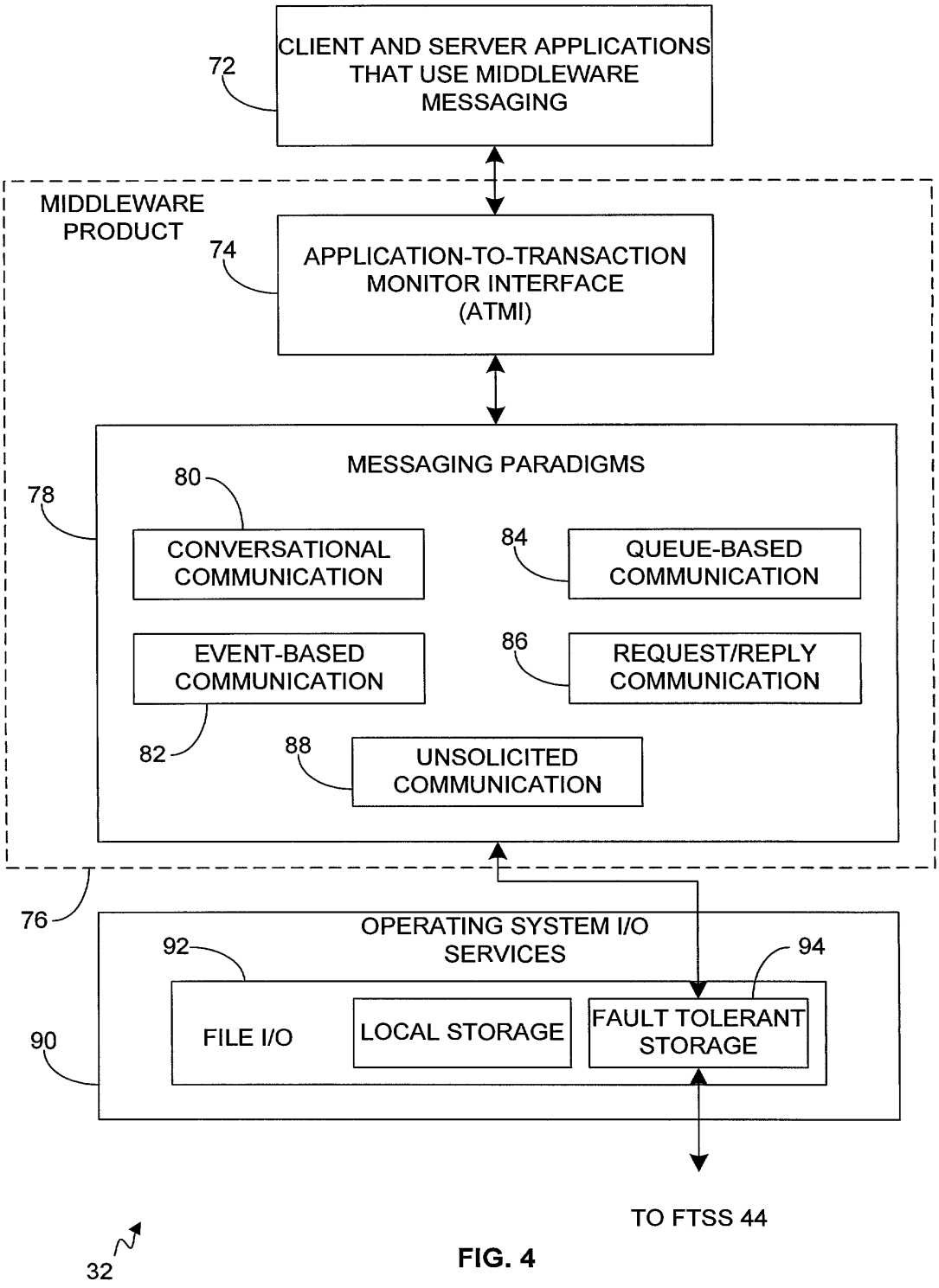


FIG. 4

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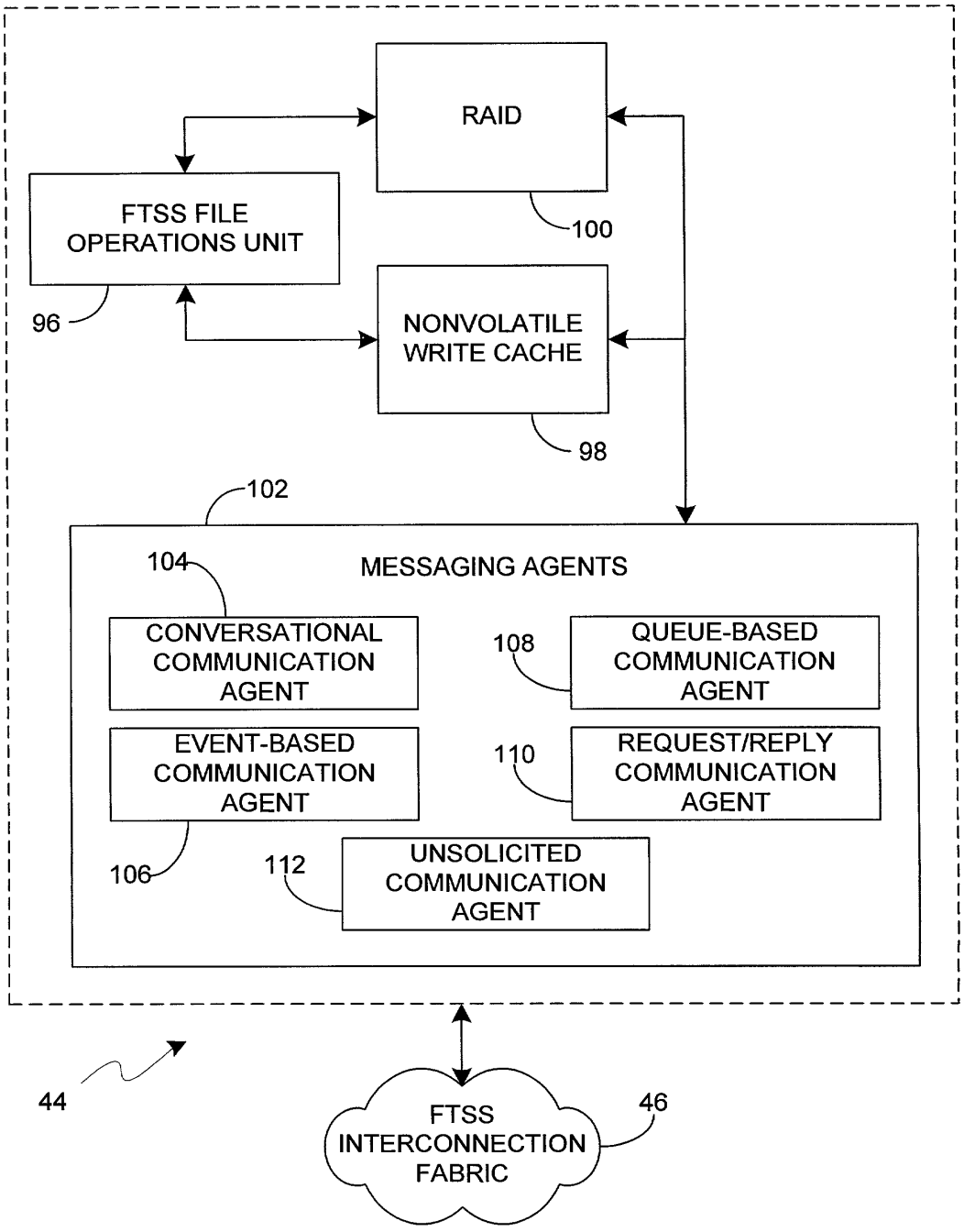

RAID
100
FTSS FILE OPERATIONS UNIT
96
NONVOLATILE WRITE CACHE
98
102
MESSAGING AGENTS
104
CONVERSATIONAL COMMUNICATION AGENT
108
QUEUE-BASED COMMUNICATION AGENT
EVENT-BASED COMMUNICATION AGENT
110
REQUEST/REPLY COMMUNICATION AGENT
106
112
UNSOLICITED COMMUNICATION AGENT
44
FTSS INTERCONNECTION FABRIC
46

FIG. 5

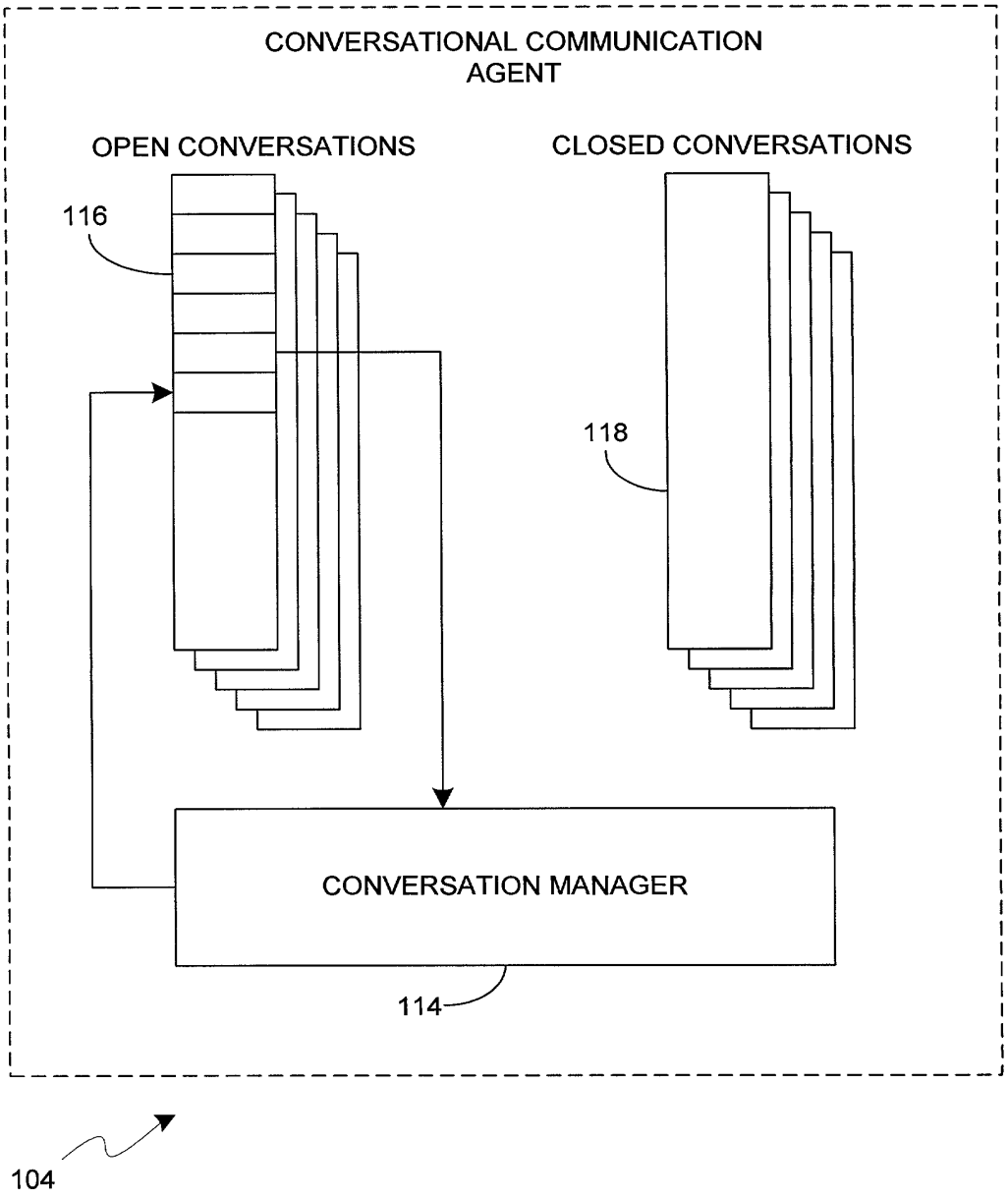

CONVERSATIONAL COMMUNICATION AGENT
OPEN CONVERSATIONS
CLOSED CONVERSATIONS
116
118
CONVERSATION MANAGER
114
104

FIG. 6

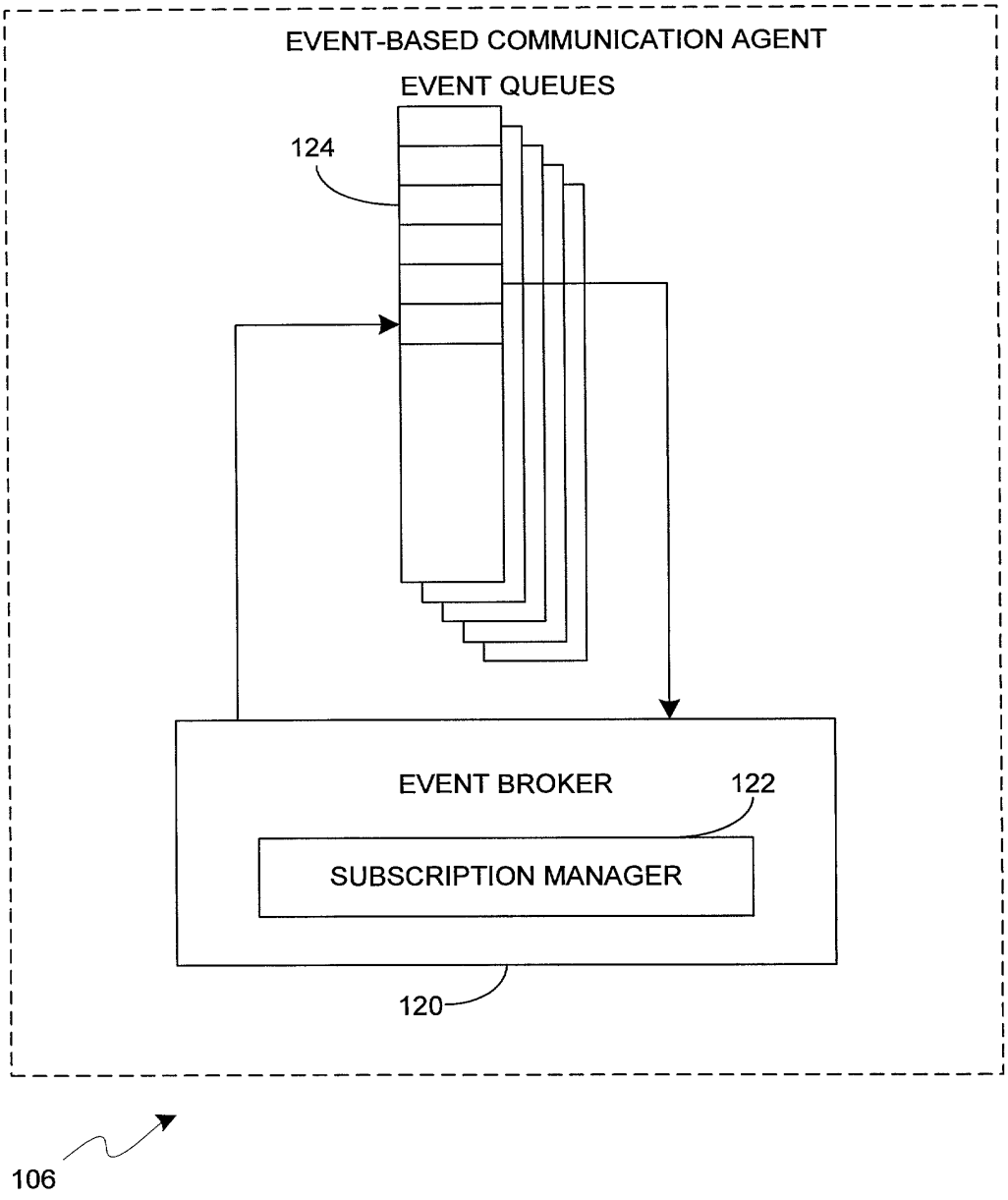


FIG. 7

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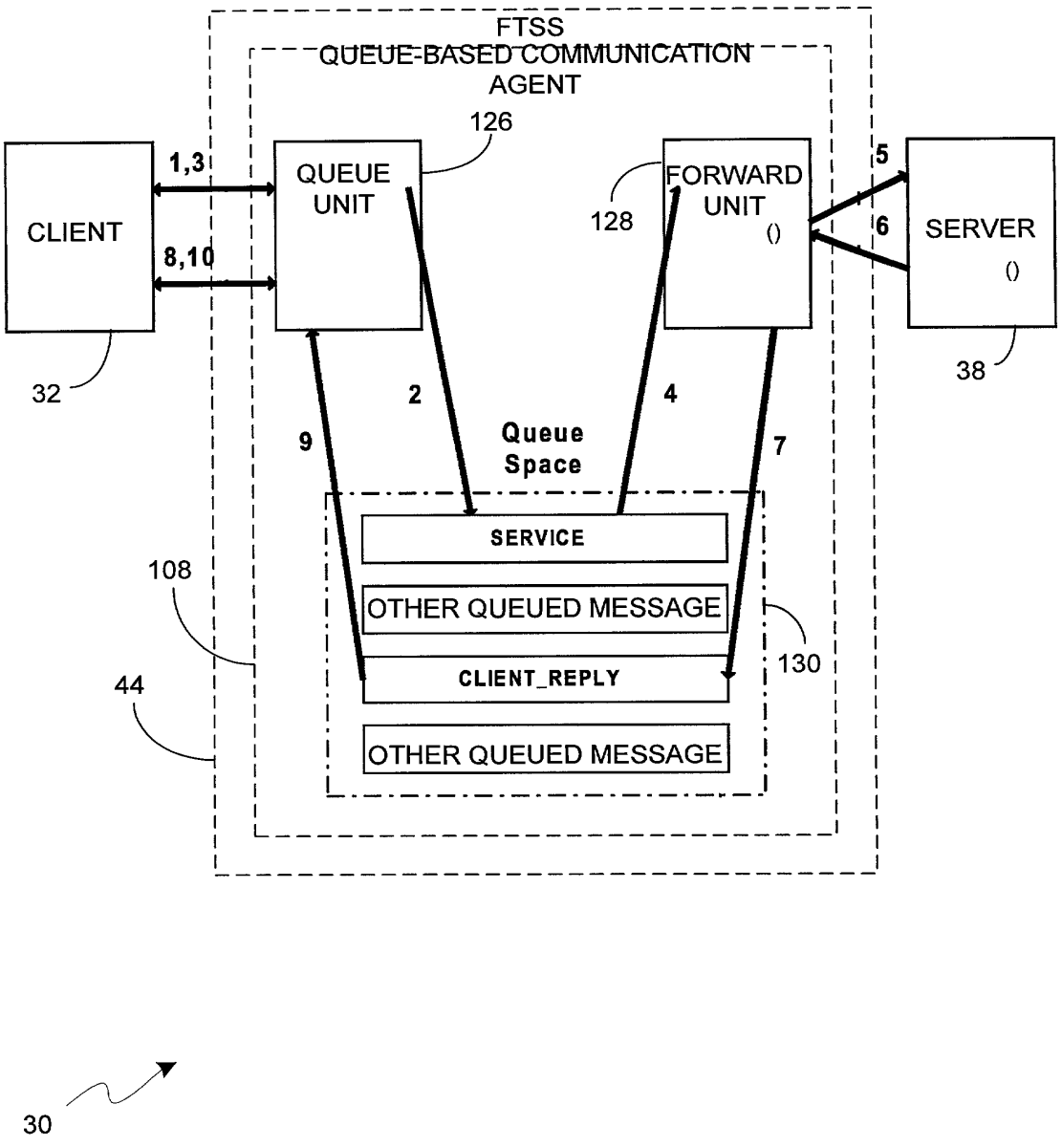

FTSS
QUEUE-BASED COMMUNICATION AGENT
126
CLIENT
1,3
8,10
QUEUE UNIT
FORWARD UNIT
128
5
6
SERVER
32
38
2
4
9
7
Queue Space
SERVICE
OTHER QUEUED MESSAGE
CLIENT_REPLY
OTHER QUEUED MESSAGE
108
130
44
30

FIG. 8

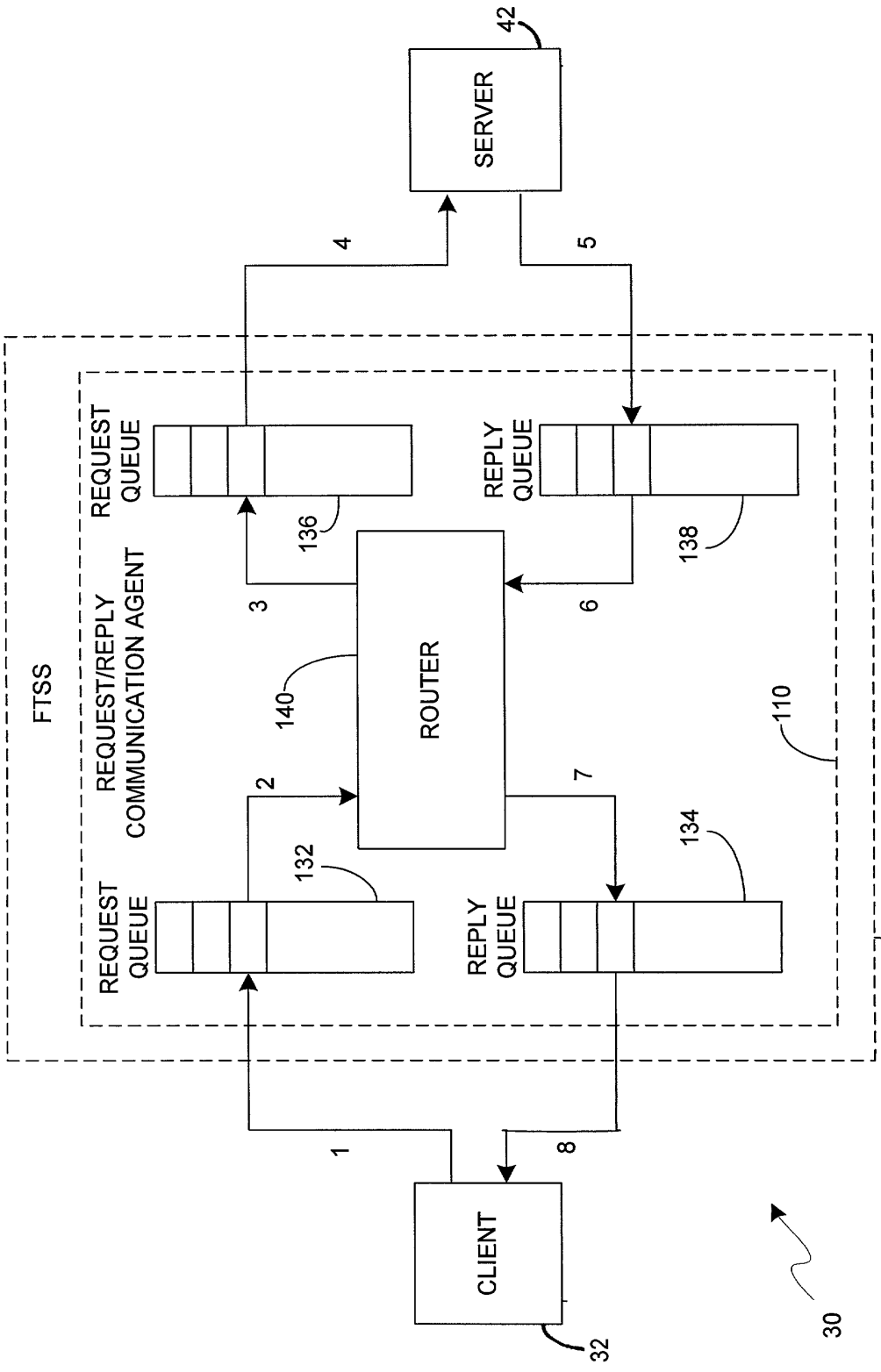

SERVER
42
4
5
FTSS
REQUEST/REPLY
COMMUNICATION AGENT
REQUEST
QUEUE
REPLY
QUEUE
136
138
3
6
ROUTER
140
110
2
7
132
134
REQUEST
QUEUE
REPLY
QUEUE
44
1
8
CLIENT
32
30

FIG. 9

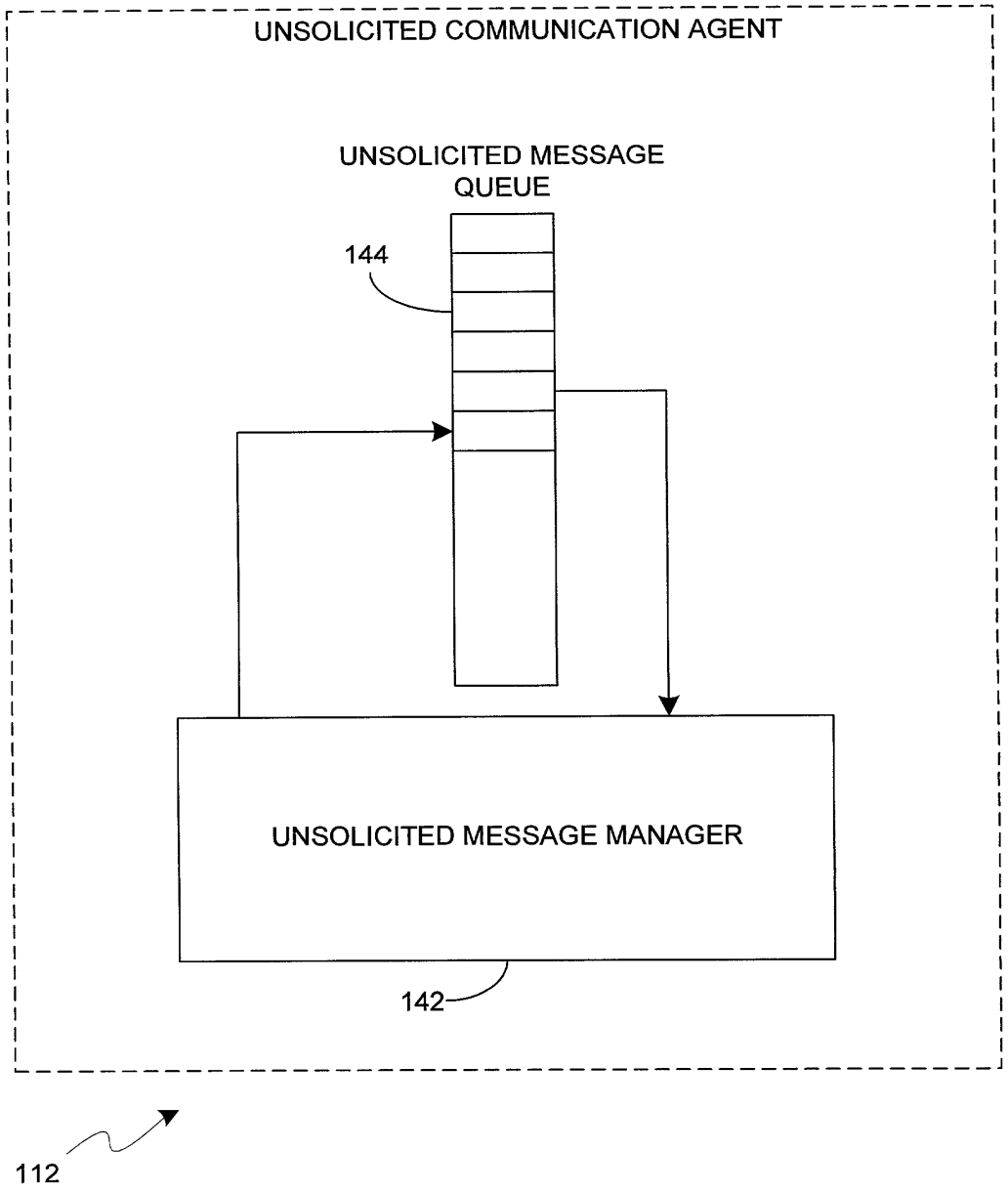


FIG. 10

Attorney Docket No. 2003P00358US

DECLARATION AND POWER OF ATTORNEY FOR PATENT APPLICATION

ATTORNEY DOCKET NO. 10008316-1

As a below named inventor, I hereby declare that:

My residence/post office address and citizenship are as stated below next to my name;

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

A Method And Apparatus For Passing Messages Using A Fault Tolerant Storage System

the specification of which is attached hereto unless the following box is checked:

( ) was filed on _____ as US Application Serial No. or PCT International Application Number _____ and was amended on _____ (if applicable).

I hereby state that I have reviewed and understood the contents of the above-identified specification, including the claims, as amended by any amendment(s) referred to above. I acknowledge the duty to disclose all information which is material to patentability as defined in 37 CFR 1.56.

Foreign Application(s) and/or Claim of Foreign Priority

I hereby claim foreign priority benefits under Title 35, United States Code Section 119 of any foreign application(s) for patent or inventor(s) certificate listed below and have also identified below any foreign application for patent or inventor(s) certificate having a filing date before that of the application on which priority is claimed:

COUNTRY	APPLICATION NUMBER	DATE FILED	PRIORITY CLAIMED UNDER 35 U.S.C. 119
			YES: ___ NO: ___
			YES: ___ NO: ___

Provisional Application

I hereby claim the benefit under Title 35, United States Code Section 119(e) of any United States provisional application(s) listed below:

APPLICATION SERIAL NUMBER	FILING DATE

U. S. Priority Claim

I hereby claim the benefit under Title 35, United States Code, Section 120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code Section 112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, Section 1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

APPLICATION SERIAL NUMBER	FILING DATE	STATUS (patented/pending/abandoned)

POWER OF ATTORNEY:

As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith:

Customer Number 022879

Place Customer Number Bar Code Label here

Send Correspondence to:	**Direct Telephone Calls To:**
HEWLETT-PACKARD COMPANY	
Intellectual Property Administration	**David A. Plettner**
P.O. Box 272400	
Fort Collins, Colorado 80527-2400	**(408) 447-3013**

I hereby 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 issued thereon.

Full Name of Inventor: Blaine D. Gaither **Citizenship:** US

Residence: 1600 Serramonte Drive, Fort Collins, CO 80524-1718

Post Office Address: Same as residence

_____ _____

Inventor's Signature **Date**

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DECLARATION AND POWER OF ATTORNEY FOR PATENT APPLICATION (continued)

ATTORNEY DOCKET NO. 10008316-1

Full Name of # 2 joint inventor: Bret A. McKee Citizenship: US

Residence: 1712 Ridgewood Road, Fort Collins, CO 80526

Post Office Address: Same as residence

Inventor's Signature _____ Date _____

Full Name of # 3 joint inventor: _____ Citizenship: _____

Residence: _____

Post Office Address: _____

Inventor's Signature _____ Date _____

Full Name of # 4 joint inventor: _____ Citizenship: _____

Residence: _____

Post Office Address: _____

Inventor's Signature _____ Date _____

Full Name of # 5 joint inventor: _____ Citizenship: _____

Residence: _____

Post Office Address: _____

Inventor's Signature _____ Date _____

Full Name of # 6 joint inventor: _____ Citizenship: _____

Residence: _____

Post Office Address: _____

Inventor's Signature _____ Date _____

Full Name of # 7 joint inventor: _____ Citizenship: _____

Residence: _____

Post Office Address: _____

Inventor's Signature _____ Date _____

Full Name of # 8 joint inventor: _____ Citizenship: _____

Residence: _____

Post Office Address: _____

Inventor's Signature _____ Date _____

SAP - Exhibit 1102
SAP v. Valtrus et al. - IPR2025-00420
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Jc925 U.S. PTO
09/703427
10/31/00

Class	Subclass

ISSUE CLASSIFICATION

PATENT NUMBER

U.S. UTILITY Patent Application

O.I.P.E.	PATENT DATE
SCANNED AC MT2 Q.A. CTH	

APPLICATION NO.	CONT/PRIOR	CLASS	SUBCLASS	ART UNIT	EXAMINER
09/703427		~~714~~ 709	202 ~~204~~	~~2138~~ 2144	TRAN

APPLICANTS
Blaine Gaither
Bret McKee

TITLE
Method and apparatus for passing messages using a fault tolerant storage system

PTO-2040
12/99

ISSUING CLASSIFICATION

ORIGINAL		CROSS REFERENCE(S)	
CLASS	SUBCLASS	CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)
INTERNATIONAL CLASSIFICATION			
			☐ Continued on Issue Slip Inside File Jacket

☐ TERMINAL DISCLAIMER	DRAWINGS			CLAIMS ALLOWED	
	Sheets Drwg.	Figs. Drwg.	Print Fig.	Total Claims	Print Claim for O.G.
☐ The term of this patent subsequent to _____ (date) has been disclaimed.				NOTICE OF ALLOWANCE MAILED	
	(Assistant Examiner)		(Date)		
☐ The term of this patent shall not extend beyond the expiration date of U.S Patent. No. _____				ISSUE FEE	
				Amount Due	Date Paid
	(Primary Examiner)		(Date)		
☐ The terminal ____months of this patent have been disclaimed.				ISSUE BATCH NUMBER	
	(Legal Instruments Examiner)		(Date)		

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Class	Sub.	Date	Exmr.
709	202 206 227 318 312 313	6/19/03 6/23/03	LS
~~379~~ ↓	265 266	6/19/03 6/23/03 6/24/03	LS
707	10	6/25/03	LS
~~705~~			
714	4	2/22/04	LS

INTERFERENCE SEARCHED

Class	Sub.	Date	Exmr.
	—		

SEARCH NOTES
(INCLUDING SEARCH STRATEGY)

	Date	Exmr.
1. Consulted XA. Vaughn RE: Class 709 · Search strategy	6/19/03	LS
2. Consulted primary Tiers, Bith RE class 379. for search class 379/9, ~~W~~, 145	6/24/03	LS
3. Consulted Primary J Myhre for ref. 705 class.	7/8/03	LS
4 Plus Search 5 EIC Search	6/26/03	LS
6. Consulted K.P. Thompson, M about finality of amendment	2/12/04	LS
7. Search EAST	2/22/04	LS

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ISSUE SLIP STAPLE AREA (for additional cross references)

POSITION	INITIALS	ID NO.	DATE
FEE DETERMINATION		71531	1.15.01
O.I.P.E. CLASSIFIER		49	11/25/00
FORMALITY REVIEW		71531	1.15.01
RESPONSE FORMALITY REVIEW		71531	2.15.01

INDEX OF CLAIMS

✔	Rejected	N	Non-elected
=	Allowed	I	Interference
—	(Through numeral)... Canceled	A	Appeal
÷	Restricted	O	Objected

Claim		Date									
Final	Original										
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HEWLETT-PACKARD COMPANY
Intellectual Property Administration
P. O. Box 272400
Fort Collins, Colorado 80527-2400

PATENT APPLICATION

ATTORNEY DOCKET NO. 10008316-1

IN THE U.S. PATENT AND TRADEMARK OFFICE
Patent Application Transmittal Letter

COMMISSIONER FOR PATENTS
Washington, D.C. 20231

Sir:

Transmitted herewith for filing under 37 CFR 1.53(b) is a(n): (X) Utility ( ) Design
(X) original patent application,
( ) continuation-in-part application

INVENTOR(S): **Blaine D. Gaither, et al.**

TITLE: **A Method And Apparatus For Passing Messages Using A Fault Tolerant Storage System**

Enclosed are:

(X) The Declaration and Power of Attorney. ( ) signed (X) unsigned or partially signed

(X) 10 sheets of drawings (one set) ( ) Associate Power of Attorney

( ) Form PTO-1449 ( ) Information Disclosure Statement and Form PTO-1449

( ) Priority document(s) ( ) (Other) _____ (fee $_____)

CLAIMS AS FILED BY OTHER THAN A SMALL ENTITY				
(1) FOR	(2) NUMBER FILED	(3) NUMBER EXTRA	(4) RATE	(5) TOTALS
TOTAL CLAIMS	10 — 20	0	X $18	$ 0
INDEPENDENT CLAIMS	1 — 3	0	X $80	$ 0
ANY MULTIPLE DEPENDENT CLAIMS	0		$270	$ 0
BASIC FEE: Design ($320.00); Utility ($710.00)				$ 710
TOTAL FILING FEE				$ 710
OTHER FEES				$
TOTAL CHARGES TO DEPOSIT ACCOUNT				$ 710

Charge $ 710 to Deposit Account 08-2025. At any time during the pendency of this application, please charge any fees required or credit any over payment to Deposit Account 08-2025 pursuant to 37 CFR 1.25. Additionally please charge any fees to Deposit Account 08-2025 under 37 CFR 1.16, 1.17,1.19, 1.20 and 1.21. A duplicate copy of this sheet is enclosed.

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Date of Deposit Oct. 31, 2000

I hereby certify that this is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 CFR 1.10 on the date indicated above and is addressed to: Commissioner for Patents, Washington, D.C. 20231

By _____

Typed Name: Jerome Dechant

Respectfully submitted,

Blaine D. Gaither, et al.

By _____

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APPROVED BY DRAFTSMAN | O.G. FIG. CLASS | SUBCLASS

DOCKET ALARM

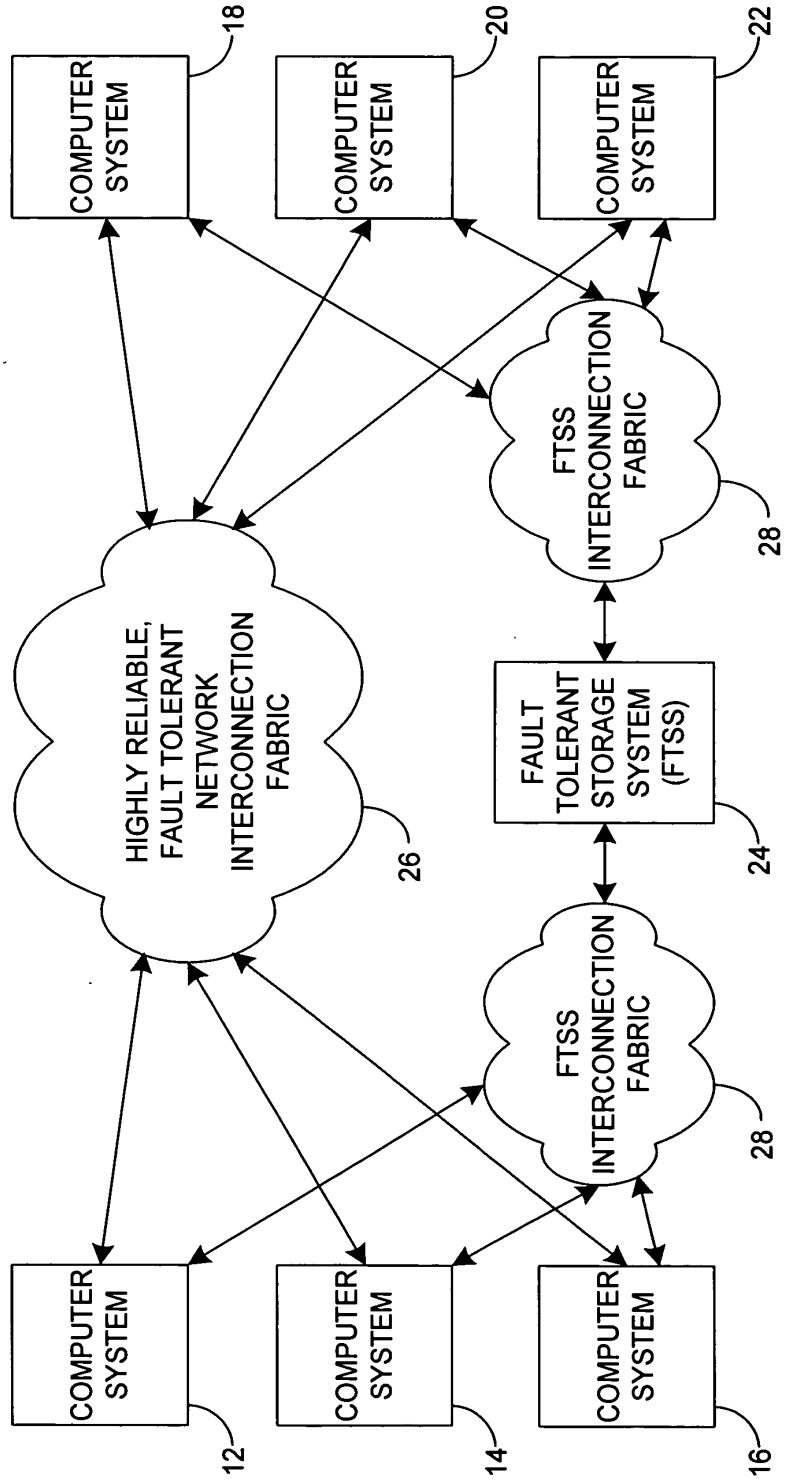


FIG. 1
(PRIOR ART)

APPROVED O.G. FIG.
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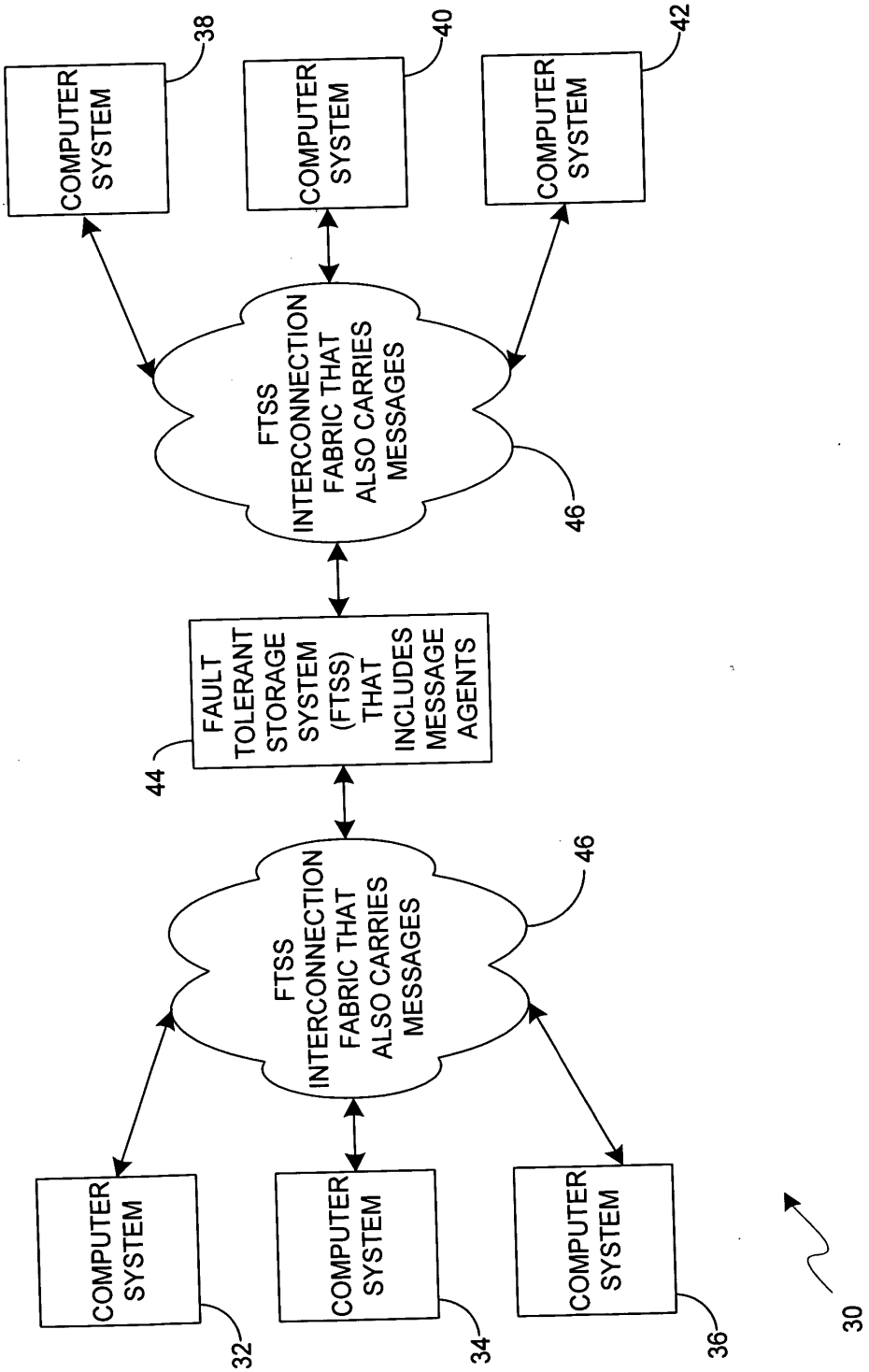


FIG. 2

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APPROVED BY DRAFTSMAN | C.G. FIG. | CLASS | SUBCLASS

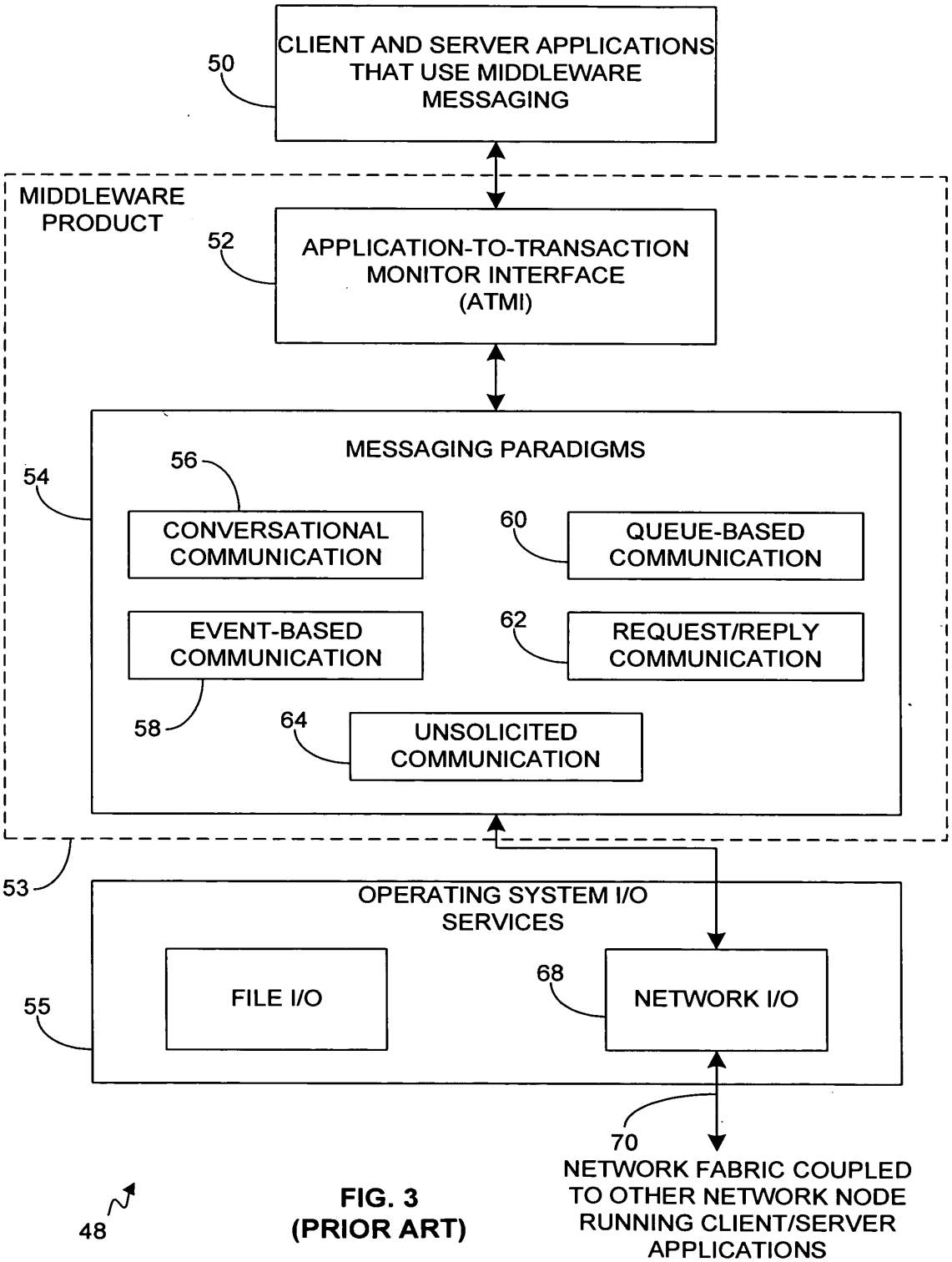


FIG. 3 (PRIOR ART)

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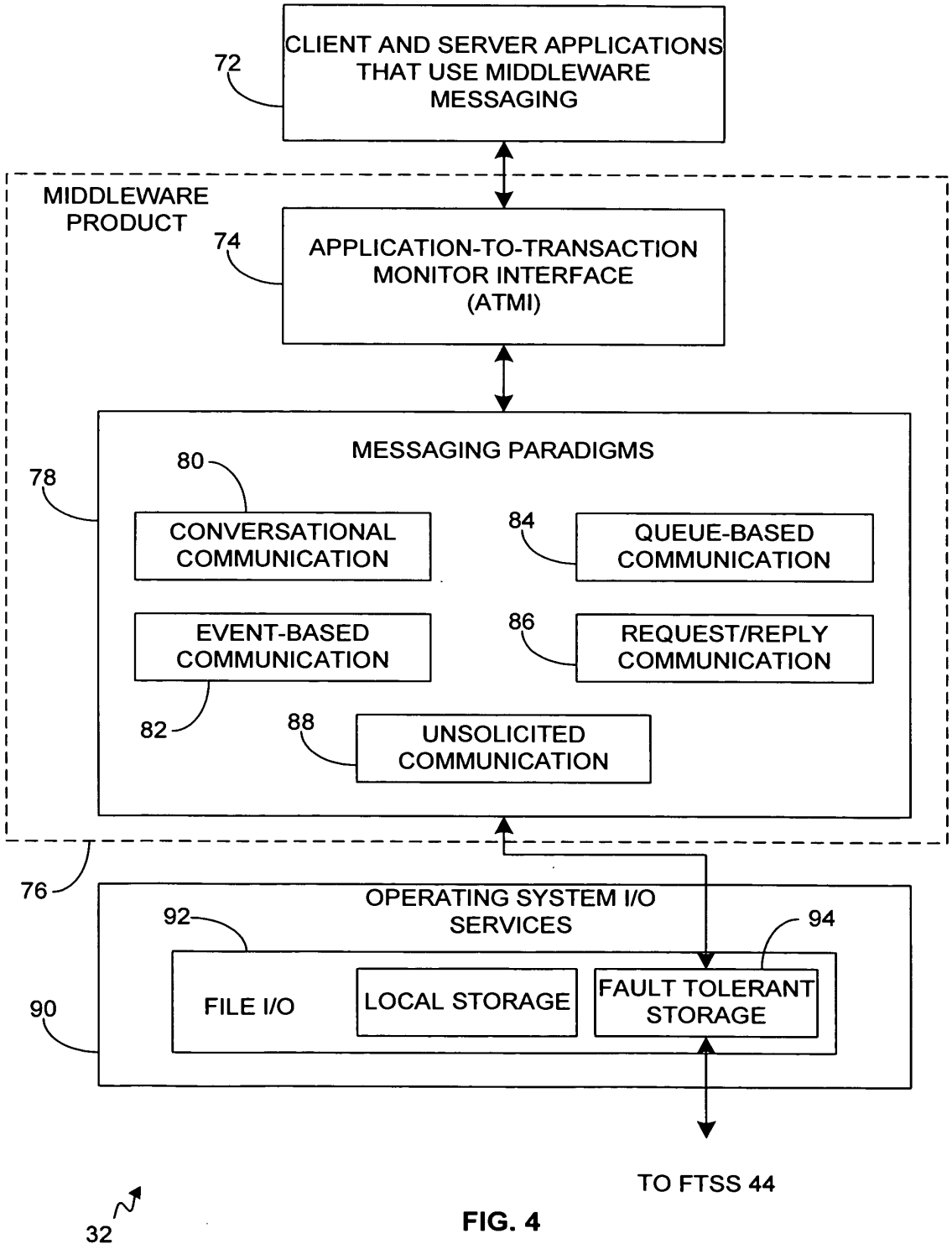


FIG. 4

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APPROVED O.G. FIG.
BY CLASS SUBCLASS
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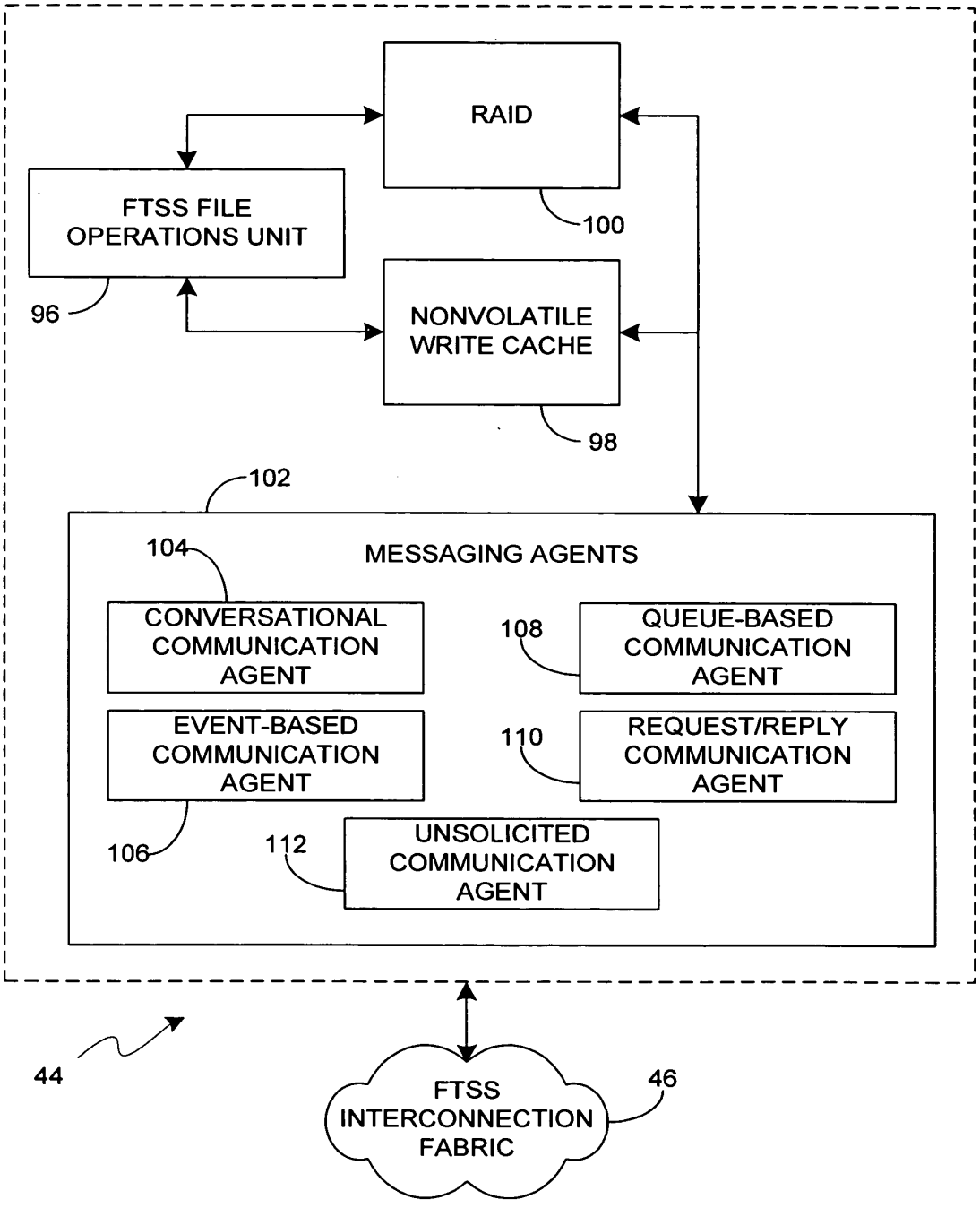


FIG. 5

APPROVED O.G. FIG.
BY CLASS SUBCLASS
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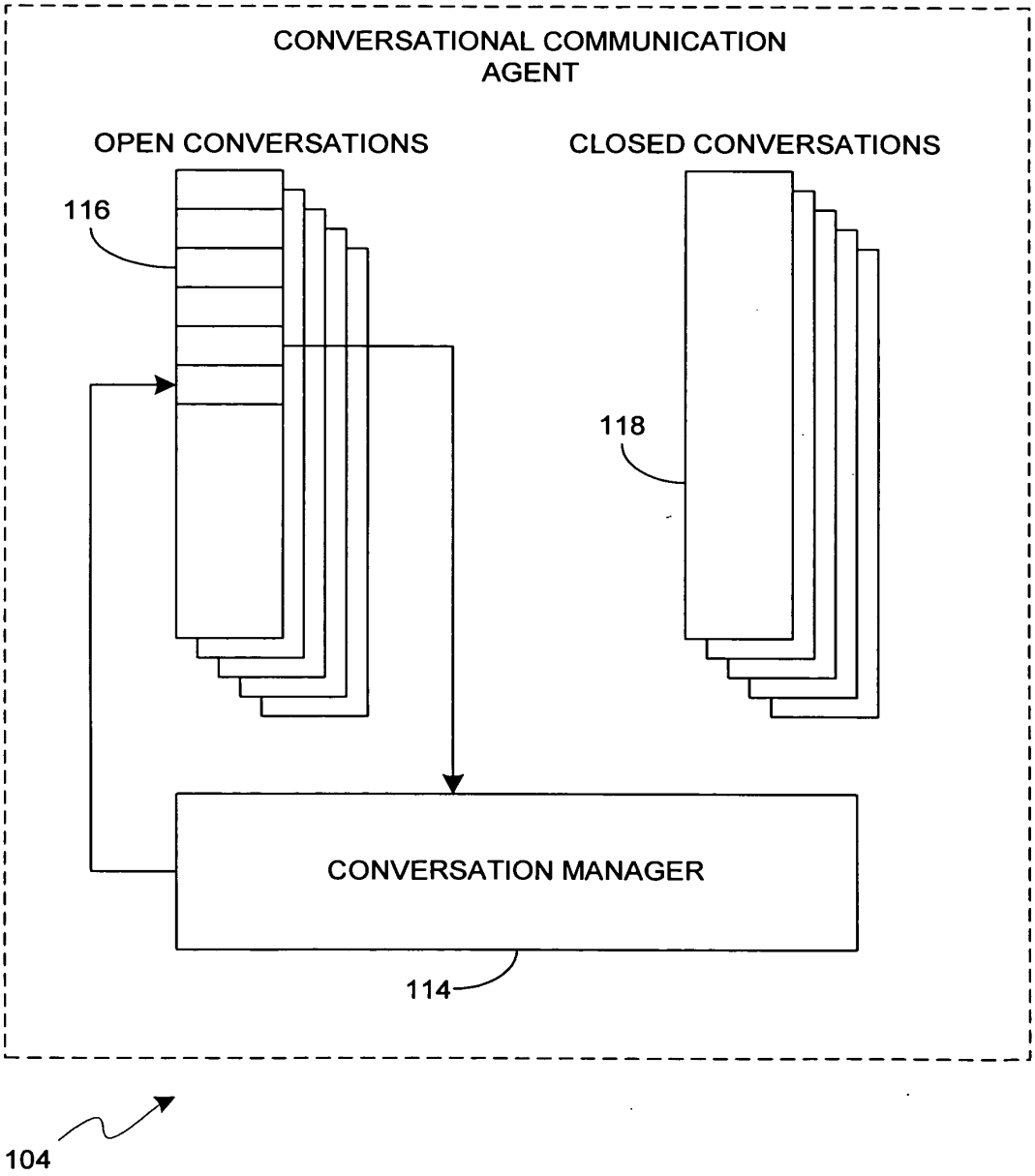


FIG. 6

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APPROVED: C.G. FIG.
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Docket 2016-0159

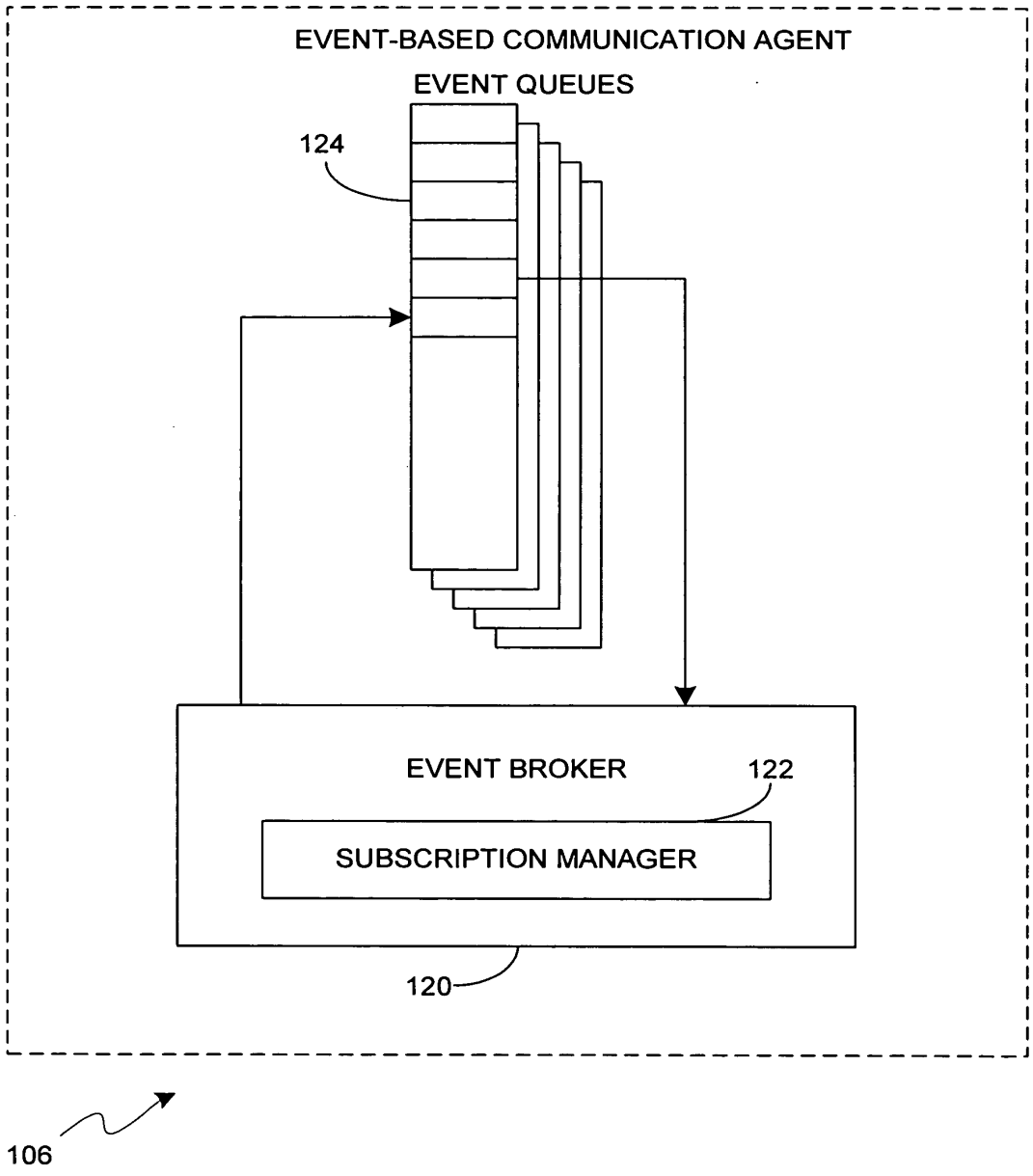


FIG. 7

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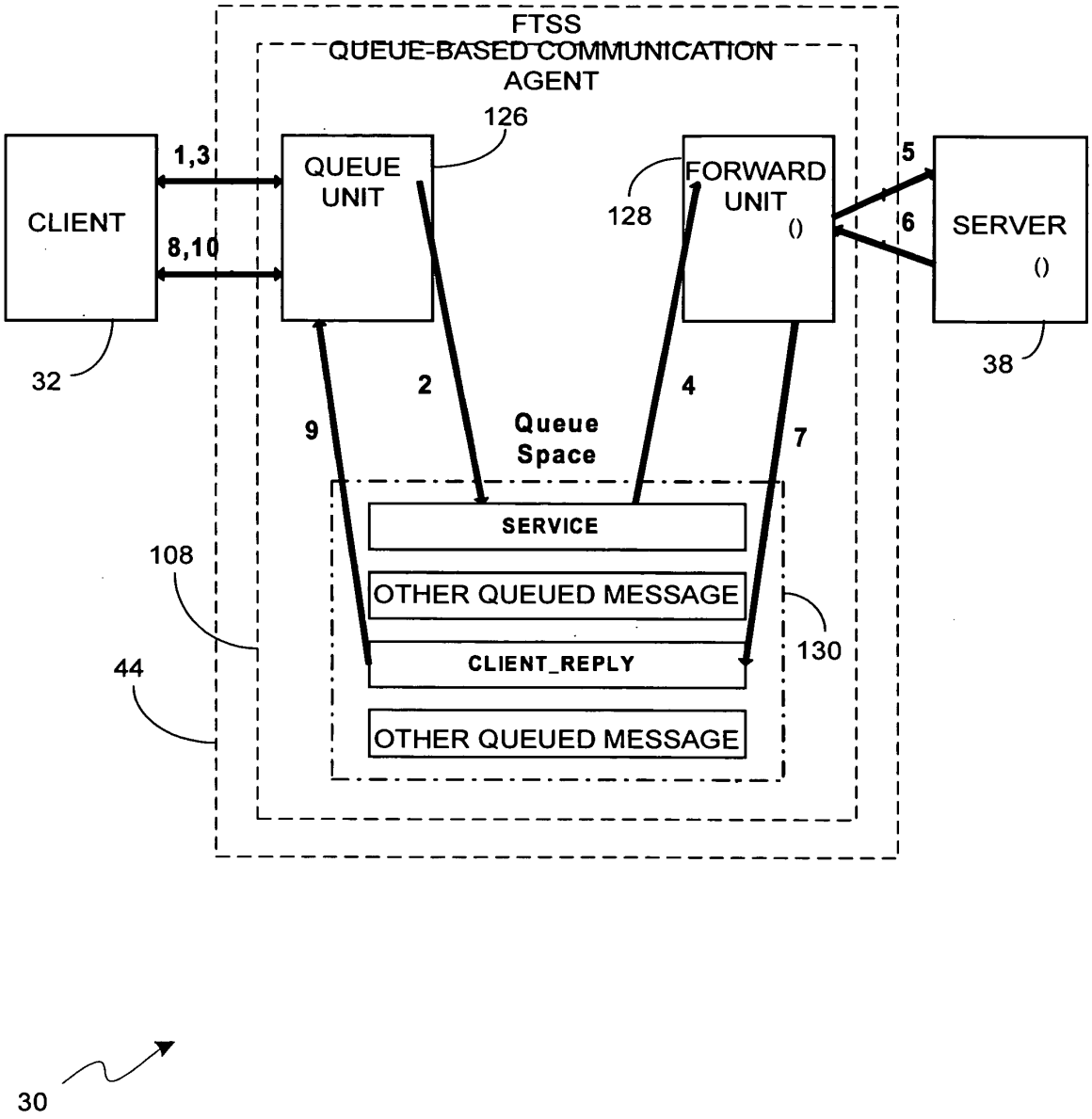


FIG. 8

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O.G. FIG.
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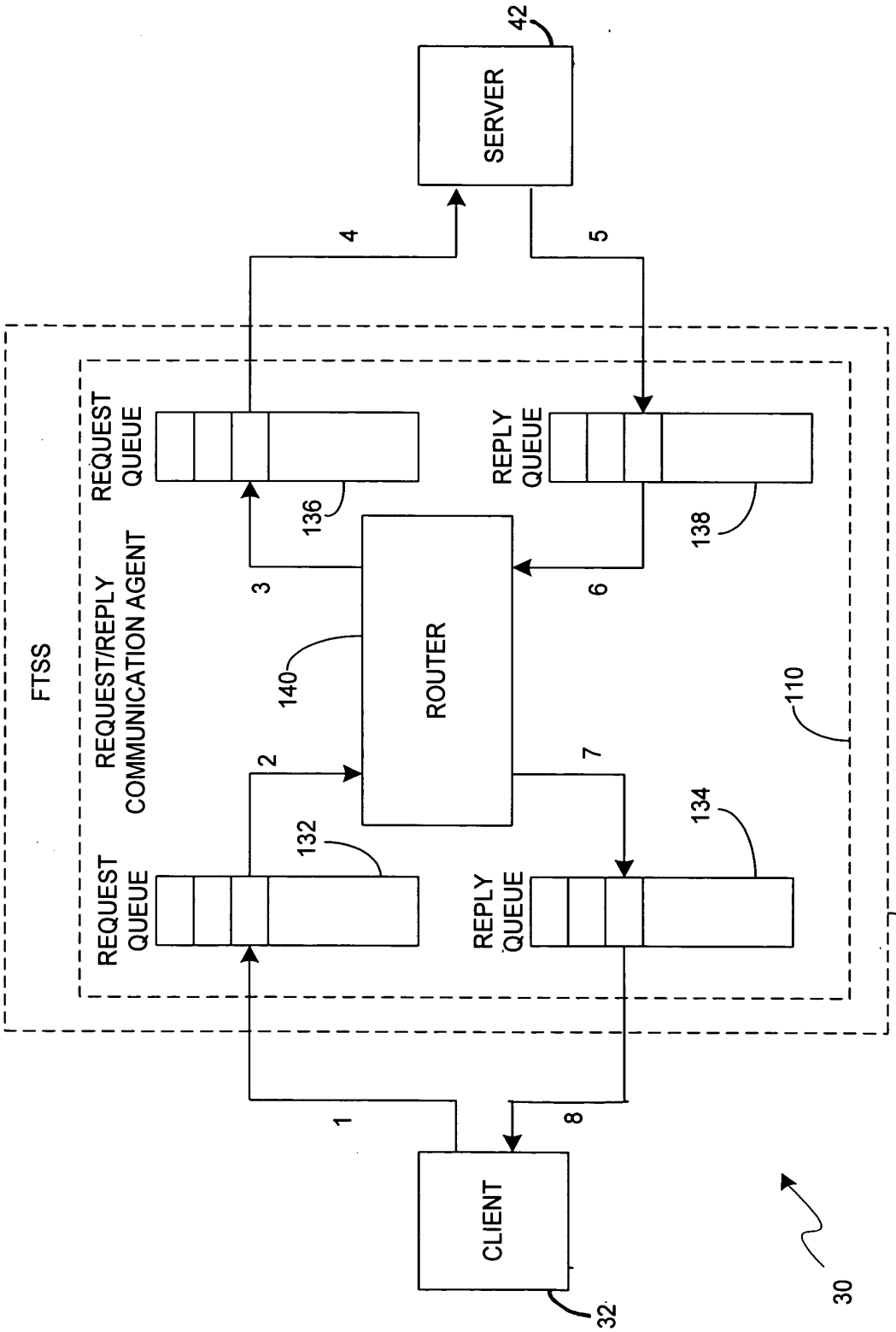


FIG. 9

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APPROVED O.G. FIG.
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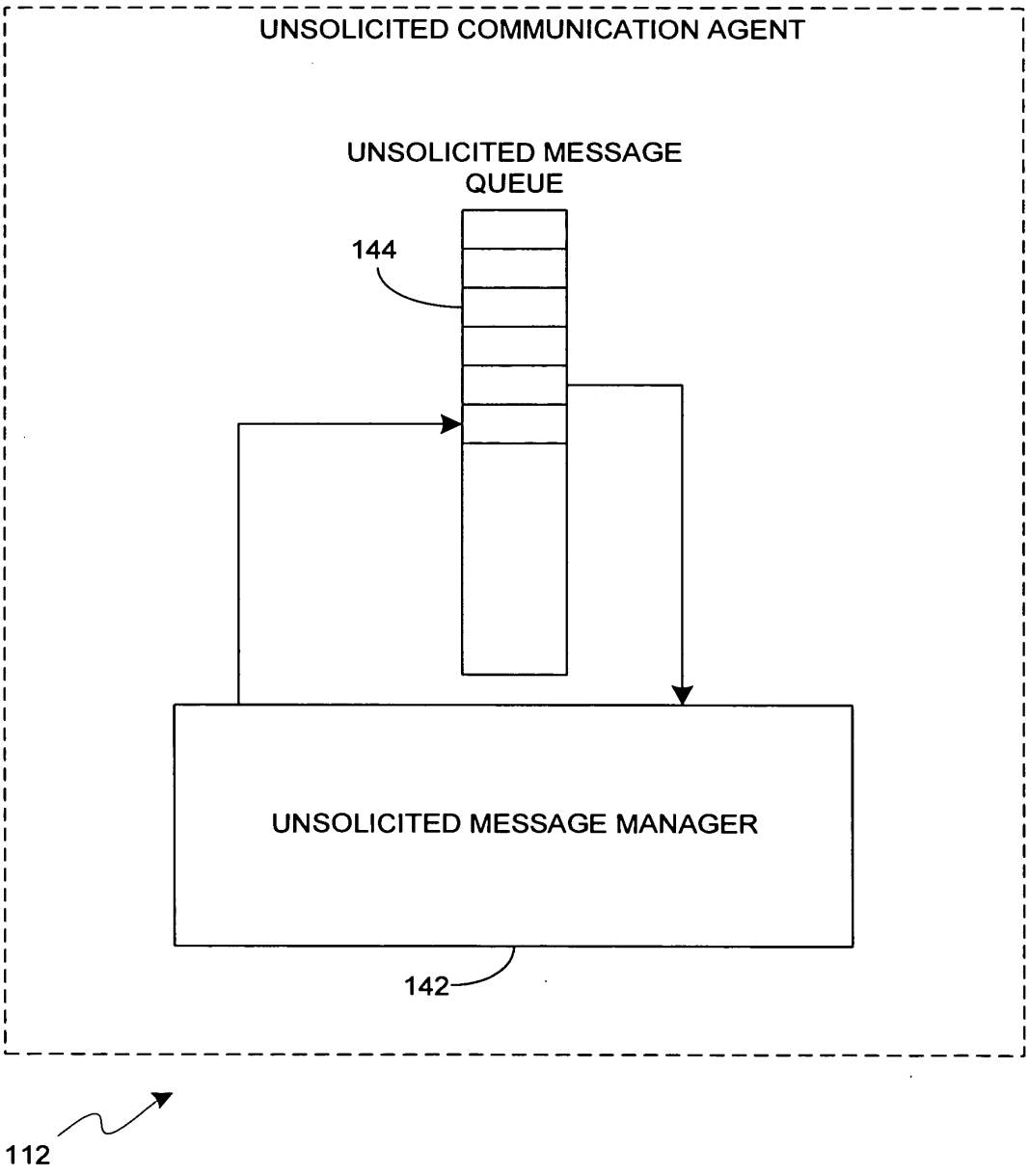


FIG. 10

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A METHOD AND APPARATUS FOR PASSING MESSAGES USING A FAULT TOLERANT STORAGE SYSTEM

CROSS REFERENCE TO RELATED APPLICATION

This application contains subject matter related to a co-pending application entitled "A Fault Tolerant Storage System Having an Interconnection Fabric That Also Carries Network Traffic" by Blaine D. Gaither et al., which has been assigned Hewlett-Packard Docket Number 10001666-1. This application is hereby incorporated by reference, is assigned to the same assignee as the present application, and was filed on October 31, 2000, which is also the date on which the present application was filed.

FIELD OF THE INVENTION

The present invention relates to messaging between computer systems. More specifically, the present invention relates to a messaging architecture wherein messages are transmitted over the interconnection fabric of a fault tolerant storage system and are stored within the fault tolerant storage system.

DESCRIPTION OF THE RELATED ART

In the art of computing, a distributed application is an application that is separated into two or more parts, such as a client application on a first computer system and a server application on a second computer system, with the two computers coupled together via a network. As used herein, the term "client" refers to an entity that requests a service, and the term "server" refers to the entity that fulfills the request. The entity can be a an application, *i.e.*, a client application or a server application, or the entity can be a computer system coupled to a network, *i.e.*, a client computer system or a server computer system. Computer systems coupled to a network may also be referred to as "nodes". The meaning of these terms will be apparent from the contexts in which the terms are used.

Consider, for example, a distributed application that allows a customer to order a product over the Internet from an on-line retailer. The customer accesses the distributed

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application using a web browser. The web browser communicates over the Internet with a web server, which provides the customer with a catalog of products that can be ordered, and provides a "shopping basket" that allows the customer to select the products that the customer wishes to purchase.

Assume that the customer decides to complete the order, and pay for the order with a credit card. The web server must communicate as a client with a server application that verifies that the credit card is valid, and posts the purchase to the customer's credit card account. The web server must also communicate with an application that delivers the order to the warehouse so the order can be shipped. In addition, the web server may communicate with an inventory control application to verify that the products ordered are in stock, and to order replacement inventory from the vendor. If the customer checks back latter to view the status of the order, the web server may communicate with an application maintained by the shipping company to provide the customer with a tracking number.

This is a very simple example, and a typical distributed application may be much more complex. However, even in this simple example one can see that designing a distributed application is very complex. Perhaps the most complex task faced by a distributed application developer is ensuring that all the disparate applications that comprise the distributed application communicate in a seamless and reliable manner.

To ensure that all applications communicate seamlessly and reliably in a distributed application, the application designer may use a middleware product that distributes applications across multiple platforms, databases, and operating systems using message-based communications and, if desired, distributed transaction processing. Middleware products are used with client/server applications to distribute processing among multiple servers, manage distributed transactions, and integrate multiple database platforms. Middleware systems are sometimes known in the art as "on-line transaction processing" (OLTP) systems. One such system is Bea Tuxedo®, which is a product of BEA Systems, Inc.

To facilitate communication between disparate applications, Bea Tuxedo® provides an application designer with a series of messaging paradigms. These messaging paradigms

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are conversational communication, event-based communication, queue-based communication, request/reply communication, and unsolicited communication.

Conversational communication allows messages to be exchanged between clients and servers in a manner analogous to human conversation. This form of communication is implemented using inter-process communication (IPC) message queues. IPC message queues are typically implemented in transient memory areas, and are typically provided by the underlying operating system and are used for communication between clients and servers. IPC message queues can be used to pass messages between client and server applications operating on the same computer system or on separate computer systems coupled by a network.

Just as in a conversation between two people, a number of messages pass back and forth between the client and server until a conclusion is reached. Over the course of the communication, both sides "remember" the point (or state) of the conversation so that relatively long operations, such as ad hoc queries, reports, and file transfers, can be supported. Note that the context of any particular message is interpreted in view the previous messages comprising the conversation.

Event-based communication uses an event broker to transfer messages. The event broker provides a communication paradigm in which message suppliers can post messages for message subscribers. Because client and server processes that use the event broker communicate with one another based on a set of subscriptions, this paradigm is also known in the art as publish-and-subscribe communication. The event broker acts like a newspaper delivery person who delivers newspapers only to customers who have paid for a subscription. Event generators inform the event broker of events (such as changes and problems) as they occur. This process is called posting an event. The event broker then matches the name of the event to an event name associated with a list of subscribers, and notifies each subscriber on the list of the event by passing a message to the subscriber. Communication between the suppliers, subscribers, and event broker is provided by IPC message queues.

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Queue-based communication requires persistent storage of data. Queue-based communication allows any client or server to store messages in queues, and guarantees that any stored message will be delivered to the destination. Queues can be ordered as last-in first-out (LIFO) or first-in first-out (FIFO), or on the basis of time or priority. A collection of queues is administered and referred to as a single entity known as a queue space.

Queue-based communication is appropriate when communication can occur in a time-independent fashion. Time-independence is a characteristic of programs that operate independently from one another and do not need to synchronize their communications simultaneously. Time-independent programs synchronize with each other by leaving messages in application queues. Because queued messages are stored using persistent media, such as a hard disk drive, queue-based communication is highly reliable and messages can even be delivered after failures, such as power outages or network interruptions.

Even though queue-based messages pass through persistent storage, server applications and client applications enqueue and dequeue messages by sending the messages to a queue administrator. The queue administrator can reside on the same computer as either the server or client application, or can reside on a third server.

Request/reply communication is also implemented using inter-process communication (IPC) message queues. Each server is assigned an IPC message queue called a request queue, and each client is assigned an IPC message queue called a reply queue. Accordingly, a client application can send requests to the server by putting those requests on the server's queue, and then check and retrieve messages from the server by retrieving messages from its own reply queue.

Request/reply communication is typically carried out in either a synchronous mode or an asynchronous mode. In a synchronous mode, a client sends a request to a server, which performs the requested action while the client waits. The server then sends the reply to the client, which receives the reply. In asynchronous mode, the client does not wait for a server to complete a service request before the client undertakes other tasks. Rather, after issuing a request, the client performs additional tasks (which may include issuing more

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requests to the server). When a reply to the first request is available, the client retrieves it from its reply queue.

Unsolicited communication is a type of communication that allows a client or server to receive a message that it never requested, thereby making it possible for applications to receive notification of application-specific events as they occur without having to request notification. Unsolicited messages can be sent to a single server node or client node, or be broadcast to a group of nodes. For example, a server may alert a single client that the account about which the client is inquiring has been closed, or a server may send a message to all the clients to notifying the clients that the server will be shut down for maintenance at a specific time. In addition, unsolicited messages can be sent either with or without guaranteed delivery. Unsolicited messages are sent using IPC message queues.

As can be seen from the discussion above, some of these messaging paradigms, such as request/reply communication, use transient media, such as network connections and system memory, to pass messages between clients and servers. On the other hand, queue-based communication delivers messages using persistent media, such as a hard disk drive.

In most distributed applications, availability is very important. Consider the example above, if the application that processes credit card transactions suffers a failure, the customer will not be able to purchase products. Similarly, if the web server can not communicate with the inventory control application, the web server can not inform the customer whether the product is in stock.

To ensure that a distributed application has a high rate of availability, it is important to make each component that hosts the distributed application as reliable and fault-tolerant as possible. As discussed above, messaging is critical in a distributed application, and two components critical in the communication of messages are the persistent storage media, such as the hard drives, and the transient communication network. Accordingly, a designer of a distributed application will often specify that the application be implemented using highly reliable and fault tolerant interconnection fabrics and storage systems.

Several interconnection fabrics are available to provide guaranteed delivery of packets. For example, ServerNet® is a system interconnect architecture available from

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Compaq Computer Corporation. ServerNet® hardware ensures data integrity using multiple techniques. For example, command link integrity isolates single-bit errors, cyclic redundancy checks maintain both data and control integrity of transfers crossing the interconnect fabric, and hardware protocol acknowledgments ensure that end-to-end reliable data transfer has occurred. In addition, ServerNet® is capable of providing a high level of availability by incorporating spare alternate paths within a primary interconnection fabric, and providing a fully redundant secondary interconnect fabric with redundant secondary attachments to network nodes. Similar interconnection fabrics are available from other vendors, such as the Coupling Facility provided by IBM Corporation. While interconnection fabrics such as ServerNet® and the Coupling Facility are fast, highly reliable, and fault tolerant, they are also very expensive.

A fault tolerant storage systems (FTSS), such as the SureStore® XP512 Disk Array, which is a product of Hewlett-Packard Company, guarantees the availability and integrity of files stored by the FTSS. Fault tolerant storage systems are also available from other companies, such as Hitachi Data Systems Corporation and EMC Corporation.

Typically an FTSS is coupled to a server using a high-speed interface, such as an Ultra160 SCSI interface, a fiber channel interface, or an enterprise system connectivity (ESCON) interface. Such systems are highly reliable and fault tolerant. For example, the SureStore® XP512 Disk Array uses a fault-tolerant, redundant architecture that ensures there is no single point-of-failure, and has a mean time between failure (MTBF) of 2.5 million hours, or alternatively 285 years. Such systems are also incredibly fast. A single fiber channel port can support transfer rates of 100 megabytes per second, and ports can be ganged together to increase transfer rates even further. Moreover, the internal crossbar architecture of the XP512 has a bandwidth of 6.4 gigabytes per second.

Figure 1 shows such a highly reliable fault-tolerant prior art system 58, which may be used to host a distributed application. System 10 comprises computer systems 12, 14, 16, 18, 20, and 22, and fault tolerant storage system (FTSS) 24. Computer systems 12, 14, 16, 18, 20, and 22 are coupled to FTSS 24 via FTSS interconnection fabric 28 to carry file I/O transactions between the computer systems and FTSS 24. Typically, interconnection

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fabric 28 couples each computer system directly to the FTSS, but does not directly couple the computer systems to each other. In addition, computer systems 12, 14, 16, 18, 20, and 22 are coupled to together by highly reliable, fault tolerant network interconnection fabric 26 to carry messages between the computer systems.

Note that interconnection fabrics 26 and 28 are both highly reliable and fault tolerant. Accordingly, a customer configuring a system such as that shown in Figure 1 ends up paying for two interconnection fabrics. Furthermore, interconnection fabric 26 does not include any type of persistent storage. If a client suffers some type of error after receiving a message, the client is not able to request retransmission of the message from fabric 26. What is needed in the art is a practical way for a customer to use the same highly reliable and fault tolerant interconnection fabric to carry both file I/O transactions and messaging traffic, and also allowing a client to request retransmission of messages.

SUMMARY OF THE INVENTION

The present invention is a method and apparatus for passing messages between server and client applications using a fault tolerant storage system (FTSS). The interconnection fabric that couples the FTSS to the computer systems that host the client and server applications may also be used to carry messages. In accordance with the present invention, a networked system capable of hosting a distributed application includes a plurality of computer systems coupled to an FTSS via an FTSS interconnection fabric. The FTSS not only processes file-related I/O transactions, but also carries message traffic. In addition, the FTSS includes several message agents to facilitate message transfer in a reliable and fault tolerant manner. The message agents include a conversational communication agent, an event-based communication agent, a queue-based communication agent, a request/reply communication agent, and an unsolicited communication agent.

The highly reliable and fault tolerant nature of the FTSS ensures that the FTSS can guarantee delivery of a message transmitted from a sending computer system to a destination

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computer system. As soon as a message is received by the FTSS from a sending computer system, the message is committed to a nonvolatile write cache. Thereafter, the message is written to a redundant array of independent disks (RAID) of the FTSS, and processed by one of the message agents.

The present invention enhances the reliability and fault tolerance of messaging in several ways. First, messages may be transmitted between nodes using the FTSS interconnection fabric, which is highly reliable and fault tolerant. Since many systems that host distributed applications already include an FTSS, using the FTSS fabric instead of a less reliable network media, such as Ethernet, increases availability of the distributed application without the customer having to incur additional hardware costs.

Second, in the prior art, several messaging paradigms use agents that operate on separate servers. By moving these agents to the FTSS, availability is increased because the FTSS is typically more reliable than the servers to which it is coupled. Furthermore, since the FTSS is being used to pass messages anyway, providing the agents in the FTSS eliminates the need to route the messages to a separate server, thereby allowing the messages to be processed faster.

Finally, several prior art messaging paradigms pass interprocess communication messages directly between nodes in a transient manner. In the present invention, these messages pass through the FTSS and are stored in and retained by the FTSS, thereby allowing any application to "rollback" to a known point and retrieve lost messages from the FTSS.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 shows a highly reliable fault-tolerant prior art system that may be used to host a distributed application.

Figure 2 shows a highly reliable fault-tolerant system in accordance with the present invention that may be used to host a distributed application.

Figure 3 is a block diagram of a prior art computer system that illustrates how messages are processed.

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Figure 4 is a block diagram of a computer system having a middleware product that passes messages to another computer system via a fault tolerant storage system (FTSS), in accordance with the present invention.

Figure 5 is a block diagram of an FTSS that passes messages between client and server nodes via communication agents, in accordance with the present invention.

Figure 6 is a block diagram illustrating a conversational communication agent provided in the FTSS of Figure 5.

Figure 7 is a block diagram illustrating an event-based communication agent provided in the FTSS of Figure 5.

Figure 8 is a block diagram illustrating a queue-based communication agent provided in the FTSS of Figure 5.

Figure 9 is a block diagram illustrating a request/reply communication agent provided in the FTSS of Figure 5.

Figure 10 is a block diagram illustrating an unsolicited communication agent provided in the FTSS of Figure 5.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present invention is a method and apparatus for passing messages between server and client applications using a fault tolerant storage system (FTSS). The interconnection fabric that couples the FTSS to the computer systems that host the client and server applications may also be used to carry messages.

Figure 2 shows a networked system 30 in accordance with the present invention. Networked system 30 may be used to host a distributed application, such as an on-line store accessible from the Internet. System 30 includes computer systems 32, 34, 36, 38, 40, and 42, fault tolerant storage system (FTSS) 44, and FTSS interconnection fabric 46. Although only computer systems are shown in Figure 2, those skilled in the art will recognize that other network nodes may be coupled to FTSS 44 via fabric 46, such as printers, scanners, backup

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systems, and the like. Although not shown in Figure 2, computer systems 32, 34, 36, 38, 40, and 42 may be coupled to each other and to other computers via another interconnection fabric, such as an Ethernet network, which in turn may be coupled to the Internet via a gateway.

Typically, interconnection fabric 46 will be comprised of high-speed interfaces and related cabling used to connect computer systems to storage systems, such as small computer system interfaces (SCSI), fiber channel interfaces, or enterprise system connectivity (ESCON) interfaces. In a typical FTSS, these interfaces tend to connect each computer system directly to the FTSS, but do not connect the computer systems to each other.

In accordance with the present invention, FTSS 44 not only processes file-related I/O transactions, but also carries message traffic. In addition, FTSS 44 includes several message agents to facilitate message transfer in a reliable and fault tolerant manner, as described below. The highly reliable and fault tolerant nature of FTSS 44 ensures that FTSS 44 can guarantee delivery of a message transmitted from a sending computer system to a destination computer system. To see how this is accomplished, first consider a typical FTSS, such as the SureStore® XP512 Disk Array, which is a product of Hewlett-Packard Company. The XP512 has a battery-protected fully redundant nonvolatile write cache that can range in size from 2 gigabytes to 32 gigabytes. As soon as a message is received by FTSS 44 from a sending computer system, the message is committed to the nonvolatile write cache. Thereafter, the message is written to a redundant array of independent disks (RAID) of FTSS 44, and processed by one of the message agents.

Before considering the present invention in greater detail, first consider how messages that are transmitted between network nodes are processed in a prior art computer using a middleware product such Bea Tuxedo®, which is a product of BEA Systems, Inc. Figure 3 shows a prior art computer system 48. Client and server applications that use middleware messaging are represented by block 50. These applications pass messages to other nodes using an application-to-transaction monitor interface (ATMI), which is represented by block 52 and is part of middleware product 53. The ATMI provides a series of functions that may be called

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by the client and server applications to pass messages, as will be described in greater detail below.

The messaging paradigms supported by middleware product 53 are represented by block 54. The conversational communication paradigm is represented by block 56, the event-based communication paradigm is represented by block 58, the queue-based communication paradigm is represented by block 60, the request/reply communication paradigm is represented by block 62, and the unsolicited communication paradigm is represented by block 64. Block 54 communicates with the I/O services of the operating system, which are represented by block 55, to transmit messages. Figure 3 illustrates how messages are transmitted between network nodes. Accordingly, block 54 communicates with network I/O block 68 to send and receive messages from other network nodes via network fabric 70.

In accordance with the present invention, Figure 4 shows how middleware product 76 is modified in computer system 32 of Figure 2, as well as the other computer systems shown in Figure 2, to pass messages via FTSS 44. Similar to prior art Figure 3, client and server applications that use middleware messaging are represented by block 72. These applications pass messages to other nodes using an application-to-transaction monitor interface (ATMI), which is represented by block 74 and is part of middleware product 76. Note that all the function calls available in prior art ATMI 52 in Figure 3 are available in ATMI 74, thereby providing complete compatibility with prior art applications.

The messaging paradigms supported by middleware product 76 are represented by block 78. The conversational communication paradigm is represented by block 80, the event-based communication paradigm is represented by block 82, the queue-based communication paradigm is represented by block 84, the request/reply communication paradigm is represented by block 86, and the unsolicited communication paradigm is represented by block 88. Block 78 communicates with the I/O services of the operating system, which are represented by block 90, to transmit messages. However, unlike messaging paradigms block 54 of Figure 3, block 78 has been modified to pass messages between computer systems coupled to FTSS 44 by

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communicating with message agents in FTSS 44. Accordingly, block 78 communicates with fault tolerant storage block 94 of file I/O block 92, which is provided by operating system I/O services 90.

The communication between block 78 and FTSS 44 can be accomplished several ways. For example, a series of directories can be defined on FTSS 44 to store incoming and outgoing messages as files. Using this technique, block 78 can pass messages to FTSS 44 by writing messages as files into the appropriate directory of FTSS 44. Another way to accomplish this communication is to use the techniques disclosed in a co-pending application entitled "A Fault Tolerant Storage System Having an Interconnection Fabric That Also Carries Network Traffic" by Blaine D. Gaither et al., which is incorporated by reference above. This application teaches how a network protocol stack can be modified to route all network traffic between nodes coupled to the FTSS via the FTSS interconnection fabric. Using the techniques taught in this application, each message agent in FTSS 44 can be assigned an address, and block 78 can communicate with the network protocol stack to transmit the messages to FTSS 44. If this technique is used, the messages would first pass through the network protocol stack before being processed by fault tolerant storage block 94. Those skilled in the art will understand how to adapt the teachings herein to pass messages from messaging paradigms bock 78 to FTSS 44.

In accordance with the present invention, Figure 5 illustrates how FTSS 44 can be modified to support messaging. In Figure 5, FTSS 44 includes file operations unit 96, which processes file I/O requests in a manner similar to the prior art. Incoming file data is first committed to non-volatile write cache 98, and is then stored in RAID 100. Outgoing file data is retrieved from RAID 100, and then transmitted to the node that requested the file data.

Messaging agents block 102 includes several messaging agents that support the messaging paradigms described above. Accordingly, messaging agents block 102 includes conversational communication agent 104, event-based communication agent 106, queue-based communication agent 108, request/reply communication agent 110, and unsolicited communication agent 112.

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In the following discussion, the communication agents will be described in greater detail. A variety of queues and other data structures will be illustrated. All of these data structures are stored in fault tolerant storage, such as RAID 100 and/or nonvolatile write cache 98. In addition, all incoming messages are immediately stored in fault tolerant storage. Furthermore, the communication agents retain old message transactions for some time after the message transactions are complete. In some of the figures discussed below, old transactions will be illustrated, while in other figures, retention of the old transactions is assumed. Saving the old transactions allows any node engaged in messaging to recover from an error by "rolling back" to a known point in the message transaction, and reconstructing the transaction. Transactions can eventually be deleted using some mechanism known in the art, such as an expiration date and time or a FIFO queue. Since a typical FTSS can be configured with terabytes of data, the FTSS is will suited for retaining old message transactions.

Figure 6 is a diagram illustrating conversational communication agent 104. Before discussing agent 104 in greater detail, first consider the relevant ATMI function calls provided by block 74 in Figure 4 that support conversational communication in a Bea Tuxedo® system. The C programing language version of these function calls will be discussed below, however analogous function calls are available in other languages, such as COBOL and Java.

The function *tpconnect()* is used to begin a conversation with another node, and the function *tpdiscon()* is used to end the conversation. To send a message in the conversation, the function *tpsend()* is used, and to receive a message in the conversation, the function *tprecv()* is used.

Figure 6 illustrates conversation communication agent 104. Agent 104 includes a conversation manager 114, open conversations 116, and closed conversations 118. When a client node calls *tpconnect()* to open a conversation with a server node, conversation manager 114 creates an open conversation 116. When either node calls *tpsend()*, the message in the conversation is stored in the appropriate open conversation 116, and is transmitted to the other node. Since the message is transmitted to the other node by manager

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114, when the other node calls the function *tprecv()*, the message is provided locally to program that called the *tprecv()* function. However, if the other node suffered some type of error or failure that caused it to lose the message, the message can still be retrieved from the appropriate open conversation 116. When either node calls *tpdiscon()*, the conversation is closed and is moved to closed conversations 118, and is retained for a period of time, as discussed above. Accordingly, either node can "rollback" to a known point by accessing open conversations 116 or closed conversations 118. Note that in the prior art, conversations occurred directly between the client and server in a transient manner. By providing conversational communication agent 104 in FTSS 44, reliability and fault tolerance are increased because conversations are also retained in FTSS 44.

Figure 7 is a diagram illustrating event-based communication agent 106. Before discussing agent 106 in greater detail, first consider the relevant ATMI function calls provided by block 74 in Figure 4 that support event-based communication.

The function *tpsubscribe()* allows a client to subscribe to receive certain types of event messages, and the function *tpunsubscribe()* allows the client to unsubscribe. The function *tppost()* allows a server to post an event message.

In Figure 7, event-based communication agent 106 includes an event broker 120, which includes a subscription manager 122, and event queues 124. Subscription manager 122 maintains lists of clients that have subscribed to certain events using the *tpsubscribe()* function call. When a server posts an event message using the *tppost()* function call, the message is posted in the appropriate event queue 124, and is relayed to all client nodes that have subscribed to the event. If a particular client suffers some type of error or other failure, the client can access event broker 120 to retrieve any event messages corresponding to events to which it has subscribed. In the prior art, an event broker was also provided on a server. However, the present invention increases reliability and fault tolerance by providing the event broker in FTSS 44. In a typical distributed application that includes an FTSS, the FTSS will typically be more reliable and fault tolerant than the servers coupled to the FTSS.

Figure 8 is a diagram illustrating queue-based communication agent 108. For reasons that will be come apparent below, this type of messaging is also known in the art as "store

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and forward" messaging. Before discussing agent 108 in greater detail, first consider the relevant ATMI function calls provided by block 74 in Figure 4 that support queue-based communication. The function *tpenqueu()* enqueues a message to a message queue and the function *tpdequeue()* dequeues a message from the message queue.

In Figure 8, a client application on computer system 32 of Figure 2 seeks to execute a service of a server application on computer 38. First, the client calls the *tpenqueue()* function, which passes the service message to queue-based communication agent 108 on FTSS 44. Queue unit 126 enqueues the service message in queue space 130. Forwarding unit 128 dequeues the service message and forwards the message to the server application on computer system 38. Forwarding unit 128 communicates with the server application using request/reply communication, which will be described in greater detail below with reference to Figure 9. Accordingly, forwarding unit 128 executed a *tpcall()* function to transmit the service message to computer system 38. The server application processes the service message and forms a client reply message, and returns the client reply message to forwarding unit 128 by calling a *tpreturn()* function. Forwarding unit 128 enqueues the client reply message in queue space 130. Sometime thereafter, the client application on computer system 32 calls the *tpdequeu()* function to retrieve the client reply message. Queue unit 126 retrieves the client reply message from queue space 130 and transmits the message to the client application of computer system 32.

In the prior art, a queue-based communication manager was also provided on a server. However, the present invention increases reliability and fault tolerance by providing the queue-based communication manager in FTSS 44. As mentioned above, in a typical distributed application that includes an FTSS, the FTSS will typically be more reliable and fault tolerant than the servers coupled to the FTSS.

Figure 9 is a diagram illustrating request/reply communication agent 110. Before discussing agent 110 in greater detail, first consider the relevant ATMI function calls provided by block 74 in Figure 4 that support queue-based communication. The function *tpcall()* is used to initiate a synchronous request/reply transaction to a service, and the function *tpascall()* is used to initiate an asynchronous request to a service. After the service

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is executed, the server application calls *tpreturn()* to return the reply message. As discussed above, in synchronous mode, a client sends a request to a server, which performs the requested action while the client waits. The server then sends the reply to the client, which receives the reply. In asynchronous mode, the client does not wait for a server to complete a service request before the client undertakes other tasks. Accordingly, a reply is implied with a *tpcall()* function in synchronous mode. In asynchronous mode, a reply is received by calling the *tpgetrply()* function. An asynchronous request can also be cancelled by calling the *tpcancel()* function.

As discussed above, prior art request/reply communication is also implemented using transient inter-process communication (IPC) message queues. Each server is assigned an IPC message queue called a request queue, and each client is assigned an IPC message queue called a reply queue. Accordingly, a client application can send requests to the server by putting those requests on the server's queue, and then check and retrieve messages from the server by retrieving messages from its own reply queue. The present invention provides request/reply communication with additional reliability and fault tolerance by replicating each IPC message queue in FTSS 44, and storing the contents of the IPC message queues in RAID 100 and/or nonvolatile write cache 98 of Figure 5

In Figure 9, request/reply communication agent 110 maintains a request and reply queue for each request and reply queue present on a computer system configured to transmit messages between network nodes. Accordingly, request queue 132 and reply queue 134 correspond to queues in computer system 32, and request queue 136 and reply queue 138 correspond to queues in computer system 42. Router 140 routes the messages between the queues.

For example, assume that a client application on computer system 32 calls the *tpcall()* or *tpascall()* function to send a request message to a server application on computer system 42. The request message is transmitted to request queue 132. Router 140 receives the request message and routes it to request queue 136, and in turn the request message is transmitted to the server application on computer system 42. The server application processes the request message and calls the *tpreturn()* function to transmit the reply message

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back to the client application. The reply message is enqueued in reply queue 138. Router 140 routes the reply message to reply queue 134, and the reply message is retrieved by the client application in computer system 32.

Note that the method used to process messages in Figure 9 can be applied to any type of inter-process communication. By intercepting and storing IPC messages within FTSS 44, an application can easily recover from an error or other type of failure by accessing agent 110 to receive messages from the queues.

Figure 10 is a diagram illustrating unsolicited communication agent 112. Before discussing agent 112 in greater detail, first consider the relevant ATMI function calls provided by block 74 in Figure 4 that support event-based communication. The function *tpnotify()* sends an unsolicited message to a single client and *tpbroadcast()* sends a message to several clients. Note that unsolicited communication is similar to event-based communication, except that there is no subscription function.

In Figure 10, unsolicited communication agent 112 includes an unsolicited message manager 142 and unsolicited message queue 114. When a server calls the *tpnotify()* or *tpbroadcast()* function, the message is posted in queue 144, and is relayed to the appropriate nodes. If a particular client suffers some type of error or other failure, the client can access unsolicited message manager 142 to retrieve any relevant unsolicited messages.

The present invention enhances the reliability and fault tolerance of messaging in several ways. First, messages may be transmitted between nodes using FTSS interconnection fabric 46 of Figure 2. Fabric 46 is highly reliable and fault tolerant. Since many systems that host distributed applications already include an FTSS, using fabric 46 instead of a less reliable network media, such as Ethernet, increases availability of the distributed application without the customer having to incur additional hardware costs.

Second, in the prior art, several messaging paradigms, such as queue-based communication and event based communication, use agents that operate on separate servers. By moving these agents to the FTSS, availability is increased because the FTSS is typically more reliable than the servers to which it is coupled. Furthermore, since the FTSS is being

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used to pass messages anyway, providing the agents in the FTSS eliminates the need to route the messages to a separate server, thereby allowing the messages to be processed faster.

Finally, several prior art messaging paradigms, such as conversational communication and request/reply communication, pass IPC messages directly between nodes in a transient manner. In the present invention, these IPC messages pass through the FTSS and are stored in and retained by the FTSS, thereby allowing any application to "rollback" to a known point and retrieve lost IPC messages from the FTSS.

Although the present invention has been described with reference to preferred embodiments, workers skilled in the art will recognize that changes may be made in form and detail without departing from the spirit and scope of the invention.

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WHAT IS CLAIMED IS:

1. A method of transmitting messages between a first node and a second node, wherein the first and second nodes are each coupled to a fault tolerant storage system (FTSS), the method comprising:

transmitting a message from the first node to a communication agent in the FTSS;

storing the message in a data structure in highly reliable fault-tolerant storage media of the FTSS;

processing the message at the FTSS in accordance with a messaging paradigm; and

transmitting the message from the FTSS to the second node.

2. The method of claim 1 wherein the messaging paradigm is a request/reply communication paradigm, and:

transmitting a message from the first node to a communication agent in the FTSS comprises:

transmitting a request message from the first node to a request/reply communication agent in the FTSS;

storing the message in a data structure in highly reliable fault-tolerant storage media of the FTSS comprises:

storing the request message in a request queue in highly reliable fault-tolerant storage media of the FTSS;

processing the message at the FTSS in accordance with a messaging paradigm comprises:

retrieving the request message from the request queue; and

transmitting the message from the FTSS to the second node comprises:

transmitting the request message from the FTSS to a service on the second node;

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and the method further comprises:

executing the service on the second node using the request message as an input and providing a reply message as an output;

transmitting the reply message from the second node to the request/reply communication agent in the FTSS;

storing the reply message in a reply queue in highly reliable fault-tolerant storage media of the FTSS;

retrieving the reply message from the reply queue; and

transmitting the reply message from the FTSS to the first node.

3. The method of claim 1 wherein the messaging paradigm is a conversational communication paradigm, and:

transmitting a message from the first node to a communication agent in the FTSS comprises:

transmitting a connect message from the first node to a conversational communication agent in the FTSS;

processing the message at the FTSS in accordance with a messaging paradigm comprises:

opening a conversation queue in highly reliable fault-tolerant storage media of the FTSS;

storing the message in a data structure in highly reliable fault-tolerant storage media of the FTSS comprises:

storing the connect message in the conversation queue; and

transmitting the message from the FTSS to the second node comprises:

transmitting the connect message from the FTSS to the second node.

4. The method of claim 3 and further comprising:

transmitting a send message from the first node to the conversational communication agent in the FTSS;

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storing the send message in the conversation queue;
transmitting the send message to from the FTSS to a service on the second node;
executing the service in the second node using the send message as an input and providing a receive message as an output;
transmitting the receive message from the second node to the conversational communication agent in the FTSS;
storing the receive message in the conversation queue; and
transmitting the receive message to the first node.

5. The method of claim 3 and further comprising:
transmitting a disconnect message from the first node to the conversational communication agent in the FTSS;
closing the conversation queue; and
transmitting the disconnect message to the second node.

6. The method of claim 1 wherein the messaging paradigm is an event-based communication paradigm, and:
transmitting a message from the first node to a communication agent in the FTSS comprises:
transmitting a post message from the first node to an event-based communication agent in the FTSS;
processing the message at the FTSS in accordance with a messaging paradigm comprises:
accessing a subscription manager to determine whether any nodes have subscribed to receive the event represented by the post message;
storing the message in a data structure in highly reliable fault-tolerant storage media of the FTSS comprises:
storing the post message in an event queue in highly reliable fault-tolerant storage media of the FTSS; and

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transmitting the message from the FTSS to the second node comprises:

transmitting the post message from the FTSS to the second node if the second node has subscribed to receive the event represented by the post message.

7. The method of claim 6 and further comprising:

transmitting a subscribe message from the second node to the event-based communication manager in the FTSS, wherein the subscribe message includes an event; and

accessing the subscription manager to record that the second node has subscribed to receive post messages associated with the event.

8. The method of claim 6 and further comprising:

transmitting an unsubscribe message from the second node to the event-based communication manager in the FTSS, wherein the unsubscribe message includes an event; and

accessing the subscription manager to record that the second node should no longer receive post messages associated with the event.

9. The method of claim 1 wherein the messaging paradigm is a queue-based communication paradigm, and:

transmitting a message from the first node to a communication agent in the FTSS comprises:

transmitting an enqueue message from the first node to a queue-based communication agent in the FTSS;

storing the message in a data structure in highly reliable fault-tolerant storage media of the FTSS comprises:

storing the enqueue message in a queue space in highly reliable fault-tolerant storage media of the FTSS;

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processing the message at the FTSS in accordance with a messaging paradigm comprises:

retrieving the enqueue message from the queue space only if the second node is available; and

transmitting the message from the FTSS to the second node comprises:

transmitting the enqueue message from the FTSS to a service on the second node only if the second node is available;

and the method further comprises:

executing the service on the second node using the enqueue message as an input and providing a dequeue message as an output;

transmitting the dequeue message from the second node to the queue-based communication agent in the FTSS;

storing the dequeue message in the queue space;

retrieving the dequeue message from the queue space; and

transmitting the dequeue message from the FTSS to the first node.

10. The method of claim 1 wherein the messaging paradigm is an unsolicited communication paradigm, and:

transmitting a message from the first node to a communication agent in the FTSS comprises:

transmitting a broadcast message from the first node to an unsolicited communication agent in the FTSS;

processing the message at the FTSS in accordance with a messaging paradigm comprises:

accessing determining which nodes should receive the broadcast message based on the broadcast message;

storing the message in a data structure in highly reliable fault-tolerant storage media of the FTSS comprises:

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storing the broadcast message in an unsolicited message queue in highly reliable fault-tolerant storage media of the FTSS; and

transmitting the message from the FTSS to the second node comprises:

transmitting the post message from the FTSS to all nodes that should receive the broadcast message.

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A METHOD AND APPARATUS FOR PASSING MESSAGES USING A FAULT TOLERANT STORAGE SYSTEM

ABSTRACT OF THE DISCLOSURE

A method and apparatus pass messages between server and client applications using a fault tolerant storage system (FTSS). The interconnection fabric that couples the FTSS to the computer systems that host the client and server applications may also be used to carry messages. A networked system capable of hosting a distributed application includes a plurality of computer systems coupled to an FTSS via an FTSS interconnection fabric. The FTSS not only processes file-related I/O transactions, but also includes several message agents to facilitate message transfer in a reliable and fault tolerant manner. The message agents include a conversational communication agent, an event-based communication agent, a queue-based communication agent, a request/reply communication agent, and an unsolicited communication agent. The highly reliable and fault tolerant nature of the FTSS ensures that the FTSS can guarantee delivery of a message transmitted from a sending computer system to a destination computer system. As soon as a message is received by the FTSS from a sending computer system, the message is committed to a nonvolatile fault tolerant write cache. Thereafter, the message is written to a redundant array of independent disks (RAID) of the FTSS, and processed by one of the message agents.

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PATENT APPLICATION

DECLARATION AND POWER OF ATTORNEY FOR PATENT APPLICATION

ATTORNEY DOCKET NO. 10008316-1

As a below named inventor, I hereby declare that:

My residence/post office address and citizenship are as stated below next to my name;

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

A Method And Apparatus For Passing Messages Using A Fault Tolerant Storage System

the specification of which is attached hereto unless the following box is checked:

( ) was filed on _____ as US Application Serial No. or PCT International Application Number _____ and was amended on _____ (if applicable).

I hereby state that I have reviewed and understood the contents of the above-identified specification, including the claims, as amended by any amendment(s) referred to above. I acknowledge the duty to disclose all information which is material to patentability as defined in 37 CFR 1.56.

Foreign Application(s) and/or Claim of Foreign Priority

I hereby claim foreign priority benefits under Title 35, United States Code Section 119 of any foreign application(s) for patent or inventor(s) certificate listed below and have also identified below any foreign application for patent or inventor(s) certificate having a filing date before that of the application on which priority is claimed:

COUNTRY	APPLICATION NUMBER	DATE FILED	PRIORITY CLAIMED UNDER 35 U.S.C. 119
			YES: ___ NO: ___
			YES: ___ NO: ___

Provisional Application

I hereby claim the benefit under Title 35, United States Code Section 119(e) of any United States provisional application(s) listed below:

APPLICATION SERIAL NUMBER	FILING DATE

U. S. Priority Claim

I hereby claim the benefit under Title 35, United States Code, Section 120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code Section 112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, Section 1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

APPLICATION SERIAL NUMBER	FILING DATE	STATUS (patented/pending/abandoned)

POWER OF ATTORNEY:

As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith:

Customer Number 022879

Place Customer Number Bar Code Label here

Send Correspondence to:	Direct Telephone Calls To:
HEWLETT-PACKARD COMPANY Intellectual Property Administration P.O. Box 272400 Fort Collins, Colorado 80527-2400	David A. Plettner (408) 447-3013

I hereby 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 issued thereon.

Full Name of Inventor: Blaine D. Gaither **Citizenship:** US

Residence: 1600 Serramonte Drive, Fort Collins, CO 80524-1718

Post Office Address: Same as residence

_____ _____

Inventor's Signature **Date**

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DECLARATION AND POWER[illegible] ATTORNEY FOR PATENT APPLICATION[illegible]ntinued)

AT[illegible]EY DOCKET NO. 10008316-1

Full Name of # 2 joint inventor: Bret A. McKee Citizenship: US

Residence: 1712 Ridgewood Road, Fort Collins, CO 80526

Post Office Address: Same as residence

Inventor's Signature _____ Date _____

Full Name of # 3 joint inventor: _____ Citizenship: _____

Residence: _____

Post Office Address: _____

Inventor's Signature _____ Date _____

Full Name of # 4 joint inventor: _____ Citizenship: _____

Residence: _____

Post Office Address: _____

Inventor's Signature _____ Date _____

Full Name of # 5 joint inventor: _____ Citizenship: _____

Residence: _____

Post Office Address: _____

Inventor's Signature _____ Date _____

Full Name of # 6 joint inventor: _____ Citizenship: _____

Residence: _____

Post Office Address: _____

Inventor's Signature _____ Date _____

Full Name of # 7 joint inventor: _____ Citizenship: _____

Residence: _____

Post Office Address: _____

Inventor's Signature _____ Date _____

Full Name of # 8 joint inventor: _____ Citizenship: _____

Residence: _____

Post Office Address: _____

Inventor's Signature _____ Date _____

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(10)

Application or Docket Number

PATENT APPLICATION FEE DETERMINATION RECORD
Effective October 1, 2000

CLAIMS AS FILED - PART I

	(Column 1)	(Column 2)
TOTAL CLAIMS		
FOR	NUMBER FILED	NUMBER EXTRA
TOTAL CHARGEABLE CLAIMS	10 minus 20=	*
INDEPENDENT CLAIMS	1 minus 3 =	*
MULTIPLE DEPENDENT CLAIM PRESENT		☐

* If the difference in column 1 is less than zero, enter "0" in column 2

SMALL ENTITY TYPE ☐		OR	OTHER THAN SMALL ENTITY	
RATE	FEE		RATE	FEE
BASIC FEE	355.00	OR	BASIC FEE	710.00
X$ 9=		OR	X$18=	
X40=		OR	X80=	
+135=		OR	+270=	
TOTAL		OR	TOTAL	710

CLAIMS AS AMENDED - PART II

AMENDMENT A

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	*	Minus	**	=
Independent	*	Minus	***	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				☐

SMALL ENTITY		OR	OTHER THAN SMALL ENTITY	
RATE	ADDITIONAL FEE		RATE	ADDITIONAL FEE
X$ 9=		OR	X$18=	
X40=		OR	X80=	
+135=		OR	+270=	
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
Total	*	Minus	**	=
Independent	*	Minus	***	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				☐

RATE	ADDITIONAL FEE		RATE	ADDITIONAL FEE
X$ 9=		OR	X$18=	
X40=		OR	X80=	
+135=		OR	+270=	
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

AMENDMENT C

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	*	Minus	**	=
Independent	*	Minus	***	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				☐

RATE	ADDITIONAL FEE		RATE	ADDITIONAL FEE
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+135=		OR	+270=	
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* 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.

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Patent and Trademark Office, U.S. DEPARTMENT OF COMMERCE

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PATENT APPLICATION SERIAL NO. _____

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

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*U.S. GPO: 1999-459-082/19144

CLAIMS ONLY

SERIAL NO.	FILING DATE
APPLICANT(S)	

CLAIMS

	AS FILED		AFTER 1st AMENDMENT		AFTER 2nd AMENDMENT	
	IND.	DEP.	IND.	DEP.	IND.	DEP.
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TOTAL CLAIMS	10					

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TOTAL DEP.						
TOTAL CLAIMS						

* MAY BE USED FOR ADDITIONAL CLAIMS OR ADMENDMENTS

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