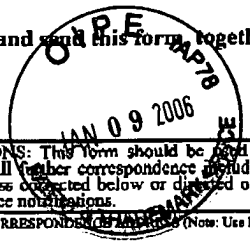
Motorola Mobility, Inc. v. Microsoft Corporation Doc. 125 Att. 7

Exhibit 304

Dockets.Justia.com

PART B - FEE(S) TRANSMITTAL



Complete and mail this form, together with applicable fee(s), to: Mail **Mail Stop ISSUE FEE**
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (571) 273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

47973 7590 11/15/2005

WORKMAN NYDEGGER/MICROSOFT
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UT 84111

01/10/2006 TBESHAH2 00000085 10082918

01 FC:1501 1400.00 OP
02 FC:1504 300.00 OP
03 FC:1800 12.00 OP

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/082,918	02/26/2002	Shawn Domenic Loveland	13768.255	4771

TITLE OF INVENTION: SYNCHRONIZING OVER A NUMBER OF SYNCHRONIZATION MECHANISMS USING FLEXIBLE RULES

APPLN. TYPE	SMALL ENTITY	ISSUE FEE	PUBLICATION FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	$1400	$300	$1700	02/15/2006

EXAMINER	ART UNIT	CLASS-SUBCLASS
NGUYEN, KHAI MINH	2687	455-502000

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 Workman Nydegger
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: MICROSOFT CORPORATION

(B) RESIDENCE: (CITY and STATE OR COUNTRY): Redmond, WA

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 4

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 23-3178 (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 Rick D. Nydegger Date January 9, 2006

Typed or printed name RICK D. NYDEGGER Registration No. 28,651

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.

PAGE 4/6 * RCVD AT 1/9/2006 7:06:30 PM [Eastern Standard Time] * SVR:USPTO-EFXRF-6/26 * DNIS:2732885 * CSID:8013281707 * DURATION (mm-ss):02-42

WORKMAN NYDEGGER
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111
TELEPHONE (801) 533-9800
FAX (801) 328-1707

TELECOPIER COVER SHEET

January 9, 2006

Total Number of Pages
(including cover letter): 6

Please deliver the transmitted facsimile pages to:

ISSUE FEE

Business Phone	(703) 746-4000
Telecopier Phone:	(571) 273-2885
From:	RICK D. NYDEGGER
Comments:	Please see attached.
Docket No.	13768.255
Serial No.	10/082,918

****

We are transmitting from a Sharp FO-750 or Sharp FO-6100 facsimile machine. If you do not receive all the pages or they are unreadable, please contact me as soon as possible at (801) 533-9800.

THE INFORMATION CONTAINED IN THIS FACSIMILE MESSAGE IS ATTORNEY PRIVILEGED AND CONFIDENTIAL INFORMATION INTENDED ONLY FOR THE USE OF THE INDIVIDUAL OR ENTITY NAMED ABOVE. IF THE READER OF THIS MESSAGE IS NOT THE INTENDED RECIPIENT, OR THE EMPLOYEE OR AGENT RESPONSIBLE TO DELIVER IT TO THE INTENDED RECIPIENT, YOU ARE HEREBY NOTIFIED THAT ANY DISSEMINATION, DISTRIBUTION OR COPYING OF THIS COMMUNICATION IS STRICTLY PROHIBITED. IF YOU HAVE RECEIVED THIS COMMUNICATION IN ERROR, PLEASE IMMEDIATELY NOTIFY US BY TELEPHONE, AND RETURN THE ORIGINAL MESSAGE TO US AT THE ABOVE ADDRESS VIA THE U.S. POSTAL SERVICE. THANK YOU.

KCS0000006376V001

RICK D. NYDEGGER
BRENT P. LORIMER
THOMAS R. VUKSINICK
LARRY R. LAYCOCK
JONATHAN W. RICHARDS
DAVID R. WRIGHT
JOHN C. STRINGHAM
JOHN M. GUYNN
CHARLES L. ROBERTS
DANA L. TANGREN
ERIC L. MASCHOFF
CHARLES J. VEVERKA
ROBYN L. PHILLIPS
RICHARD C. GILMORE *
STERLING A. BRENNAN
R. BURNS ISRAELSEN
DAVID R. TODD
DAVID B. DELLENBACH
L. DAVID GRIFFIN
ADRIAN J. LEE
FRASER D. ROY
CARL T. REED

R. PARRISH FREEMAN, JR.
PETER F. MALEN, JR.
L. REX SEARS, PH.D.
WILLIAM R. RICHTER
ROBERT E. AYCOCK
JENS C. JENKINS
MICHAEL B. DODD
KEVIN W. STINGER
WILLIAM J. ATHAY
RYAN D. BENSON
SARA D. JONES
TYGE KELLER
JANNA L. JENSEN
MATTHEW D. TODD
J. LAVAR OLDHAM
MICHAEL J. FRODSHAM
BRETT A. HANSEN
BRETT L. JOHNSON
MATTHEW A. BARLOW
WESLEY C. ROSANDER
ANDREW S. HANSEN
CHAD E. NYDEGGER
JOSEPH G. PIA
CLINTON E. DUKE
RYAN N. FARR
JAMES B. BELSHE
KIRK R. HARRIS
MICHAEL M. BALLARD
DAVID A. JONES
SHANE K. JENSEN
JONATHAN M. BENNS, PH.D.
SCOTT A. WOODBURY
JOHN T. GADD
MARK W. FORD
AARON M. SMITH

VERNON R. RICE §
OF COUNSEL

WORKMAN | NYDEGGER

INTELLECTUAL PROPERTY ATTORNEYS

1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111
TELEPHONE: (801) 533-9800
FAX: (801) 328-1707
WEBSITE: HTTP://WWW.WNLAW.COM

OIPE IAP78 JAN 09 2006 PATENT & TRADEMARK OFFICE

PATENT APPLICATION
Docket No. 13768.255

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:	Shawn Domenic Loveland, et al.	
Serial No.:	10/082,918	Art Unit 2687
Filed:	February 26, 2002	
Confirmation No.:	4771	
For:	SYNCHRONIZING OVER A NUMBER OF SYNCHRONIZING MECHANISMS USING FLEXIBLE RULES	
Examiner:	Khai Minh Nguyen	

TRANSMITTAL OF ISSUE FEE PAYMENT

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

Sir:

The enclosed Notice of Allowance and Issue Fee due is submitted herewith pursuant to 37 C.F.R. § 1.67 and M.P.E.P 603.01 for filing in the matter of the United States patent application as hereinabove identified. Enclosed is PTO Form 2038 for $1,712.00 for payment of the issue fee.

The Commissioner is hereby authorized to credit any overpayment or charge any additional fees to Deposit Account No. 23-3178 of the undersigned.

* Admitted only in California
§ Admitted only in Virginia

Please address all future correspondence in connection with the above-identified patent application to the attention of the undersigned.

Comments on Statement of Reasons for Allowance

Applicants respectfully submit that the claimed invention as set forth in each of the independent claims and the dependent claims must be read as a whole, and not as a single feature or subcombination of features which represent less than the entirety of the claimed invention as a whole. While a particular feature or subcombination of features referred to by the Examiner in the Statement of Reasons for Allowance may represent a basis for distinguishing the claimed invention over the prior art, Applicants further submit that this may not necessarily be the *sole* ground for distinguishing the claimed invention over the prior art of record. Accordingly, the Examiner's statement should, in Applicants' view, not be read as constituting or meaning that the invention can or should be reduced to a single "feature" of the invention or to a subcombination of features that is less than the entire invention claimed as a whole, nor that the single feature referenced by the Examiner or subcombination of features referenced by the Examiner in the Statement of Reasons for Allowance is the only or sole grounds for distinguishing the invention over the prior art of record.

Dated this 9th day of January, 2006.

Respectfully submitted,

Rick D. Nydegger

RICK D. NYDEGGER
Attorney for Applicant
Registration No. 28,651
Customer No. 47973

RDN:kcs
KCS0000007439V001.doc

PAGE 3/6 * RCVD AT 1/9/2006 7:06:30 PM [Eastern Standard Time] * SVR:USPTO-EFXRF-6/26 * DNIS:2732885 * CSID:8013281707 * DURATION (mm-ss):02-42

FILED VIA FACSIMILE

PATENT APPLICATION
Docket: 13768.255

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of		)
	Shawn Domenic Loveland	)
Serial No.:	10/082,918	) Art Unit) 2687
Filed:	February 26, 2002	)
Confirmation No.:	4771	)
For:	SYNCHRONIZING OVER A NUMBER OF SYNCHRONIZATION MECHANISMS USING FLEXIBLE RULES	)

CERTIFICATE OF FACSIMILE TRANSMISSION

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

Sir:

I hereby certify that this paper is being transmitted via facsimile from facsimile number (801) 328-1707 to the Patent and Trademark Office to phone no. (571) 273-2885 (Issue Fee Facsimile) on the date shown below.

- Transmittal Letter (2 pages)
- PTOL-85B Issue Fee Transmittal (1 page)
- Form PTO-2038 in the amount of $1,712.00 (1 page)

Dated this 9th day of January, 2006.

Respectfully submitted,

Rick D. Nydegger

RICK D. NYDEGGER
Registration No. 28,651
WORKMAN NYDEGGER
Attorney for Applicant
Customer No. 47973

RDN:kcs
KCS0000007440V001.doc

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

47973 7590 11/15/2005

WORKMAN NYDEGGER/MICROSOFT
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UT 84111

EXAMINER	
NGUYEN, KHAI MINH	
ART UNIT	PAPER NUMBER
2687	

DATE MAILED: 11/15/2005

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/082,918	02/26/2002	Shawn Domenic Loveland	13768.255	4771

TITLE OF INVENTION: SYNCHRONIZING OVER A NUMBER OF SYNCHRONIZATION MECHANISMS USING FLEXIBLE RULES

APPLN. TYPE	SMALL ENTITY	ISSUE FEE	PUBLICATION FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	$1400	$300	$1700	02/15/2006

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. 07/05) Approved for use through 04/30/2007.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: Mail **Mail Stop ISSUE FEE**
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (571) 273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

47973 7590 11/15/2005

WORKMAN NYDEGGER/MICROSOFT
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UT 84111

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission
I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)

(Signature)

(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/082,918	02/26/2002	Shawn Domenic Loveland	13768.255	4771

TITLE OF INVENTION: SYNCHRONIZING OVER A NUMBER OF SYNCHRONIZATION MECHANISMS USING FLEXIBLE RULES

APPLN. TYPE	SMALL ENTITY	ISSUE FEE	PUBLICATION FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	$1400	$300	$1700	02/15/2006

EXAMINER	ART UNIT	CLASS-SUBCLASS
NGUYEN, KHAI MINH	2687	455-502000

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, 1 _____

(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. 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.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/082,918	02/26/2002	Shawn Domenic Loveland	13768.255	4771

47973 7590 11/15/2005

WORKMAN NYDEGGER/MICROSOFT
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UT 84111

EXAMINER	
NGUYEN, KHAI MINH	
ART UNIT	**PAPER NUMBER**
2687	

DATE MAILED: 11/15/2005

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 446 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 446 day(s).

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571) 272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at (703) 305-8283.

PTOL-85 (Rev. 07/05) Approved for use through 04/30/2007.

Notice of Allowability	Application No.	Applicant(s)	
	10/082,918	LOVELAND, SHAWN DOMENIC	
	Examiner	Art Unit	
	Khai M. Nguyen	2687	

-- 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 *9/2/2005*.

2. ☒ The allowed claim(s) is/are *1-43 and 46-60*.

3. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
   a) ☐ All b) ☐ Some* c) ☐ None of the:
      1. ☐ Certified copies of the priority documents have been received.
      2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
      3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
      1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____.
   (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☒ Notice of References Cited (PTO-892)
2. ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
3. ☐ Information Disclosure Statements (PTO-1449 or PTO/SB/08), Paper No./Mail Date _____
4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
5. ☐ Notice of Informal Patent Application (PTO-152)
6. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____ .
7. ☐ Examiner's Amendment/Comment
8. ☒ Examiner's Statement of Reasons for Allowance
9. ☐ Other _____.

DETAILED ACTION

Allowable Subject Matter

1. Claims 1-43, and 46-60 are allowed.

The following is a statement of reason for the indication of allowance: As the applicant stated in the remark (pages 17-21) of the amendment filed on 9/2/2005, and remark (pages 17-22) of the amendment filed on 11/12/2004.

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."

Citation of Pertinent Prior Art

2. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Pesola (U.S.Pub-20030125057) discloses System and method for automatic synchronization of managed data.

Opgenoorth (U.S.Pat-6308223) discloses Process for the synchronization of programs on different computers of an interconnected system.

Bilitza et al. (U.S.Pat-5390216) discloses Synchronization method for a mobile radiotelephone.

Sands et al. (U.S.Pat-6134283) discloses Method and system for synchronizing time-division-duplexed transceivers.

Vayrynen (U.S.Pat-6256304) discloses Mobile station using synchronization word order information for improved channel acquisition.

Ziegler (U.S.Pat-6711151) discloses Apparatus and method using paging for synchronizing to a communication network without joining the network.

Conclusion

3. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Khai M. Nguyen whose telephone number is 571.272.7923. The examiner can normally be reached on 8:00-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Lester Kincaid can be reached on 571.272.7922. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

SONNY TRINH
PRIMARY EXAMINER

Khai Nguyen
Au:2687

11/7/2005

Notice of References Cited	Application/Control No. 10/082,918	Applicant(s)/Patent Under Reexamination LOVELAND, SHAWN DOMENIC	
	Examiner Khai M. Nguyen	Art Unit 2687	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-6,711,151 B1	03-2004	Ziegler, Kevin	370/350
*	B	US-6,256,304 B1	07-2001	Vayrynen, Mika	370/350
*	C	US-6,134,283 A	10-2000	Sands et al.	375/354
*	D	US-5,390,216 A	02-1995	Bilitza et al.	375/354
*	E	US-6,308,223 B1	10-2001	Opgenoorth, Bernd	709/248
*	F	US-2003/0125057 A1	07-2003	Pesola, Troy Raymond	455/502
	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.

INFORMATION DISCLOSURE CITATION

(Use several sheets if necessary)

Docket Number (Optional)	Application Number
13768.255	Not yet assigned
Applicant(s)	
Shawn D. Loveland	
Filing Date	**Group Art Unit**
February 26, 2002	Not yet assigned

U.S. PATENT DOCUMENTS

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

JC80 U.S. PTO
10/089918
02/26/02

FOREIGN PATENT DOCUMENTS

	REF	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	Translation YES	Translation NO

OTHER DOCUMENTS *(Including Author, Title, Date, Pertinent Pages, Etc.)*

KW	1	EFFICIENT DATA SHARING WITH CONDITIONAL REMOTE MEMORY TRANSFERS, Hummel, S.F., Computer Architecture News, Vol. 24, No. 5, 1996, Pages 9-17. NO MONTH LISTED

EXAMINER	DATE CONSIDERED
Khanpour	8/11/04

EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP Section 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

BEST AVAILABLE COPY

Issue Classification	Application/Control No.	Applicant(s)/Patent under Reexamination	
	10/082,918	LOVELAND, SHAWN DOMENIC	
	Examiner	Art Unit	
	Khai M. Nguyen	2687	

ISSUE CLASSIFICATION

ORIGINAL			CROSS REFERENCE(S)							
CLASS	SUBCLASS	CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)							
455	502	455	501	503	500					
INTERNATIONAL CLASSIFICATION		370	350	503	506					
H 0 4 B	15/00	375	354	355	358					
	/									
	/									
	/									
	/									

Khai Nguyen 11/7/2005
(Assistant Examiner) (Date)

(Legal Instruments Examiner) (Date)

SONNY TRINH
PRIMARY EXAMINER 11-9-05
(Primary Examiner) (Date)

Total Claims Allowed: 58

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

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
1	1	31	31		61		91		121		151		181
2	2	32	32		62		92		122		152		182
3	3	33	33		63		93		123		153		183
4	4	34	34		64		94		124		154		184
5	5	35	35		65		95		125		155		185
6	6	36	36		66		96		126		156		186
7	7	37	37		67		97		127		157		187
8	8	38	38		68		98		128		158		188
9	9	39	39		69		99		129		159		189
10	10	40	40		70		100		130		160		190
11	11	41	41		71		101		131		161		191
12	12	42	42		72		102		132		162		192
13	13	43	43		73		103		133		163		193
14	14	—	44		74		104		134		164		194
15	15	—	45		75		105		135		165		195
16	16	44	46		76		106		136		166		196
17	17	45	47		77		107		137		167		197
18	18	46	48		78		108		138		168		198
19	19	47	49		79		109		139		169		199
20	20	48	50		80		110		140		170		200
21	21	49	51		81		111		141		171		201
22	22	50	52		82		112		142		172		202
23	23	51	53		83		113		143		173		203
24	24	52	54		84		114		144		174		204
25	25	53	55		85		115		145		175		205
26	26	54	56		86		116		146		176		206
27	27	55	57		87		117		147		177		207
28	28	56	58		88		118		148		178		208
29	29	57	59		89		119		149		179		209
30	30	58	60		90		120		150		180		210

Index of Claims

Application/Control No.	Applicant(s)/Patent under Reexamination
10/082,918	LOVELAND, SHAWN DOMENIC
Examiner	**Art Unit**
Khai M. Nguyen	2687

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

Claim		Date								
Final	Original	11/7/05								
1	1	=								
2	2	=								
3	3	=								
4	4	=								
5	5	=								
6	6	=								
7	7	=								
8	8	=								
9	9	=								
10	10	=								
11	11	=								
12	12	=								
13	13	=								
14	14	=								
15	15	=								
16	16	=								
17	17	=								
18	18	=								
19	19	=								
20	20	=								
21	21	=								
22	22	=								
23	23	=								
24	24	=								
25	25	=								
26	26	=								
27	27	=								
28	28	=								
29	29	=								
30	30	=								
31	31	=								
32	32	=								
33	33	=								
34	34	=								
35	35	=								
36	36	=								
37	37	=								
38	38	=								
39	39	=								
40	40	=								
41	41	=								
42	42	=								
43	43	=								
—	44	-								
—	45	-								
44	46	=								
45	47	=								
46	48	=								
47	49	=								
48	50	=								

Claim		Date								
Final	Original									
49	51	=								
50	52	=								
51	53	=								
52	54	=								
53	55	=								
54	56	=								
55	57	=								
56	58	=								
57	59	=								
58	60	=								
	61									
	62									
	63									
	64									
	65									
	66									
	67									
	68									
	69									
	70									
	71									
	72									
	73									
	74									
	75									
	76									
	77									
	78									
	79									
	80									
	81									
	82									
	83									
	84									
	85									
	86									
	87									
	88									
	89									
	90									
	91									
	92									
	93									
	94									
	95									
	96									
	97									
	98									
	99									
	100									

Claim		Date								
Final	Original									
	101									
	102									
	103									
	104									
	105									
	106									
	107									
	108									
	109									
	110									
	111									
	112									
	113									
	114									
	115									
	116									
	117									
	118									
	119									
	120									
	121									
	122									
	123									
	124									
	125									
	126									
	127									
	128									
	129									
	130									
	131									
	132									
	133									
	134									
	135									
	136									
	137									
	138									
	139									
	140									
	141									
	142									
	143									
	144									
	145									
	146									
	147									
	148									
	149									
	150									

Search Notes

Application/Control No.	Applicant(s)/Patent under Reexamination	
10/082,918	LOVELAND, SHAWN DOMENIC	
Examiner	**Art Unit**	
Khai M. Nguyen	2687	

SEARCHED			
Class	Subclass	Date	Examiner
455	502 501 503 500	11/6/2005	KN
370	350 503 506	11/6/2005	KN
375	354 355 358	11/6/2005	KN

INTERFERENCE SEARCHED			
Class	Subclass	Date	Examiner
see	attached		KN

SEARCH NOTES (INCLUDING SEARCH STRATEGY)		
	DATE	EXMR
East (see attached)		KN

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L8	2	"20030125057"	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/11/08 11:01
L9	15	"545573"	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/11/08 11:03
L10	8	"5450573"	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/11/08 11:09
L11	3990	(synchro$6 with (data file$1 information)) with (rule$1 instruct$3 menu)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/11/08 11:14
L12	1850	(synchro$8 with (security econmic))	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/11/08 11:14
L13	5612	(synchro$8 with (data file$1 information)) with (rule$1 instruct$3 menu)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/11/08 15:18
L14	95	12 and 13	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/11/08 11:14
L15	810	((synchro$8 with (data file$1 information)) with (rule$1 instruct$3 menu)).clm.	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/11/08 15:18
L16	104	((synchro$8 with (data file$1 information)) with (rule$1 instruct$3 menu))with (security ID password)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/11/08 15:22

L17	1310	455/502,501,503,500.ccls.	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/11/08 15:21
L18	1	16 and 17	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/11/08 15:22
L19	2926	370/350,503.ccls.	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/11/08 15:22
L20	3145	375/354.ccls.	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/11/08 15:22
L21	1	(17 L19 L20) and 16	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/11/08 15:22
L22	9	(((synchro$8 with (data file$1 information)) with (rule$1 instruct$3 menu))with (security ID password)).clm.	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/11/08 15:22
S1	1	10/082918	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/11/07 18:34
S2	178184	synchro$6 with (data file$1 information)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/11/08 11:09
S3	2232	("802.11" and "455"/$.ccls.)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/11/07 18:39
S4	303	S2 and S3	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/11/07 18:41

S5	2925	370/350,503.ccls.	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/11/07 18:41
S6	3144	375/354.ccls.	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/11/07 18:41
S7	153	S5 and S6	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/11/07 18:42
S8	104	S2 and S7	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/11/07 18:42
S9	1947845	(identif$4 ID)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/11/07 18:43
S10	50	S8 and S9	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/11/08 10:48

RECEIVED
CENTRAL FAX CENTER
SEP 02 2005

WORKMAN NYDEGGER
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111
TELEPHONE (801) 533-9800
FAX (801) 328-1707

TELECOPIER COVER SHEET

September 2, 2005

Total Number of Pages
(including cover letter): 24

Please deliver the transmitted facsimile pages to:

EXAMINER KHAI M. NGUYEN

Business Phone	(571) 272-7923
Telecopier Phone:	(571) 273-8300
From:	JENS C. JENKINS
Comments:	Please see attached.
Docket No.:	13768.255
Customer No.	047973

****

We are transmitting from a Sharp FO-750 or Sharp FO-6100 facsimile machine. If you do not receive all the pages or they are unreadable, please contact me as soon as possible at (801) 533-9800.

THE INFORMATION CONTAINED IN THIS FACSIMILE MESSAGE IS ATTORNEY PRIVILEGED AND CONFIDENTIAL INFORMATION INTENDED ONLY FOR THE USE OF THE INDIVIDUAL OR ENTITY NAMED ABOVE. IF THE READER OF THIS MESSAGE IS NOT THE INTENDED RECIPIENT, OR THE EMPLOYEE OR AGENT RESPONSIBLE TO DELIVER IT TO THE INTENDED RECIPIENT, YOU ARE HEREBY NOTIFIED THAT ANY DISSEMINATION, DISTRIBUTION OR COPYING OF THIS COMMUNICATION IS STRICTLY PROHIBITED. IF YOU HAVE RECEIVED THIS COMMUNICATION IN ERROR, PLEASE IMMEDIATELY NOTIFY US BY TELEPHONE, AND RETURN THE ORIGINAL MESSAGE TO US AT THE ABOVE ADDRESS VIA THE U.S. POSTAL SERVICE. THANK YOU.

PPA0000000935V001

RECEIVED
CENTRAL FAX CENTER
SEP 02 2005

FILED VIA FACSIMILE

PATENT APPLICATION
Docket: 13768.255

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of		)
	Shawn Domenic Loveland	)
Serial No.:	10/082,918	) Art Unit) 2687
Filed:	February 26, 2002	)
Confirmation No.:	4771	)
For:	SYNCHRONIZING OVER A NUMBER OF SYNCHRONIZATION MECHANISMS USING FLEXIBLE RULES	)
Examiner:	Khai M. Nguyen	)

CERTIFICATE OF FACSIMILE TRANSMISSION

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

Sir:

I hereby certify that this paper is being transmitted via facsimile at facsimile number 801-328-1707 to the Patent and Trademark Office to phone no. 571-273-8300 (Formal Fax No.) on the date shown below.

- Transmittal Letter (1 pag)
- Amendment "B" (21 pages)

Dated this 2 day of September 2005.

Respectfully submitted,

JENS C. JENKINS
Attorney for Applicant
Registration No. 44,803
Customer No. 047973

PTA0000000934V001

RECEIVED
CENTRAL FAX CENTER
SEP 02 2005

AMENDMENT TRANSMITTAL LETTER (Large Entity) Applicant(s): Shawn Domenic Loveland				Docket No. 13768.255	
Application No. 10/082,918	Filing Date February 26,2002	Examiner Khai M. Nguyen	Customer No. 047973	Group Art Unit 2687	Confirmation No. 4771

Invention: SYNCHRONIZING OVER A NUMBER OF SYNCHRONIZATION MECHANISMS USING FLEXIBLE RULES

COMMISSIONER FOR PATENTS:

Transmitted herewith is an amendment in the above-identified application.

The fee has been calculated and is transmitted as shown below.

CLAIMS AS AMENDED

	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST # PREV. PAID FOR		NUMBER EXTRA CLAIMS PRESENT	RATE	ADDITIONAL FEE
TOTAL CLAIMS	58	-	60	=	0	x $50.00	$0.00
INDEP. CLAIMS	6	-	7	=	0	x $200.00	$0.00
Multiple Dependent Claims (check if applicable) ☐							$0.00
TOTAL ADDITIONAL FEE FOR THIS AMENDMENT							$0.00

- ☒ No additional fee is required for amendment.
- ☐ Please charge Deposit Account No. in the amount of
- ☐ A check in the amount of to cover the filing fee is enclosed.
- ☒ The Director is hereby authorized to charge payment of the following fees associated with this communication or credit any overpayment to Deposit Account 23-3178
  - ☒ Any additional filing fees required under 37 C.F.R. 1.16.
  - ☒ Any patent application processing fees under 37 CFR 1.17.
- ☒ Payment by credit card. Form PTO-2038.

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

Signature

Dated: September 1, 2005

JENS C. JENKINS
Registration No. 44,803
Customer No. 047973

I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to "Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450" [37 CFR 1.8(a)] on

(Date)

Signature of Person Mailing Correspondence

Typed or Printed Name of Person Mailing Correspondence

cc:

RECEIVED
CENTRAL FAX CENTER
SEP 02 2005

FILED VIA FACSIMILE

PATENT APPLICATION
Docket No. 13768.255

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of	Shawn Domenic Loveland	)
Serial No.:	10/082,918	) Art Unit) 2687
Filed:	February 26, 2002	)
Conf. No.:	4771	)
For:	SYNCHRONIZING OVER A NUMBER OF SYNCHRONIZATION MECHANISMS USING FLEXIBLE RULES	)
Examiner:	Khai M Nguyen	)
Customer No.:	047973	)

AMENDMENT "B" AFTER NON-FINAL

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

Dear Sir:

In response to the Office action of June 17, 2005, please amend the above-identified application as follows:

Amendments to the Claims are reflected in the listing of claims which begins on page 2 of this paper.

Remarks/Arguments begin on page 17 of this paper.

AMENDMENTS TO THE CLAIMS

The listing of claims replaces all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Currently Amended) In a network that includes a first computer system having a first data store and second computer system having a second data store, a method for synchronizing the first and second data stores in a flexible manner considering the circumstances that exist at the time of synchronization, the method comprising the following:

an act of the first computer system determining that a data item is to be synchronized;

an act of the first computer system identifying which of a plurality of synchronization mechanisms, including one or more hardwired or wireless communication connections, are available to use for synchronization;

an act of the first computer system consulting a set of one or more flexible selection rules to select a synchronization mechanism, the set of one or more flexible rules taking into consideration value, from having access to synchronized data, relative to at least one of (i) an economic cost for synchronization using each available synchronization mechanism, (ii) network security for each available synchronization mechanism, or (iii) security of the second computer system, or (iv) value of data being synchronized and thereby selecting an available synchronization mechanism appropriate for the data item given the one or more flexible selection rules; and

an act of the first computer system using the selected synchronization mechanism to synchronize the data item with the second computer.

2. (Original) A method in accordance with Claim 1, wherein the first computer system is a synchronization server, and the second computer system is a mobile device.

3. (Original) A method in accordance with Claim 1, wherein the first computer system is a mobile device, and the second computer system is a synchronization server.

PAGE 5/24 * RCVD AT 9/2/2005 6:57:08 PM [Eastern Daylight Time] * SVR:USPTO-EFXRF-6/24 * DNIS:2738300 * CSID:8013281707 * DURATION (mm-ss):08-06

4. (Original) A method in accordance with Claim 3, wherein the act of the first computer system determining that a data item is to be synchronized comprises the following:

an act of the mobile device determining on its own that the data item is to be synchronized.

5. (Original) A method in accordance with Claim 3, wherein the act of the first computer system determining that a data item is to be synchronized comprises the following:

an act of the mobile device receiving a user-issued instruction to synchronize the data item.

6. (Original) A method in accordance with Claim 3, wherein the act of the first computer system determining that a data item is to be synchronized comprises the following:

an act of the mobile device receiving a signal from the synchronization server that represents to the mobile device that the data item is to be synchronized.

7. (Original) A method in accordance with Claim 3, wherein the second data store is incorporated within a common sphere of trust.

8. (Original) A method in accordance with Claim 7, wherein the second data store is incorporated within a corporate network.

9. (Original) A method in accordance with Claim 3, wherein the second data store is incorporated within the Internet.

10. (Original) A method in accordance with Claim 3, wherein the mobile device comprises a mobile telephone.

11. (Original) A method in accordance with Claim 3, wherein the mobile device comprises a personal digital assistant.

PAGE 6/24 * RCVD AT 9/2/2005 6:57:08 PM [Eastern Daylight Time] * SVR:USPTO-EFXRF-6/24 * DNIS:2738300 * CSID:8013281707 * DURATION (mm-ss):08-06

12. (Original) A method in accordance with Claim 3, wherein the mobile device comprises a laptop computer.

13. (Original) A method in accordance with Claim 3, wherein the mobile device comprises a tablet personal computer.

14. (Original) A method in accordance with Claim 1, wherein the plurality of synchronization mechanisms comprises at least one wireless synchronization mechanism.

15. (Original) A method in accordance with Claim 14, wherein the at least one wireless synchronization mechanism uses a GPRS network.

16. (Original) A method in accordance with Claim 14, wherein the at least one wireless synchronization mechanism uses an 802.11a network.

17. (Original) A method in accordance with Claim 14, wherein the at least one wireless synchronization mechanism uses an 802.11b network.

18. (Original) A method in accordance with Claim 14, wherein the at least one wireless synchronization mechanism uses Bluetooth network.

19. (Original) A method in accordance with Claim 14, wherein the at least one wireless synchronization mechanism uses a cellular network.

20. (Original) A method in accordance with Claim 1, wherein the plurality of synchronization mechanisms comprises an analog dialup synchronization mechanism.

21. (Original) A method in accordance with Claim 1, wherein the plurality of synchronization mechanisms comprises a Virtual Private Network (VPN).

PAGE 7/24 * RCVD AT 9/2/2005 6:57:08 PM [Eastern Daylight Time] * SVR:USPTO-EFXRF-6/24 * DNIS:2738300 * CSID:8013281707 * DURATION (mm-ss):08-06

22. (Original) A method in accordance with Claim 1, further comprising the following:

an act of receiving instructions to change the set of flexible selection rules; and

an act of changing the set of selection rules in response to the instruction.

23. (Original) A method in accordance with Claim 22, wherein the act of receiving instructions to change the set of flexible selection rules comprises the following:

an act of receiving instructions to change the set of flexible selection rules from a user of the first computer system.

24. (Original) A method in accordance with Claim 22, wherein the act of receiving instructions to change the set of flexible selection rules comprises the following:

an act of receiving instructions to change the set of flexible selection rules from an agent of the second computer system.

25. (Original) A method in accordance with Claim 24, wherein the act of receiving instructions to change the set of flexible selection rules from an agent of the second computer system comprises the following:

an act of receiving instructions to change the set of flexible selection rules from a network administrator of a network that includes the second computer system.

26. (Original) A method in accordance with Claim 25, further comprising the following:

an act of receiving instructions to change the set of flexible selection rules from a user.

PAGE 8/24 * RCVD AT 9/2/2005 6:57:08 PM [Eastern Daylight Time] * SVR:USPTO-EFXRF-6/24 * DNIS:2738300 * CSID:8013281707 * DURATION (mm-ss):08-06

27. (Original) A method in accordance with Claim 26, wherein the act of changing the set of selection rules in response to the instruction, comprises the following:

an act of fulfilling the instructions received from the network administrator of the second computer system to the extent that there is a conflict between the instructions received from the network administrator of the second computer system and the instructions received from the user of the first computer system.

28. (Original) A method in accordance with Claim 1, wherein the act of the first computer system consulting a set of flexible selection rules comprises the following:

an act of the first computer system selecting one of the available synchronization mechanisms without synchronous intervention from a user of the first computer system.

29. (Original) A method in accordance with Claim 1, wherein the act of determining that a data item is to be synchronized comprises the following:

an act of the first computer system receiving a notification from the second computer system that a data item is available to synchronize;

an act of the first computer system notifying the user of the availability of the data item; and

an act of receiving a user-instruction to synchronize the data item.

30. (Original) A method in accordance with Claim 1, wherein the act of consulting a set of flexible selection rules to select one of the available synchronization mechanisms comprises the following:

an act of selecting the synchronization mechanism at least based on the time of day.

PAGE 9/24 * RCVD AT 9/2/2005 6:57:08 PM [Eastern Daylight Time] * SVR:USPTO-EFXRF-6/24 * DNIS:2738300 * CSID:8013281707 * DURATION (mm-ss):08-06

31. (Original) A method in accordance with Claim 1, wherein the act of consulting a set of flexible selection rules to select one of the available synchronization mechanisms comprises the following:

an act of selecting the synchronization mechanism at least based on the day of the week.

32. (Original) A method in accordance with Claim 1, wherein the act of consulting a set of flexible selection rules to select one of the available synchronization mechanisms comprises the following:

an act of selecting the synchronization mechanism at least based on the value of the data.

33. (Original) A method in accordance with Claim 1, wherein the act of consulting a set of flexible selection rules to select one of the available synchronization mechanisms comprises the following:

an act of selecting the synchronization mechanism at least based on the economic cost of using a network associated with the synchronization mechanism.

34. (Original) A method in accordance with Claim 1, wherein the act of consulting a set of flexible selection rules to select one of the available synchronization mechanisms comprises the following:

an act of selecting the synchronization mechanism at least based on the security of a network associated with the synchronization mechanism.

35. (Original) A method in accordance with Claim 1, wherein the act of consulting a set of flexible selection rules to select one of the available synchronization mechanisms comprises the following:

an act of selecting the synchronization mechanism at least based on the security of the first computer system.

PAGE 10/24 * RCVD AT 9/2/2005 6:57:08 PM [Eastern Daylight Time] * SVR:USPTO-EFXRF-6/24 * DNIS:2738300 * CSID:8013281707 * DURATION (mm-ss):08-06

36. (Original) A method in accordance with Claim 35, wherein the act of selecting the synchronization mechanism at least based on the security of the first computer system comprises the following:

an act of selecting the selecting the synchronization mechanism at least based on the security features inherent in devices of the same type as the first computer system

37. (Original) A method in accordance with Claim 35, wherein the act of selecting the synchronization mechanism at least based on the security of the first computer system comprises the following:

an act of selecting the selecting the synchronization mechanism at least based on current security settings of the first computer system

38. (Original) A method in accordance with Claim 1, wherein the act of consulting a set of flexible selection rules to select one of the available synchronization mechanisms comprises the following:

an act of selecting the synchronization mechanism at least based on the location of the user of the first computer system.

39. (Original) A method in accordance with Claim 1, wherein the act of consulting a set of flexible selection rules to select one of the available synchronization mechanisms comprises the following:

an act of determining that there are no current synchronization mechanisms that are selectable based on the flexible set of rules;

an act of reevaluating the flexible selection rules at a later time; and

an act of repeating the reevaluation until at least one of the available synchronization mechanisms is selectable based on the flexible selection rules.

PAGE 11/24 * RCVD AT 9/2/2005 6:57:08 PM [Eastern Daylight Time] * SVR:USPTO-EFXRF-6/24 * DNIS:2738300 * CSID:8013281707 * DURATION (mm-ss):08-06

40. (Original) A method in accordance with Claim 1, further comprising the following:

after using the selected synchronization mechanism to synchronize the data item, an act of determining that the conditions for synchronization are no longer met in light of the flexible selection rules; and

an act of automatically reversing the synchronization if it has been determined that the conditions for synchronization are no longer met.

41. (Original) A method in accordance with Claim 1, wherein the act of the first computer system determining that a data item is to be synchronized comprises the following:

an act of the first computer system determining whether to synchronize a data item by consulting a set of flexible selection rules; and

an act of the first computer system synchronize the data item with the second computer if the first computer system determines that the data item is to be synchronized.

PAGE 12/24 * RCVD AT 9/2/2005 6:57:08 PM [Eastern Daylight Time] * SVR:USPTO-EFXRF-6/24 * DNIS:2738300 * CSID:8013281707 * DURATION (mm-ss):08-06

42. (Currently Amended) A computer program product for use in a network that includes a first computer system having a first data store and second computer system having a second data store, the computer program product for implementing a method for synchronizing the first and second data stores in a flexible manner considering the circumstances that exist at the time of synchronization, the computer program product comprising one or more computer-readable media having stored thereon the following:

computer-executable instructions for determining that a data item is to be synchronized;

computer-executable instructions for identifying which of a plurality of synchronization mechanisms, including one or more hardwired or wireless communication connections, are available to use for synchronization;

computer-executable instructions for consulting a set of one or more flexible selection rules to select a synchronization mechanism, the set of one or more flexible rules taking into consideration value, from having access to synchronized data, relative to at least one of (i) an economic cost for synchronization using each available synchronization mechanism, (ii) network security for each available synchronization mechanism, or (iii) security of the second computer system, or (iv) value of data being synchronized, and thereby selecting an available synchronization mechanism appropriate for the data item given the one or more flexible selection rules; and

computer-executable instructions for using the selected synchronization mechanism to synchronize the data item with the second computer.

43. (Original) A computer program product in accordance with Claim 42, wherein the one or more computer-readable media are physical storage media.

44-45. (Canceled).

PAGE 13/24 * RCVD AT 9/2/2005 6:57:08 PM [Eastern Daylight Time] * SVR:USPTO-EFXRF-6/24 * DNIS:2738300 * CSID:8013281707 * DURATION (mm-ss):08-06

46. (Currently Amended) In a network that includes a first computer system having a first data store and second computer system having a second data store, a method for synchronizing the first and second data stores in a flexible manner considering the circumstances that exist at the time of synchronization, the method comprising the following:

an act of the first computer system determining whether to synchronize a data item by consulting a set of one or more flexible selection rules, the set of one or more flexible rules taking into consideration value, from having access to synchronized data, relative to at least one of (i) an economic cost for synchronization using each available synchronization mechanism, (ii) network security for each available synchronization mechanism, or (iii) security of the second computer system, or (iv) value of data being synchronized, and thereby also determining an available synchronization mechanism appropriate for the data item given the one or more flexible selection rules; and

an act of the first computer system synchronizing the data item with the second computer if the first computer system determines that the data item is to be synchronized based on the one or more flexible selection rules and each available synchronization mechanism, including one or more hardwired or wireless communication connections.

47. (Original) A method in accordance with Claim 46, wherein the first computer system is a synchronization server, and the second computer system is a mobile device.

48. (Original) A method in accordance with Claim 46, wherein the first computer system is a mobile device, and the second computer system is a synchronization server.

49. (Original) A method in accordance with Claim 46, further comprising the following:

an act of receiving instructions to change the set of flexible selection rules; and

an act of changing the set of flexible selection rules in response to the instruction.

PAGE 14/24 * RCVD AT 9/2/2005 6:57:08 PM [Eastern Daylight Time] * SVR:USPTO-EFXRF-6/24 * DNIS:2738300 * CSID:8013281707 * DURATION (mm-ss):08-06

50. (Original) A method in accordance with Claim 49, wherein the act of receiving instructions to change the set of flexible selection rules comprises the following:

an act of receiving instructions to change the set of flexible selection rules from a user of the first computer system.

51. (Original) A method in accordance with Claim 49, wherein the act of receiving instructions to change the set of flexible selection rules comprises the following:

an act of receiving instructions to change the set of flexible selection rules from an agent of the second computer system.

52. (Original) A method in accordance with Claim 51, wherein the act of receiving instructions to change the set of flexible selection rules from an agent of the second computer system comprises the following:

an act of receiving instructions to change the set of flexible selection rules from a network administrator of trusted network that includes the second computer system.

53. (Original) A method in accordance with Claim 52, further comprising the following:

an act of receiving instructions to change the set of flexible selection rules from a user.

54. (Original) A method in accordance with Claim 53, wherein the act of changing the set of flexible selection rules in response to the instruction, comprises the following:

an act of fulfilling the instructions received from the network administrator of the second computer system to the extent that there is a conflict between the instructions received from the network administrator of the second computer system and the instructions received from the user of the first computer system.

PAGE 15/24 * RCVD AT 9/2/2005 6:57:08 PM [Eastern Daylight Time] * SVR:USPTO-EFXRF-6/24 * DNIS:2738300 * CSID:8013281707 * DURATION (mm-ss):08-06

55. (Original) A method in accordance with Claim 46, further comprising the following:

after using the selected synchronization mechanism to synchronize the data item, an act of determining that the conditions for synchronization are no longer met in light of the flexible selection rules; and

an act of automatically reversing the synchronization if it has been determined that the conditions for synchronization are no longer met.

56. (Original) A method in accordance with Claim 46, wherein the act of the first computer system synchronize the data item with the second computer comprises the following:

an act of the first computer system identifying which of a plurality of synchronization mechanisms are available to use for synchronization;

an act of the first computer system consulting a set of flexible selection rules to select one of the available synchronization mechanisms; and

an act of the first computer system using the selected synchronization mechanism to synchronize the data item with the second computer.

PAGE 16/24 * RCVD AT 9/2/2005 6:57:08 PM [Eastern Daylight Time] * SVR:USPTO-EFXRF-6/24 * DNIS:2738300 * CSID:8013281707 * DURATION (mm-ss):08-06

57. (Currently Amended) A computer program product for use in a network that includes a first computer system having a first data store and second computer system having a second data store, the computer program product for implementing a method for synchronizing the first and second data stores in a flexible manner considering the circumstances that exist at the time of synchronization, the computer program product comprising one or more computer-readable media having stored thereon the following:

computer-executable instructions for determining whether to synchronize a data item by consulting a set of one or more flexible selection rules, the set of one or more flexible rules taking into consideration value, from having access to synchronized data, relative to at least one of (i) an economic cost for synchronization using each available synchronization mechanism, (ii) network security for each available synchronization mechanism, or (iii) security of the second computer system, or (iv) value of data being synchronized, and thereby also determining an available synchronization mechanism appropriate for the data item given the one or more flexible selection rules; and

computer-executable instructions for synchronizing the data item with the second computer if the first computer system determines that the data item is to be synchronized based on the one or more flexible selection rules and each available synchronization mechanism, including one or more hardwired or wireless communication connections.

58. (Original) A computer program product in accordance with Claim 57, wherein the one or more computer-readable media comprise physical storage media.

PAGE 17/24 * RCVD AT 9/2/2005 6:57:08 PM [Eastern Daylight Time] * SVR:USPTO-EFXRF-6/24 * DNIS:2738300 * CSID:8013281707 * DURATION (mm-ss):08-06

59. (Currently Amended) A network system comprising the following:

a synchronization server comprising a data store, a networking module, and a processing module configured to access the data store as well as communicate over a network using the networking module;

a mobile device having a data store, a networking module, and a processing module configured to access the data store of the mobile device as well as communicate with the synchronization server over the network using the networking module of the mobile device, the processing device of the mobile device configured to perform the following:

determine that a data item is to be synchronized;

identify which of a plurality of synchronization mechanisms, including one or more hardwired or wireless communication connections, are available to use for synchronization;

consult a set of one or more flexible selection rules to select a synchronization mechanism, the set of one or more flexible rules taking into consideration value, from having access to synchronized data, relative to at least one of (i) an economic cost for synchronization using each available synchronization mechanism, (ii) network security for each available synchronization mechanism, ~~or~~ (iii) security of the second computer system, or (iv) value of data being synchronized, and thereby select an available synchronization mechanism appropriate for the data item given the one or more flexible selection rules; and

use the selected synchronization mechanism to synchronize the data item.

PAGE 18/24 * RCVD AT 9/2/2005 6:57:08 PM [Eastern Daylight Time] * SVR:USPTO-EFXRF-6/24 * DNIS:2738300 * CSID:8013281707 * DURATION (mm-ss):08-06

60. (Currently Amended) A network system comprising the following:

a synchronization server comprising a data store, a networking module, and a processing module configured to access the data store as well as communicate over a network using the networking module;

a mobile device having a data store, a networking module, and a processing module configured to access the data store of the mobile device as well as communicate with the synchronization server over the network using the networking module of the mobile device, the processing device of the synchronization server configured to perform the following:

determine that a data item is to be synchronized;

identify which of a plurality of synchronization mechanisms, including one or more hardwired or wireless communication connections, are available to use for synchronization;

consult a set of one or more flexible selection rules to select a synchronization mechanism, the set of one or more flexible rules taking into consideration value, from having access to synchronized data, relative to at least one of (i) an economic cost for synchronization using each available synchronization mechanism, (ii) network security for each available synchronization mechanism, ~~or~~ (iii) security of the second computer system, or (iv) value of data being synchronized, and thereby select an available synchronization mechanism appropriate for the data item given the one or more flexible selection rules; and

use the selected synchronization mechanism to synchronize the data item.

PAGE 19/24 * RCVD AT 9/2/2005 6:57:08 PM [Eastern Daylight Time] * SVR:USPTO-EFXRF-6/24 * DNIS:2738300 * CSID:8013281707 * DURATION (mm-ss):08-06

REMARKS

The Non-final Office Action mailed June 17, 2005 considered and rejected claims 1-43 and 46-60.[1]

By this paper, claims 1, 42, 46, 57, 59 and 60 have been amended, such that claims 1-43 and 46-60 remain pending, of which claims 1, 42, 46, 57, 59 and 60 are the only independent claims at issue.

BACKGROUND

The present invention is generally directed to embodiments for optimizing synchronization of data items between computers, wherein a number of synchronization mechanisms exist to synchronize data between two computers. Rules can also be used to select one of the synchronization mechanisms. For example, Applicant's disclosure shows synchronization mechanisms that include wireless connections such as WiFi, Bluetooth, cellular phone protocols such as GSM and GPRS (Paragraph 46), etc. Other synchronization mechanisms include hardwired connections (Paragraph 27). Each of these synchronization mechanisms can provide different advantages and disadvantages. For example, some are more secure than others. Some are more costly. Some have limited bandwidth and thus take more time when synchronizing.

The rules specify which synchronization mechanisms can be used for synchronizing certain types of data. For example, to synchronize junk e-mail advertisements, it may be desirable to only use less costly synchronization mechanisms with higher bandwidth such as those that include WiFi. Alternatively, if the junk e-mail advertisements do not have a minimum threshold value, they may not be synchronized at all. When high security is needed, a secure connection such as a hardwired connection or encrypted wireless connection may be used. When the data is small, limited bandwidth synchronization mechanisms can be used.

---

[1] Claims 1-8, 10-14, 22-43, and 46-60 were rejected under 35 U.S.C. 103(a) as being unpatentable over Pesola, U.S. Pub-20030125057 (*Pesola*) in view of Gronemeyer, U.S. Pat-5450573 (*Gronemeyer*). Claim 9 was rejected under 35 U.S.C. 103(a) as being unpatentable over *Pesola* in view of *Gronemeyer* further in view of Asakawa, U.S. Pub-20030036398 (*Asakawa*). Claim 15 was rejected under 35 U.S.C. 103(a) as being unpatentable over *Pesola* in view of *Gronemeyer* further in view of Carlsson, U.S. Pub-20030119524 (*Carlsson*). Claims 16-19 were rejected under 35 U.S.C. 103(a) as being unpatentable over *Pesola* in view of *Gronemeyer* further in view of Monin, U.S. Pub-20020197984 (*Monin*). Claims 20-21 were rejected under 35 U.S.C. 103(a) as being unpatentable over *Pesola* in view of *Gronemeyer* further in view of Steinka, U.S. Pat-6285680 (*Steinka*). Although the prior art status of the cited art is not being challenged at this time, Applicants reserve the right to challenge the prior art status of the cited art at any appropriate time, should it arise. Accordingly, any arguments and amendments made herein should not be construed as acquiescing to any prior art status of the cited art.

PAGE 20/24 * RCVD AT 9/2/2005 6:57:08 PM [Eastern Daylight Time] * SVR:USPTO-EFXRF-6/24 * DNIS:2738300 * CSID:8013281707 * DURATION (mm-ss):08-06

The pending claims are also directed to corresponding embodiments. Claim 1, for example, recites a method of synchronizing first and second data stores in a flexible manner considering the circumstances that exist at the time of synchronization. The recited method includes the first computer system determining that a data item is to be synchronized; the first computer system *identifying which of a plurality of synchronization mechanisms* (which may include such connections as the wireless and hardwired connections discussed above) *are available to use for synchronization*; the first computer system *consulting a set of one or more flexible selection rules to select a synchronization mechanism*, the set of one or more flexible rules taking into consideration value, from having access to synchronized data, relative to at least one of (i) an economic cost for synchronization using each available synchronization mechanism, (ii) network security for each available synchronization mechanism, (iii) security of the second computer system, or (iv) the value of data being synchronized, and thereby selecting an available synchronization mechanism appropriate for the data item given the one or more flexible selection rules; and the first computer system using the selected synchronization mechanism to synchronize the data item with the second computer.

Independent claim 42 recites similar limitations, only from the perspective of a computer program product.

Independent method claim 46 recites a similar method for synchronizing first and second data stores in a flexible manner considering the circumstances that exist at the time of synchronization. The method includes the first computer system determining whether to synchronize a data item by *consulting a set of one or more flexible selection rules*, the set of one or more flexible rules taking into consideration value, from having access to synchronized data, relative to at least one of (i) an economic cost for synchronization using each available synchronization mechanism, (ii) network security for each available synchronization mechanism, (iii) security of the second computer system, or (iv) value of data being synchronized and thereby also determining an available synchronization mechanism appropriate for the data item given the one or more flexible selection rules; and the first computer system synchronizing the data item with the second computer if the first computer system determines that the data item is to be synchronized based on the one or more flexible selection rules and each available synchronization mechanism.

PAGE 21/24 * RCVD AT 9/2/2005 6:57:08 PM [Eastern Daylight Time] * SVR:USPTO-EFXRF-6/24 * DNIS:2738300 * CSID:8013281707 * DURATION (mm-ss):08-06

Independent claim 57 recites similar limitations from the perspective of a computer program product.

Independent system claim 59 recites a similar claim directed from the perspective of a network system. The network system includes a synchronization server comprising a data store, a networking module, and a processing module configured to access the data store as well as communicate over a network using the networking module; a mobile device having a data store, a networking module, and a processing module configured to access the data store of the mobile device as well as communicate with the synchronization server over the network using the networking module of the mobile device, the processing device of the mobile device configured to perform the following: determine that a data item is to be synchronized; *identify which of a plurality of synchronization mechanisms are available to use for synchronization*; *consult a set of one or more flexible selection rules to select a synchronization mechanism*, the set of one or more flexible rules taking into consideration value, from having access to synchronized data, relative to at least one of (i) an economic cost for synchronization using each available synchronization mechanism, (ii) network security for each available synchronization mechanism, (iii) security of the second computer system, or (iv) value of data being synchronized, and thereby select an available synchronization mechanism appropriate for the data item given the one or more flexible selection rules; and use the selected synchronization mechanism to synchronize the data item.

Independent claim 60 recites similar limitations from the perspective of a processing device of a synchronization server.

ARGUMENTS

The art cited by the office action fails to disclose or suggest a plurality of synchronization mechanisms and consulting rules to select one of the synchronization mechanisms where the rules take into consideration at least one of (i) an economic cost for synchronization using each available synchronization mechanism, (ii) network security for each available synchronization mechanism, (iii) security of the second computer system, or (iv) value of data being synchronized.

For example, *Pesola* illustrates a method of synchronizing managed data. Paragraph [0008]. *Pesola* discusses communication links which may be wired or wireless. *E.g.* paragraphs [0008] and [0014]. However, as admitted by the Office Action, *Pesola* fails to teach consulting a

PAGE 22/24 * RCVD AT 9/2/2005 6:57:08 PM [Eastern Daylight Time] * SVR:USPTO-EFXRF-6/24 * DNIS:2738300 * CSID:8013281707 * DURATION (mm-ss):08-06

set of one or more flexible selection rules to select a synchronization mechanism, the set of one or more flexible rules taking into consideration at least one of (i) an economic cost for synchronization using each available synchronization mechanism, (ii) network security for each available synchronization mechanism, (iii) security of the second computer system, or (iv) value of data being synchronized.

Gronemeyer fails to compensate for the deficiencies of *Pesola*. In particular, *Gronemeyer* is directed to synchronizing a multi-computer system that includes parallel-working computers. Col. 3, lines 3-12. *Gronemeyer* teaches only a single connection method existing between the computers of the system. For example, *Gronemeyer* teaches at col. 5, lines 16-20 that computers are compared through monitoring channels of a dual design running among the computers. Further *Gronemeyer* illustrates that the computers are synchronized using hardware synchronization modules. Col. 6, lines 15-17. *Gronemeyer* teaches only a single synchronization connection, and not a plurality of synchronization mechanisms as is recited by the claims. Because *Gronemeyer* does not teach a plurality of synchronization mechanisms, *Gronemeyer* has no basis for teaching using rules to select from among different synchronization mechanisms.

Applicant respectfully submits that the portion of *Gronemeyer* cited by the Office Action (Col. 1, lines 22-37) clearly does not show what the Office Action claims it shows. Namely, the cited portion does not show consulting rules, but rather gives general background information regarding synchronizing multicomputer systems. Perhaps the Examiner intended to cite some other portion of *Gronemeyer*, or some other reference altogether. In any case, Applicants respectfully submit that *Gronemeyer* clearly fails to teach or suggest what is recited by the claims of the present application, alone or in combination with *Pesola*.

Applicants therefore respectfully submit that that the pending claims are not, therefore, anticipated or made obvious by *Pesola* and/or *Gronemeyer* alone or in combination. The remaining art cited by the Office Action, *Asakawa*[2], *Carlsson*[3], *Monin*[4], and *Steinka*[5], which were only cited to reject some of the dependent claims, also clearly fail to compensate for the deficiencies of *Pesola* and *Gronemeyer*.

---

[2] *Asakawa* is cited only to show a data store incorporated with the internet.
[3] *Carlsson* is cited only to show a GPRS network.
[4] *Monin* is cited only to show various wireless networks.
[5] *Steinka* is cited only to show dial-up and VPN networks.

PAGE 23/24 * RCVD AT 9/2/2005 6:57:08 PM [Eastern Daylight Time] * SVR:USPTO-EFXRF-6/24 * DNIS:2738300 * CSID:8013281707 * DURATION (mm-ss):08-06

BEST AVAILABLE COPY

Furthermore, although the foregoing remarks have been focused primarily on the independent claims, it will be appreciated that all of the rejections and assertions of record with respect to the independent claims, as well as the dependent claims, are now moot, and therefore need not be addressed individually. However, in this regard, it should be appreciated that Applicant does not necessarily acquiesce to any assertions in the previous Office Action that are not specifically addressed above, and hereby reserves the right to challenge those assertions at any appropriate time in the future, should it arise, including any official notice

In the event that the Examiner finds any remaining impediment to a prompt allowance of this application that may be clarified through a telephone interview, the Examiner is requested to contact the undersigned attorney

Dated this 1 day of September, 2005.

Respectfully submitted,

RICK D. NYDEGGER
Registration No. 28,651
JENS C. JENKINS
Registration No. 44,803
J. LAVAR OLDHAM
Registration No. 53,409
Attorneys for Applicant

Customer No. 047973

JCJ:JLO
PPA0000000656V001

PAGE 24/24 * RCVD AT 9/2/2005 6:57:08 PM [Eastern Daylight Time] * SVR:USPTO-EFXRF-6/24 * DNIS:2738300 * CSID:8013281707 * DURATION (mm-ss):08-06

PATENT APPLICATION FEE DETERMINATION RECORD
Effective October 1, 2001

Application or Docket Number: 10/082918

CLAIMS AS FILED - PART I

	(Column 1)	(Column 2)
TOTAL CLAIMS	60	
FOR	NUMBER FILED	NUMBER EXTRA
TOTAL CHARGEABLE CLAIMS	60 minus 20=	* 40
INDEPENDENT CLAIMS	7 minus 3 =	* 4
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	370.00	OR	BASIC FEE	740.00
X$ 9=		OR	X$18=	720
X42=		OR	X84=	
+140=		OR	+280=	336
TOTAL		OR	TOTAL	1496

CLAIMS AS AMENDED - PART II

9/2/05

AMENDMENT A

	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA
Total	* 58	Minus	** 60	=
Independent	* 6	Minus	*** 7	=
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM				☐

SMALL ENTITY		OR	OTHER THAN SMALL ENTITY	
RATE	ADDITIONAL FEE		RATE	ADDITIONAL FEE
X$ 9=		OR	X$18=	
X42=		OR	X84=	
+140=		OR	+280=	
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=	
X42=		OR	X84=	
+140=		OR	+280=	
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
X$ 9=		OR	X$18=	
X42=		OR	X84=	
+140=		OR	+280=	
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20."
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3."
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/082,918	02/26/2002	Shawn Domenic Loveland	13768.255	4771

47973 7590 06/17/2005

WORKMAN NYDEGGER/MICROSOFT
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UT 84111

EXAMINER	
NGUYEN, KHAI MINH	
ART UNIT	**PAPER NUMBER**
2687	

DATE MAILED: 06/17/2005

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

Office Action Summary	Application No.	Applicant(s)	
	10/082,918	LOVELAND, SHAWN DOMENIC	
	Examiner	Art Unit	
	Khai M Nguyen	2687	

-- 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 *22 December 2004*.

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) *1-43 and 46-60* is/are pending in the application.

4a) Of the above claim(s) *44 and 45* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-43 and 46-60* 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 _____ 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 *3/30/2005*.
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. This Office Action is response to Amendment filed on 12/22/2004.

Claims 1-43, 46-60 are pending.

Response to Arguments

2. Applicant's arguments with respect to claims 1-43, 46-60have been considered but are moot in view of the new ground(s) of rejection.

Information Disclosure Statement

3. The reference listed in the Information Disclosure Statement filed on March 30, 2005 have been considered by the examiner (see attached PTO-1449 form or PTO/SB/08A and 08B forms).

Claim Rejections - 35 USC § 103

4. 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.

Claims **1-8,10-14, 22-43, and 46-60** are rejected under 35 U.S.C. 103(a) as being unpatentable over Pesola (U.S.Pub-20030125057) in view of Gronemeyer (U.S.Pat-545573)

Regarding claim 1, Pesola teaches in a network (fig.1) that includes a first computer system having a first data store (fig.1, paragraph 0008) and second computer system having a second data store (fig.1, paragraph 0008), a method for synchronizing the first and second data stores in a flexible manner considering the circumstances that exist at the time of synchronization (fig.1, paragraph 0008, 0019), the method comprising the following:

an act of the first computer system determining that a data item is to be synchronized (fig.1, paragraph 0005, 0008);

an act of the first computer system identifying which of a plurality of synchronization mechanisms are available to use for synchronization (fig.1, paragraph 0008, 0015);

and an act of the first computer system using the selected synchronization mechanism to synchronize the data item with the second computer (fig.1, paragraph 0008, 0018-0019).

Pesola fails to teaches an act of the first computer system consulting a set of one or more flexible selection rules to select a synchronization mechanism, the set of one or more flexible rules taking into consideration value, from having access to synchronized

data relative to at least one of (i) an economic cost for synchronization using each available synchronization mechanism, (ii) network security for each available synchronization mechanism, or (iii) security of the second computer system, and thereby selecting an available synchronization mechanism appropriate for the data item given the one or more flexible selection rules. However, Gronemeyer teaches an act of the first computer system consulting a set of one or more flexible selection rules to select a synchronization mechanism, the set of one or more flexible rules taking into consideration value, from having access to synchronized data relative to at least one of (i) an economic cost for synchronization using each available synchronization mechanism, (ii) network security for each available synchronization mechanism, or (iii) security of the second computer system, and thereby selecting an available synchronization mechanism appropriate for the data item given the one or more flexible selection rules (col.1, lines 22-37). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use an act of the first computer system consulting a set of one or more flexible selection rules to select a synchronization mechanism, the set of one or more flexible rules taking into consideration value, from having access to synchronized data relative to at least one of (i) an economic cost for synchronization using each available synchronization mechanism, (ii) network security for each available synchronization mechanism, or (iii) security of the second computer system, and thereby selecting an available synchronization mechanism appropriate for the data item given the one or more flexible selection rules as taught by Gronemeyer with Pesola teaching in order to provides that

the control signals, which come from the other computers and which adjust the time monitoring devices in the synchronization modules, are fed via OR elements.

Regarding claim 2, Pesola and Gronemeyer further teaches a method in accordance with claim 1, wherein the first computer system is a synchronization server, and the second computer system is a mobile device (fig.1, paragraph 0005, 0008, 0013).

Regarding claim 3, Pesola and Gronemeyer further teaches a method in accordance with claim 1, wherein the first computer system is a mobile device, and the second computer system is a synchronization server (fig.1, paragraph 0004, 0008, 0013).

Regarding claim 4, Pesola and Gronemeyer further teaches a method in accordance with claim 3, wherein the act of the first computer system determining that a data item is to be synchronized (fig.1, paragraph 0005, 0008) comprises the following:

an act of the mobile device determining on its own that the data item is to be synchronized (fig.1, paragraph 0004, 0013).

Regarding claim 5, Pesola and Gronemeyer further teaches a method in accordance with claim 3, wherein the act of the first computer system determining that a data item is to be synchronized (fig.1, paragraph 0005, 0008) comprises the following:

an act of the mobile device receiving a user-issued instruction to synchronize the data item (fig.1, fig.2, paragraph 0005, 0013, 0022, 0024).

Regarding claim 6, Pesola and Gronemeyer further teaches a method in accordance with claim 3, wherein the act of the first computer system determining that a data item is to be synchronized (fig.1, paragraph 0005, 0008) comprises the following:

an act of the mobile device receiving a signal from the synchronization server that represents to the mobile device that the data item is to be synchronized (fig.1, fig.2, paragraph 0005, 0013, 0025).

Regarding claim 7, Pesola and Gronemeyer further teaches a method in accordance with claim 3, wherein the second data store is incorporated within a common sphere of trust (fig.1, paragraph 0008).

Regarding claim 8, Pesola and Gronemeyer further teaches a method in accordance with claim 7, wherein the second data store is incorporated within a corporate network (fig.1, paragraph 0005, 0008).

Regarding claim 10, Pesola and Gronemeyer further teaches a method in accordance with claim 3, wherein the mobile device comprises a mobile telephone (fig.1, paragraph 0004, 0013).

Regarding claim 11, Pesola and Gronemeyer further teaches a method in accordance with claim 3, wherein the mobile device comprises a personal digital assistant (fig.1, paragraph 0004, 0013).

Regarding claim 12, Pesola and Gronemeyer further teaches a method in accordance with claim 3, wherein the mobile device comprises a laptop computer (fig.1, paragraph 0004, 0013).

Regarding claim 13, Pesola and Gronemeyer further teaches a method in accordance with claim 3, wherein the mobile device comprises a tablet personal computer (fig.1, paragraph 0004, 0013).

Regarding claim 14, Pesola and Gronemeyer further teaches a method in accordance with claim 1, wherein the plurality of synchronization mechanisms comprises at least one wireless synchronization mechanism (fig.1, paragraph 0005, 0008).

Regarding claim 22, Pesola and Gronemeyer further teaches a method in accordance with claim 1, further comprising the following:

an act of receiving instructions to change the set of flexible selection rules (fig.1, paragraph 0019, 0022); and

an act of changing the set of selection rules in response to the instruction (fig.1, paragraph 0006, 0019, 0022).

Regarding claim 23, Pesola and Gronemeyer further teaches a method in accordance with claim 22, wherein the act of receiving instructions to change the set of flexible selection rules (fig.1, paragraph 0006, 0019, 0022) comprises the following:

an act of receiving instructions to change the set of flexible selection rules from a user of the first computer system (fig.1, paragraph 0006, 0019, 0022).

Regarding claim 24, Pesola and Gronemeyer further teaches a method in accordance with claim 22, wherein the act of receiving instructions to change the set of flexible selection rules (fig.1, paragraph 0008, 0016, 0019) comprises the following:

an act of receiving instructions to change the set of flexible selection rules from an agent of the second computer system (fig.1, paragraph 0006, 0008, 0019, 0022).

Regarding claim 25, Pesola and Gronemeyer further teaches a method in accordance with claim 24, wherein the act of receiving instructions to change the set of flexible selection rules from an agent of the second computer system (fig.1, paragraph 0006, 0008, 0019, 0022) comprises the following:

an act of receiving instructions to change the set of flexible selection rules from a network administrator of a network that includes the second computer system (fig.1, fig.2, paragraph 0006, 0008, 0019, 0022).

Regarding claim 26, Pesola and Gronemeyer further teaches a method in accordance with claim 25, further comprising the following:

an act of receiving instructions to change the set of flexible selection rules from a user (fig.1, paragraph 0016, 0022).

Regarding claim 27, Pesola and Gronemeyer further teaches a method in accordance with claim 26, wherein the act of changing the set of selection rules in response to the instruction (fig.1, paragraph 0006, 0019, 0022), comprises the following:

an act of fulfilling the instructions received from the network administrator of the second computer system to the extent that there is a conflict between the instructions received from the network administrator of the second computer system and the instructions received from the user of the first computer system (fig.1, fig.2, paragraph 0008, 0013, 0022).

Regarding claim 28, Pesola and Gronemeyer further teaches a method in accordance with claim 1, wherein the act of the first computer system consulting a set of flexible selection rules (paragraph 0008) comprises the following:

an act of the first computer system selecting one of the available synchronization mechanisms without synchronous intervention from a user of the first computer system (fig.1, paragraph 0009).

Regarding claim 29, Pesola and Gronemeyer further teaches a method in accordance with claim 1, wherein the act of determining that a data item is to be synchronized (paragraph 0008) comprises the following:

an act of the first computer system receiving a notification from the second computer system that a data item is available to synchronize (fig.1,fig.2, paragraph 0008, 0022);

an act of the first computer system notifying the user of the availability of the data item; and an act of receiving a user-instruction to synchronize the data item (fig.1, fig.2, paragraph 0005, 0008, 0013, 0022).

Regarding claim 30, Pesola and Gronemeyer further teaches a method in accordance with claim 1, wherein the act of consulting a set of flexible selection rules to select one of the available synchronization mechanisms (fig.1, paragraph 0008, 0016, 0019) comprises the following:

an act of selecting the synchronization mechanism at least based on the time of day (paragraph 0009).

Regarding claim 31, Pesola and Gronemeyer further teaches a method in accordance with claim 1, wherein the act of consulting a set of flexible selection rules to select one of the available synchronization mechanisms (fig.1, paragraph 0008, 0016, 0019) comprises the following:

an act of selecting the synchronization mechanism at least based on the day of the week (paragraph 0009).

Regarding claim 32, Pesola and Gronemeyer further teaches a method in accordance with claim 1, wherein the act of consulting a set of flexible selection rules to select one of the available synchronization mechanisms (fig.1, paragraph 0008, 0016, 0019) comprises the following:

an act of selecting the synchronization mechanism at least based on the value of the data (fig.1, fig.2, paragraph 0016, 0025).

Regarding claim 33, Pesola and Gronemeyer further teaches a method in accordance with claim 1, wherein the act of consulting a set of flexible selection rules to select one of the available synchronization mechanisms (fig.1, paragraph 0008, 0016, 0019) comprises the following:

an act of selecting the synchronization mechanism at least based on the economic cost of using a network associated with the synchronization mechanism (fig.1, paragraph 0014).

Regarding claim 34, Pesola and Gronemeyer further teaches a method in accordance with claim 1, wherein the act of consulting a set of flexible selection rules to select one of the available synchronization mechanisms (fig.1, paragraph 0008, 0016, 0019) comprises the following:

an act of selecting the synchronization mechanism at least based on the security of a network associated with the synchronization mechanism (fig.1, fig.2, paragraph 0014, 0019).

Regarding claim 35, Pesola and Gronemeyer further teaches a method in accordance with claim 1, wherein the act of consulting a set of flexible selection rules to select one of the available synchronization mechanisms (fig.1, paragraph 0008, 0016, 0019) comprises the following:

an act of selecting the synchronization mechanism at least based on the security of the first computer system (fig.1, paragraph 0008, 0014, 0019).

Regarding claim 36, Pesola and Gronemeyer further teaches a method in accordance with claim 35, wherein the act of selecting the synchronization mechanism at least based on the security of the first computer system (fig.1, paragraph 0008, 0014, 0019) comprises the following:

an act of selecting the selecting the synchronization mechanism at least based on the security features inherent in devices of the same type as the first computer system (fig.1, paragraph 0008, 0019).

Regarding claim 37, Pesola and Gronemeyer further teaches a method in accordance with claim 35, wherein the act of selecting the synchronization mechanism at least based on the security of the first computer system (fig.1, paragraph 0008, 0014, 0019) comprises the following:

an act of selecting the selecting the synchronization mechanism at least based on current security settings of the first computer system (fig.1, fig.2, paragraph 0008, 0019, 0024).

Regarding claim 38, Pesola and Gronemeyer further teaches a method in accordance with claim 1, wherein the act of consulting a set of flexible selection rules to select one of the available synchronization mechanisms (fig.1, paragraph 0008, 0016, 0019) comprises the following:

an act of selecting the synchronization mechanism at least based on the location of the user of the first computer system (fig.1, fig.2, paragraph 0008, 0019, 0024).

Regarding claim 39, Pesola and Gronemeyer further teaches a method in accordance with claim 1, wherein the act of consulting a set of flexible selection rules to select one of the available synchronization mechanisms (fig.1, paragraph 0008, 0016, 0019) comprises the following:

an act of determining that there are no current synchronization mechanisms that are selectable based on the flexible set of rules (fig.1, paragraph 0019);

an act of reevaluating the flexible selection rules at a later time (fig.1, paragraph 0004, 0019); and

an act of repeating the reevaluation until at least one of the available synchronization mechanisms is selectable based on the flexible selection rules (paragraph 0005-0006).

Regarding claim 40, Pesola and Gronemeyer further teaches a method in accordance with claim 1, further comprising the following:

after using the selected synchronization mechanism to synchronize the data item (fig.1, paragraph 0005), an act of determining that the conditions for synchronization are no longer met in light of the flexible selection rules (fig.1, paragraph 0015); and

an act of automatically reversing the synchronization if it has been determined that the conditions for synchronization are no longer met (fig.1, paragraph 0008, 0015).

Regarding claim 41, Pesola and Gronemeyer further teaches a method in accordance with claim 1, wherein the act of the first computer system determining that a data item is to be synchronized (paragraph 0008) comprises the following:

an act of the first computer system determining whether to synchronize a data item by consulting a set of flexible selection rules (fig.2, paragraph 0008, 0024); and

an act of the first computer system synchronize the data item with the second computer if the first computer system determines that the data item is to be synchronized (fig.1, fig.2, paragraph 0008, 0015).

Regarding claim 42, Pesola teaches a computer program product for use in a network that includes a first computer system having a first data store and second computer system having a second data store (paragraph 0008), the computer program product for implementing a method for synchronizing the first and second data stores in a flexible manner considering the circumstances that exist at the time of synchronization (fig.1, paragraph 0008, 0019), the computer program product comprising one or more computer-readable media having stored (paragraph 0008) thereon the following:

computer-executable instructions for determining that a data item is to be synchronized (fig.1, fig.2, paragraph 0005);

computer-executable instructions for identifying which of a plurality of synchronization mechanisms are available to use for synchronization (fig.1, fig.2, paragraph 0005, 0022, 0024);

computer-executable instructions for using the selected synchronization mechanism to synchronize the data item with the second computer (fig.1, fig.2, paragraph 0008, 0018-0019).

Pesola fails to teaches computer-executable instructions for consulting a set of one or more flexible selection rules to select a synchronization mechanism, the set of one or more flexible rules taking into consideration value, from having access to synchronized data relative to at least one of (i) an economic cost for synchronization using each available synchronization mechanism, (ii) network security for each available synchronization mechanism, or (iii) security of the second computer system, and thereby selecting an available synchronization mechanism appropriate for the data item given the one or more flexible selection rules. However, Gronemeyer teaches computer-executable instructions for consulting a set of one or more flexible selection rules to select a synchronization mechanism, the set of one or more flexible rules taking into consideration value, from having access to synchronized data relative to at least one of (i) an economic cost for synchronization using each available synchronization mechanism, (ii) network security for each available synchronization mechanism, or (iii) security of the second computer system, and thereby selecting an available synchronization mechanism appropriate for the data item given the one or more flexible selection rules (col.1, lines 22-37). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use computer-executable instructions for consulting a set of one or more flexible selection rules to select a synchronization mechanism, the set of one or more flexible rules taking into

consideration value, from having access to synchronized data relative to at least one of (i) an economic cost for synchronization using each available synchronization mechanism, (ii) network security for each available synchronization mechanism, or (iii) security of the second computer system, and thereby selecting an available synchronization mechanism appropriate for the data item given the one or more flexible selection rules as taught by Gronemeyer with Pesola teaching in order to provides that the control signals, which come from the other computers and which adjust the time monitoring devices in the synchronization modules, are fed via OR elements.

Regarding claim 43, Pesola and Gronemeyer further teaches a computer program product in accordance with claim 42, wherein the one or more computer-readable media are physical storage media (paragraph 0022).

Regarding claim 44, Pesola and Gronemeyer further teaches in a network that includes a first computer system having a first data store and second computer system having a second data store (fig.1, paragraph 0008), a method for synchronizing the first and second data stores in a flexible manner considering the circumstances that exist at the time of synchronization (fig.1, paragraph 0008, 0019), the method comprising the following:

an act of the first computer system determining that a data item is to be synchronized (fig.1, paragraph 0005, 0008); and

a step for flexibly using an appropriate synchronization mechanism considering the then-existing circumstances (fig.1, paragraph 0019).

Regarding claim 45, Pesola and Gronemeyer further teaches a method in accordance with claim 44, wherein the step for flexibly using an appropriate synchronization considering the then-existing circumstances (fig.1, paragraph 0019) comprises the following:

an act of the first computer system identifying which of the plurality of synchronization mechanisms are available to use for synchronization (fig.1, paragraph 0005, 0008), an act of the first computer system consulting a set of flexible selection rules to select one of the available synchronization mechanisms (fig.1, fig.2, paragraph 0005, 0019); and

an act of the first computer system using the selected synchronization mechanism to synchronize the data item with the second computer (fig.1, fig.2, paragraph 0008, 0023).

Regarding claim 46, Pesola teaches in a network that includes a first computer system having a first data store and second computer system having a second data store (paragraph 0008), a method for synchronizing the first and second data stores in a

flexible manner considering the circumstances that exist at the time of synchronization (paragraph 0004-0005, 0008, 0019), the method comprising the following:

an act of the first computer system synchronizing the data item with the second computer if the first computer system determines that the data item is to be synchronized based on the one or more flexible selection rules and each available synchronization mechanism (fig.1, fig.2, paragraph 0008, 0023).

Pesola fails to teaches an act of the first computer system determining whether to synchronize a data item by consulting a set of one or more flexible selection rules, the set of one or more flexible rules taking into consideration value, from having access to synchronized data relative to at least one of (i) an economic cost for synchronization using each available synchronization mechanism, (ii) network security for each available synchronization mechanism, or (iii) security of the second computer system, and thereby selecting an available synchronization mechanism appropriate for the data item given the one or more flexible selection rules. However, Gronemeyer teaches an act of the first computer system determining whether to synchronize a data item by consulting a set of one or more flexible selection rules, the set of one or more flexible rules taking into consideration value, from having access to synchronized data relative to at least one of (i) an economic cost for synchronization using each available synchronization mechanism, (ii) network security for each available synchronization mechanism, or (iii) security of the second computer system, and thereby selecting an available synchronization mechanism appropriate for the data item given the one or more flexible selection rules (col.1, lines 22-37). Therefore, it would have been obvious to one of

ordinary skill in the art at the time the invention was made to use an act of the first computer system determining whether to synchronize a data item by consulting a set of one or more flexible selection rules, the set of one or more flexible rules taking into consideration value, from having access to synchronized data relative to at least one of (i) an economic cost for synchronization using each available synchronization mechanism, (ii) network security for each available synchronization mechanism, or (iii) security of the second computer system, and thereby selecting an available synchronization mechanism appropriate for the data item given the one or more flexible selection rules as taught by Gronemeyer with Pesola teaching in order to provides that the control signals, which come from the other computers and which adjust the time monitoring devices in the synchronization modules, are fed via OR elements.

Regarding claim 47, Pesola teaches a method in accordance with claim 46, wherein the first computer system is a synchronization server, and the second computer system is a mobile device (fig.1, paragraph 0005, 0008, 0013).

Regarding claim 48, Pesola teaches a method in accordance with claim 46, wherein the first computer system is a mobile device, and the second computer system is a synchronization server (fig.1, paragraph 0004, 0008, 0013).

Regarding claim 49, Pesola teaches a method in accordance with claim 46, further comprising the following:

an act of receiving instructions to change the set of flexible selection rules (fig.1, paragraph 0019, 0022); and

an act of changing the set of flexible selection rules in response to the instruction (fig.1, paragraph 0006, 0019, 0022).

Regarding claim 50, Pesola teaches a method in accordance with claim 49, wherein the act of receiving instructions to change the set of flexible selection rules (fig.1, paragraph 0006, 0019, 0022) comprises the following:

an act of receiving instructions to change the set of flexible selection rules from a user of the first computer system (fig.1, paragraph 0006, 0019, 0022).

Regarding claim 51, Pesola teaches a method in accordance with claim 49, wherein the act of receiving instructions to change the set of flexible selection rules (fig.1, paragraph 0008, 0016, 0019) comprises the following:

an act of receiving instructions to change the set of flexible selection rules from an agent of the second computer system (fig.1, paragraph 0006, 0008, 0019, 0022).

Regarding claim 52, Pesola teaches a method in accordance with claim 51, wherein the act of receiving instructions to change the set of flexible selection rules from an agent of the second computer system (fig.1, paragraph 0006, 0008, 0019, 0022) comprises the following:

an act of receiving instructions to change the set of flexible selection rules from a network administrator of trusted network that includes the second computer system (fig.1, fig.2, paragraph 0006, 0008, 0019, 0022).

Regarding claim 53, Pesola teaches a method in accordance with claim 52, further comprising the following:

an act of receiving instructions to change the set of flexible selection rules from a user (fig.1, paragraph 0016, 0022).

Regarding claim 54, Pesola teaches a method in accordance with claim 53, wherein the act of changing the set of flexible selection rules in response to the instruction (fig.1, paragraph 0006, 0019, 0022), comprises the following:

an act of fulfilling the instructions received from the network administrator of the second computer system to the extent that there is a conflict between the instructions received from the network administrator of the second computer system and the

instructions received from the user of the first computer system (fig.1, fig.1, paragraph 0008, 0013, 0022).

Regarding claim 55, Pesola teaches a method in accordance with claim 46, further comprising the following:

after using the selected synchronization mechanism to synchronize the data item (fig.1, paragraph 0005), an act of determining that the conditions for synchronization are no longer met in light of the flexible selection rules (fig.1, paragraph 0015); and

an act of automatically reversing the synchronization if it has been determined that the conditions for synchronization are no longer met (fig.1, paragraph 0008, 0015).

Regarding claim 56, Pesola teaches a method in accordance with claim 46, wherein the act of the first computer system synchronize the data item with the second computer (paragraph 0008) comprises the following:

an act of the first computer system identifying which of a plurality of synchronization mechanisms are available to use for synchronization (fig.1, paragraph 0005, 0008);

an act of the first computer system consulting a set of flexible selection rules to select one of the available synchronization mechanisms (fig.1, fig.2, paragraph 0005, 0019); and

an act of the first computer system using the selected synchronization mechanism to synchronize the data item with the second computer (fig.1, fig.2, paragraph 0008, 0023).

Regarding claim 57, Pesola teaches a computer program product for use in a network that includes a first computer system having a first data store and second computer system having a second data store (paragraph 0005, 0008), the computer program product for implementing a method for synchronizing the first and second data stores in a flexible manner considering the circumstances that exist at the time of synchronization (fig.1, paragraph 0008, 0019), the computer program product comprising one or more computer-readable media having stored thereon the following:

computer-executable instructions for synchronize the data item with the second computer if the first computer system determines that the data item is to be synchronized based on the one or more flexible selection rules and each available synchronization mechanism.(fig.1, fig.2, paragraph 0008, 0015).

Pesola fails to teaches computer-executable instructions for determining whether to synchronize a data item by consulting a set of one or more flexible selection rules, the set of one or more flexible rules taking into consideration value, from having access

to synchronized data relative to at least one of (i) an economic cost for synchronization using each available synchronization mechanism, (ii) network security for each available synchronization mechanism, or (iii) security of the second computer system, and thereby selecting an available synchronization mechanism appropriate for the data item given the one or more flexible selection rules. However, Gronemeyer teaches computer-executable instructions for determining whether to synchronize a data item by consulting a set of one or more flexible selection rules, the set of one or more flexible rules taking into consideration value, from having access to synchronized data relative to at least one of (i) an economic cost for synchronization using each available synchronization mechanism, (ii) network security for each available synchronization mechanism, or (iii) security of the second computer system, and thereby selecting an available synchronization mechanism appropriate for the data item given the one or more flexible selection rules (col.1, lines 22-37). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use computer-executable instructions for determining whether to synchronize a data item by consulting a set of one or more flexible selection rules, the set of one or more flexible rules taking into consideration value, from having access to synchronized data relative to at least one of (i) an economic cost for synchronization using each available synchronization mechanism, (ii) network security for each available synchronization mechanism, or (iii) security of the second computer system, and thereby selecting an available synchronization mechanism appropriate for the data item given the one or more flexible selection rules as taught by Gronemeyer with Pesola teaching in order to

provides that the control signals, which come from the other computers and which adjust the time monitoring devices in the synchronization modules, are fed via OR elements.

Regarding claim 58, Pesola teaches a computer program product in accordance with claim 57, wherein the one or more computer-readable media comprise physical storage media (paragraph 0022).

Regarding claim 59, Pesola teaches a network system comprising the following:

a synchronization server comprising a data store (paragraph 0013, 0017-0018), a networking module, and a processing module configured to access the data store as well as communicate over a network using the networking module (paragraph 0015);

a mobile device having a data store, a networking module, and a processing module configured to access the data store of the mobile device as well as communicate with the synchronization server over the network using the networking module of the mobile device, the processing device of the mobile device configured to perform the following (fig.2, paragraph 0015, 0021):

determine that a data item is to be synchronized (fig.1, fig.2, paragraph 0005);

identify which of a plurality of synchronization mechanisms are available to use for synchronization (fig.1, fig.2, paragraph 0005, 0022, 0024);

use the selected synchronization mechanism to synchronize the data item (fig.1, fig.2, paragraph 0008, 0018-0019).

Pesola fails to teaches consult a set of one or more flexible selection rules to select a synchronization mechanism, the set of one or more flexible rules taking into consideration value, from having access to synchronized data relative to at least one of (i) an economic cost for synchronization using each available synchronization mechanism, (ii) network security for each available synchronization mechanism, or (iii) security of the second computer system, and thereby selecting an available synchronization mechanism appropriate for the data item given the one or more flexible selection rules. However, Gronemeyer teaches consult a set of one or more flexible selection rules to select a synchronization mechanism, the set of one or more flexible rules taking into consideration value, from having access to synchronized data relative to at least one of (i) an economic cost for synchronization using each available synchronization mechanism, (ii) network security for each available synchronization mechanism, or (iii) security of the second computer system, and thereby selecting an available synchronization mechanism appropriate for the data item given the one or more flexible selection rules (col.1, lines 22-37). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use consult a set of one or more flexible selection rules to select a synchronization mechanism, the set of one or more flexible rules taking into consideration value, from having access to

synchronized data relative to at least one of (i) an economic cost for synchronization using each available synchronization mechanism, (ii) network security for each available synchronization mechanism, or (iii) security of the second computer system, and thereby selecting an available synchronization mechanism appropriate for the data item given the one or more flexible selection rules as taught by Gronemeyer with Pesola teaching in order to provides that the control signals, which come from the other computers and which adjust the time monitoring devices in the synchronization modules, are fed via OR elements.

Regarding claim 60, Pesola teaches a network system comprising the following:

a synchronization server comprising a data store, a networking module (paragraph 0013, 0017-0018), and a processing module configured to access the data store as well as communicate over a network using the networking module (paragraph 0015);

a mobile device having a data store, a networking module, and a processing module configured to access the data store of the mobile device as well as communicate with the synchronization server over the network using the networking module of the mobile device, the processing device of the synchronization server configured to perform the following (fig.2, paragraph 0013, 0015, 0017-0018, 0021):

determine that a data item is to be synchronized (fig.1, fig.2, paragraph 0005);

identify which of a plurality of synchronization mechanisms are available to use for synchronization (fig.1, fig.2, paragraph 0005, 0022, 0024);

use the selected synchronization mechanism to synchronize the data item (fig.1, fig.2, paragraph 0008, 0018-0019).

Pesola fails to teaches consult a set of one or more flexible selection rules to select a synchronization mechanism, the set of one or more flexible rules taking into consideration value, from having access to synchronized data relative to at least one of (i) an economic cost for synchronization using each available synchronization mechanism, (ii) network security for each available synchronization mechanism, or (iii) security of the second computer system, and thereby selecting an available synchronization mechanism appropriate for the data item given the one or more flexible selection rules. However, Gronemeyer teaches consult a set of one or more flexible selection rules to select a synchronization mechanism, the set of one or more flexible rules taking into consideration value, from having access to synchronized data relative to at least one of (i) an economic cost for synchronization using each available synchronization mechanism, (ii) network security for each available synchronization mechanism, or (iii) security of the second computer system, and thereby selecting an available synchronization mechanism appropriate for the data item given the one or more flexible selection rules (col.1, lines 22-37). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use consult a set of one or more flexible selection rules to select a synchronization mechanism, the set of one or more flexible rules taking into consideration value, from having access to

synchronized data relative to at least one of (i) an economic cost for synchronization using each available synchronization mechanism, (ii) network security for each available synchronization mechanism, or (iii) security of the second computer system, and thereby selecting an available synchronization mechanism appropriate for the data item given the one or more flexible selection rules as taught by Gronemeyer with Pesola teaching in order to provides that the control signals, which come from the other computers and which adjust the time monitoring devices in the synchronization modules, are fed via OR elements.

Claim **9** is rejected under 35 U.S.C. 103(a) as being unpatentable over Pesola (U.S. Pub-20030125057) in view of Gronemeyer (U.S.Pat-545573) further in view of Asakawa (U.S. Pub-20030036398).

Regarding claim 9, Pesola and Gronemeyer teaches a method in accordance with claim 3, wherein the second data store is incorporated (fig.1, paragraph 0005, 0008).

Pesola and Gronemeyer fails to specifically disclose a data store is incorporated within the internet. However, Asakawa teaches a data store is incorporated within the internet (fig.1, paragraph 0003). Therefore, it would been obvious to one of ordinary skill in the art at the time the invention was made to use a data store is incorporated within the internet as taught by Asakawa, Pesola and Gronemeyer teaching in order to provide a single device can simultaneously be part of more than one network.

Claim **15** is rejected under 35 U.S.C. 103(a) as being unpatentable over Pesola (U.S. Pub-20030125057) in view of Gronemeyer (U.S.Pat-545573) further in view of Carlsson (U.S. Pub-20030119524).

Regarding claim 15, Pesola and Gronemeyer teaches a method in accordance with claim 14, wherein the at least one wireless synchronization mechanism uses a network (fig.1, paragraph 0005, 0008).

Pesola and Gronemeyer fails to specifically disclose a wireless synchronization mechanism uses a GPRS network. However, Carlsson teaches a wireless synchronization mechanism uses a GPRS network (fig.1, paragraph 0012). Therefore, it would been obvious to one of ordinary skill in the art at the time the invention was made to use a wireless synchronization mechanism uses a GPRS network as taught by Carlsson, Pesola and Gronemeyer teaching in order to help determine the location of the mobile terminal.

Claims **16-19** are rejected under 35 U.S.C. 103(a) as being unpatentable over Pesola (U.S. Pub-20030125057)) in view of Gronemeyer (U.S.Pat-545573) further in view of Monin (U.S. Pub-20020197984).

Regarding claims 17-19, Pesola and Gronemeyer teaches a method in accordance with claim 14, wherein the at least one wireless synchronization mechanism uses an network (fig.1, paragraph 0005, 0008).

Pesola and Gronemeyer fails to specifically disclose a wireless synchronization mechanism uses 802.11a, 802.11b, Bluetooth, cellular network. However, Monin teaches a wireless synchronization mechanism uses 802.11a, 802.11b, Bluetooth, cellular network (paragraph 0014). Therefore, it would been obvious to one of ordinary skill in the art at the time the invention was made to use a wireless synchronization mechanism uses 802.11a, 802.11b, Bluetooth, cellular network as taught by Monin, Pesola and Gronemeyer teaching in order to linking together a network of wireless local network access points at respective physical locations.

Claim **20-21** is rejected under 35 U.S.C. 103(a) as being unpatentable over Pesola (U.S. Pub-20030125057)) in view of Gronemeyer (U.S.Pat-545573) further in view of Steinka (U.S. Pat-6285680).

Regarding claims 20-21, Pesola and Gronemeyer teaches a method in accordance with claim 1, wherein the plurality of synchronization mechanisms comprises dialup synchronization mechanism and the plurality of synchronization mechanisms a network (fig.1, fig.2, paragraph 0005, 0013).

Pesola and Gronemeyer fails to specifically disclose the plurality of synchronization mechanisms comprises an analog dialup synchronization mechanism and the plurality of synchronization mechanisms a VPN network. However. Steinka teaches the plurality of synchronization mechanisms comprises an analog dialup synchronization mechanism and the plurality of synchronization mechanisms a VPN

network (fig.1, col.3, lines 34-42, col.8, lines 25-37). Therefore, it would been obvious to one of ordinary skill in the art at the time the invention was made to use the plurality of synchronization mechanisms comprises an analog dialup synchronization mechanism and the plurality of synchronization mechanisms a VPN network as taught by Steinka, Pesola and Gronemeyer teaching in order to provides selective mobile device access to multiple hot resources through a common WAN connection.

Citation of Pertinent Prior Art

5. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Park et al. (U.S.Pat-6577878) discloses Base transceiver station of digital mobile telecommunication system.

Pesola et al. (U.S.Pub-20030126327) discloses Volume translation apparatus and method.

Conclusion

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Khai M Nguyen whose telephone number is 571.272.7923. The examiner can normally be reached on 8:00-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Lester Kincaid can be reached on 571.272.7922. 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).

Khai Nguyen
Au:2687

5/14/2005

LESTER KINCAID

OIPE
MAR 3 0 2005
JC50
PATENT & TRADEMARK OFFICE

EXPRESS MAIL LABEL NO.: EV 524683237 US

Form PTO-1449

Applicant:	Shawn Domenic Loveland
Serial No.:	10/082,918
Filing Date:	February 26, 2002
Confirmation No.:	4771
For:	SYNCHRONIZING OVER A NUMBER OF SYNCHRONIZATION MECHANISMS USING FLEXIBLE RULES

Att'y Docket No.: 13768.255

Group: 2684

INFORMATION DISCLOSURE CITATIONS MADE BY APPLICANT

U.S. Patent Publications

Examiner Initial*		Publications Number	Pub. Date	Name	Class	Sub Class	Filing Date
KN	A1.	2001/0048728	12/06/01	Peng	375	354	02/01/01
KN	A2.	2001/0054115	12/20/01	Ferguson, et al.	709	248	04/09/01

Other Documents

Examiner Initial*

KN A3. Box, Donald F, et al. "Adaptive – An Object-Oriented Framework for Flexible and Adaptive Communication Protocols" IFIP Conference Online, December 1992, URL:http://www.cs.wustl.edu/schmidt/PDF/HPN-93.pdf

KN A4. Kuroda, Masahiro, et al. "A Study of Autonomous Data Coherency Protocol for Mobile Devices" Computer Communications and Networks, 1999. Proceedings Eight International Conference, Boston, MA Oct 11-13, 1999

Khanh Nguyen 5/10/2005

Examiner: Date Considered:

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

OIPE JC550
MAR 30 2005
PATENT & TRADEMARK OFFICE

EXPRESS MAIL LABEL NO.: EV 524683237 US

Applicant:	Shawn Domenic Loveland	
Serial No.:	10/082,918	Att'y Docket No.: 13768.255
Filing Date:	February 26, 2002	Group: 2684
Confirmation No.:	4771	
For:	SYNCHRONIZING OVER A NUMBER OF SYNCHRONIZATION MECHANISMS USING FLEXIBLE RULES	

References Cited by Applicants

While the filing of Information Disclosure Statements is voluntary, the procedure is governed by the guidelines of Section 609 of the Manual of Patent Examining Procedure and 37 C.F.R. §§ 1.97 and 1.98. To be considered a proper Information Disclosure Statement, Form PTO-1449 shall be accompanied by a copy of each listed patent or publication or other item of information and a translation of the pertinent portions of foreign documents (if an existing translation is readily available to the applicant), an explanation of relevance of each reference not in the English language, and should be submitted in a timely manner as set out in MPEP Sec. 609.

Examiners will consider all citations submitted in conformance with 37 C.F.R. § 1.98 and MPEP Sec. 609 and place their initials adjacent the citations in the spaces provided on this form. Examiners will also initial citations not in conformance with the guidelines which may have been considered. A reference may be considered by the Examiner for any reason whether or not the citation is in full conformance with the guidelines. A line will be drawn through a citation if it is not in conformance with the guidelines AND has not been considered. A copy of the submitted form, as reviewed by the Examiner, will be returned to the applicant with the next communication. The original of the form will be entered into the application file.

Each citation initialed by the Examiner will be printed on the issued patent in the same manner as references cited by the Examiner on Form PTO-892.

The reference designations "A1," "A2," etc. (referring to Applicant's reference 1, Applicant's reference 2, etc.) will be used by the Examiner in the same manner as Examiner's reference designations "A," "B," "C," etc. on Office Action Form PTO-1142.

KCS0000005131V001

[signature]	6/13/05
Examiner:	Date Considered:

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

Notice of References Cited	Application/Control No. 10/082,918	Applicant(s)/Patent Under Reexamination LOVELAND, SHAWN DOMENIC	
	Examiner Khai M Nguyen	Art Unit 2687	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
	A	US-5,450,573 A	09-1995	Gronemeyer, Michael	713/375
	B	US-2003/0126327 A1	07-2003	Pesola et al.	710/74
	C	US-6,577,878 B1	06-2003	Park et al.	455/561
	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.

Search Notes

Application No.	Applicant(s)	
10/082,918	LOVELAND, SHAWN DOMENIC	
Examiner	**Art Unit**	
Khai M Nguyen	2687	

SEARCHED			
Class	Subclass	Date	Examiner
455	500-502 507 561	5/10/2005	KN
455	550.1 39	5/10/2005	KN
370	350 503	5/10/2005	KN

INTERFERENCE SEARCHED			
Class	Subclass	Date	Examiner

SEARCH NOTES (INCLUDING SEARCH STRATEGY)		
	DATE	EXMR
Crosaro Nick	5/10/2005	KN
Sonny Trinh	5/13/2005	KN

4

Index of Claims

Application No.	Applicant(s)	
10/082,918	LOVELAND, SHAWN DOMENIC	
Examiner	**Art Unit**	
Khai M Nguyen	2687	

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

Claim		Date
Final	Original	5/14/05
	1	√
	2	√
	3	√
	4	√
	5	√
	6	√
	7	√
	8	√
	9	√
	10	√
	11	√
	12	√
	13	√
	14	√
	15	√
	16	√
	17	√
	18	√
	19	√
	20	√
	21	√
	22	√
	23	√
	24	√
	25	√
	26	√
	27	√
	28	√
	29	√
	30	√
	31	√
	32	√
	33	√
	34	√
	35	√
	36	√
	37	√
	38	√
	39	√
	40	√
	41	√
	42	√
	43	√
	44	-
	45	-
	46	√
	47	√
	48	√
	49	√
	50	√

Claim		Date
Final	Original	
	51	√
	52	√
	53	√
	54	√
	55	√
	56	√
	57	√
	58	√
	59	√
	60	√
	61	
	62	
	63	
	64	
	65	
	66	
	67	
	68	
	69	
	70	
	71	
	72	
	73	
	74	
	75	
	76	
	77	
	78	
	79	
	80	
	81	
	82	
	83	
	84	
	85	
	86	
	87	
	88	
	89	
	90	
	91	
	92	
	93	
	94	
	95	
	96	
	97	
	98	
	99	
	100	

Claim		Date
Final	Original	
	101	
	102	
	103	
	104	
	105	
	106	
	107	
	108	
	109	
	110	
	111	
	112	
	113	
	114	
	115	
	116	
	117	
	118	
	119	
	120	
	121	
	122	
	123	
	124	
	125	
	126	
	127	
	128	
	129	
	130	
	131	
	132	
	133	
	134	
	135	
	136	
	137	
	138	
	139	
	140	
	141	
	142	
	143	
	144	
	145	
	146	
	147	
	148	
	149	
	150	

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S45	2	(calculat$4 or determin$3 or computat$4 or measument$3) near5 threshold near4 assign$4 near5 lay$3 near7 lay$3 near7 (network or system)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/05/08 18:26
S46	5	"5805993"	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/05/08 18:18
S47	4	(calculat$4 or determin$3 or computat$4 or measument$3) near5 threshold near4 assign$4 near5 (lay$3 or level or zone) near7 (lay$3 or zone or level) near7 (network or system)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/05/08 18:26
S48	133089	(calculat$4 or determin$3 or computing or measur$5) near10 (operat$3 or calculat$3 or determin$3 or computing or measur$5) near8 (level or lay$3 or zone)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/05/09 10:21
S49	2	(calculat$4 or determin$3 or computat$4 or measur$5) near5 threshold near4 assign$4 near5 lay$3 near7 lay$3 near7 (network or system)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/05/08 18:26
S50	6	(calculat$4 or determin$3 or computat$4 or measur$5) near5 threshold near4 assign$4 near5 (lay$3 or level or zone) near7 (lay$3 or zone or level) near7 (network or system)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/05/08 18:27
S51	22	(calculat$4 or determin$3 or computat$4 or measur$5) near10 threshold near10 assign$4 near10 (lay$3 or level or zone) near10 (lay$3 or zone or level) near10 (network or system)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/05/09 08:43
S52	12114	(adjust$3 or modif$4 or updat$3) near8 threshold near6 value	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/05/09 10:22
S53	1372	S48 and S52	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/05/08 18:30

S54	5	S53 and S51	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/05/08 18:30
S55	223	nguyen near3 khai.xa.	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/05/09 09:02
S56	0	"10411844"	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/05/09 09:24
S57	2	"10/411844"	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/05/09 09:47
S58	2	"20050014496"	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/05/09 09:47
S59	133089	(calculat$4 or determin$3 or computing or measur$5) near10 (operat$3 or calculat$3 or determin$3 or computing or measur$5) near8 (level or lay$3 or zone)	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/05/09 10:21
S60	12114	(adjust$3 or modif$4 or updat$3) near8 threshold near6 value	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/05/09 10:22
S61	1372	S59 and S60	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/05/09 10:22
S62	0	(speed or velocity)near20 assigment near5 cell	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/05/09 10:24
S63	202	(speed or velocity)near20 assig$5 near5 cell	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/05/09 10:25

S64	1	S61 and S63	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/05/09 10:25
S65	45888	(speed or velocity)near25 cell	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/05/09 10:25
S66	1	S61 and S64	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/05/09 10:51
S67	25	S61 and S65	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/05/09 10:25
S68	22916	(hieracchical adj2 assignment adj2 manager)or ham	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/05/09 11:34
S69	4	S61 and S68	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/05/09 11:31
S70	533	S65 and S68	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/05/09 11:34
S71	4363	455/500-502,507,561,550.1,39.ccls.	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/05/10 14:15
S72	2764	370/350,503.ccls.	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/05/10 14:15
S73	132	S71 and S72	US-PGPUB; USPAT; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2005/05/10 14:15

03-31-05 2684

RICK D. NYDEGGER
PETER P. LORIMER
THOMAS R. VUKSINICK
LARRY R. LAYCOCK
JONATHAN W. RICHARDS
DAVID R. WRIGHT
JOHN C. STRINGHAM
JOHN M. GUYNN
CHARLES L. ROBERTS
DANA L. TANGREN
ERIC L. MASCHOFF
CHARLES J. VEVERKA
ROBYN L. PHILLIPS
RICHARD C. GILMORE *
STERLING A. BRENNAN
R. BURNS ISRAELSEN
DAVID R. TODD
DAVID B. DELLENBACH
L. DAVID GRIFFIN
ADRIAN J. LEE
FRASER D. ROY
CARL T. REED

R. PARRISH FREEMAN, JR.
PETER F. MALEN, JR.
L. REX SEARS, PH.D.
WILLIAM R. RICHTER
ERIC M. KAMERATH
ROBERT E. AYCOCK
JENS C. JENKINS
KEVIN W. STINGER
WILLIAM J. ATHAY
MICHAEL B. DODD
RYAN D. BENSON
SARA D. JONES
TIGE KELLER
JANNA L. JENSEN
MATTHEW D. TODD
J. LAVAR OLDHAM
MICHAEL J. FRODSHAM
JOSEPH L. KRUPA
BRETT A. HANSEN
BRETT I. JOHNSON
MATTHEW A. BARLOW
WESLEY C. ROSANDER
ANDREW S. HANSEN
CHAD E. NYDEGGER
JOSEPH G. PIA
CLINTON E. DUKE
RYAN N. FARR *
JAMES B. BELSHE
KIRK R. HARRIS
KEELY SCHNEITER
MICHAEL M. BALLARD
DAVID A. JONES
SHANE K. JENSEN
JONATHAN M. BENNS, PH.D.

VERNON R. RICE §
OF COUNSEL

OIPE
MAR 30 2005
PATENT & TRADEMARK OFFICE

WORKMAN | NYDEGGER
INTELLECTUAL PROPERTY ATTORNEYS

1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111
TELEPHONE: (801) 533-9800
FAX: (801) 328-1707
WEBSITE: HTTP://WWW.WNLAW.COM

EXPRESS MAIL LABEL NO.: EV 524683237 US PATENT APPLICATION
Docket No.: 13768.255

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

TRANSMITTAL FOR INFORMATION DISCLOSURE STATEMENT

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

Sir:

Transmitted herewith for filing and pursuant to 37 C.F.R. § 1.97 is an Information Disclosure Statement.

Enclosed also are the following designated documents, as required under 37 C.F.R. §§ 1.97 and 1.98:

X Form PTO-1449 list of four (4) references submitted for consideration.

X Legible copies of the listed publication references or their relevant portions.

___ All English translations of each non-English reference, if any, within the possession, custody, control or availability of anyone designated in 37 C.F.R. § 1.56(c) (see 37 C.F.R. § 1.98(c)).

The following are included within the Information Disclosure Statement if applicable and as required under 37 C.F.R. § 1.98:

___ Concise explanation of relevance of each reference not in English and unaccompanied by an English translation.

___ Statement that certain listed references not enclosed are substantially cumulative of an enclosed reference.

___ Statement that certain listed references not enclosed were previously cited by or submitted to the Office in the identified

* Admitted only in California
§ Admitted only in Virginia

prior application which is relied upon for an earlier filing date under 35 U.S.C. § 120.

___ Legible Copies of previously filed Information Disclosure Statement for application Serial No. _____, filed _____.

In order to secure consideration of the items designated above, one or more of the following, if required, is also enclosed:

___ Promptness Certification.

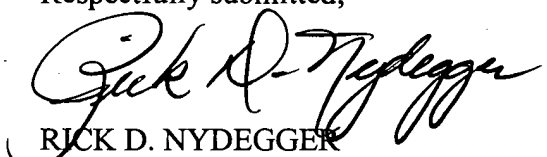
___ Check No. _____ in the amount of $_____ constituting submission fee under 37 C.F.R. 1.17(p);

___ Petition for Consideration and Check No. _____ in the amount of $_____.

X In the event that 37 C.F.R. § 1.97(c) applies and the Examiner is not satisfied that the Promptness Certification meets the requirements of 37 C.F.R. § 1.97(e), or in any other event remediable by a fee, please credit any over payment or charge any additional fees to Deposit Account No. 23-3178 of the undersigned.

Dated this 30th day of March, 2005.

Respectfully submitted,



RICK D. NYDEGGER
Attorney for Applicant
Registration No. 28,651
Customer No. 47973

RDN:kcs
KCS0000005133V001

OIPE
MAR 30 2005
PATENT & TRADEMARK OFFICE
JC50

EXPRESS MAIL LABEL NO.: EV 524683237 US

PATENT APPLICATION
Docket No.: 13768.255

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:		)
	Shawn Domenic Loveland	)
Serial No.:	10/082,918	) Art Unit) 2684
Filed:	February 26, 2002	)
Confirmation No.:	4771	)
For:	SYNCHRONIZING OVER A NUMBER OF SYNCHRONIZATION MECHANISMS USING FLEXIBLE RULES	)
Examiner:	Khai Minh Nguyen	)

INFORMATION DISCLOSURE STATEMENT
UNDER 37 C.F.R. § 1.97

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

Sir:

Please find, pursuant to 37 C.F.R. § 1.98(a)(1), the enclosed Form PTO-1449 which contains a list of all patents, publications, or other items that have come to the attention of one or more of the individuals designated in 37 C.F.R. § 1.56(c). While no representation is made that any of these references may be "prior art" within the meaning of that term under 35 U.S.C. §§

102 or 103, the enclosed list of references is disclosed so as to fully comply with the duty of disclosure set forth in 37 C.F.R. § 1.56.

Moreover, while no representation is made that a specific search of office files or patent office records has been conducted or that no better art exists, the undersigned attorney of record believes that the enclosed art is the closest to the claimed invention (taken in its entirety) of which the undersigned is presently aware, and no art which is closer to the claimed invention (taken in its entirety) has been knowingly withheld.

In accordance with 37 C.F.R. §§ 1.97 and 1.98, a copy of each of the listed references or relevant portion thereof is also enclosed.

In accordance with 37 C.F.R. § 1.98(c), all English translations within the possession, custody, control or availability of anyone designated in 37 C.F.R. § 1.56(c) of each nonenglish reference, if any, are also enclosed.

Dated this 30th day of March, 2005.

Respectfully submitted,

RICK D. NYDEGGER
Attorney for Applicant
Registration No. 28,651
Customer No. 47973

RDN:kcs
KCS0000005132V001

OIPE JC50
MAR 3 0 2005
PATENT & TRADEMARK OFFICE

CERTIFICATE OF MAILING BY "EXPRESS MAIL" (37 CFR 1.10) Applicant(s): Shawn Domenic Loveland				Docket No. 13768.255
Serial No. 10/082,918	Filing Date February 26, 2002	Confirmation No. 4771	Examiner Khai Minh Nguyen	Group Art Unit 2684

Invention: SYNCHRONIZING OVER A NUMBER OF SYNCHRONIZATION MECHANISMS USING FLEXIBLE RULES

I hereby certify that the Transmittal letter (2 pages) (in triplicate); Information Disclosure Statement (2 pgs); Form PTO-1449 Listing all Cited References (2 pgs); Legible Copies of Two (2) Cited References; and postcard are being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 CFR 1.10 in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on March 30, 2005.

Kendell Steele

(Typed or Printed Name of Person Mailing Correspondence)

(Signature of Person Mailing Correspondence)

EV 524683237 US

("Express Mail" Mailing Label Number)

KCS0000005275V001

OIPE
MAR 3 0 2005
PATENT & TRADEMARK OFFICE
JC50

EXPRESS MAIL LABEL NO.: EV 524683237 US

Form PTO-1449 Sheet 1 of 2

Applicant:	Shawn Domenic Loveland	
Serial No.:	10/082,918	Att'y Docket No.: 13768.255
Filing Date:	February 26, 2002	Group: 2684
Confirmation No.:	4771	
For:	SYNCHRONIZING OVER A NUMBER OF SYNCHRONIZATION MECHANISMS USING FLEXIBLE RULES	

INFORMATION DISCLOSURE CITATIONS MADE BY APPLICANT

U.S. Patent Publications

Examiner Initial*		Publications Number	Pub. Date	Name	Class	Sub Class	Filing Date
_____	A1.	2001/0048728	12/06/01	Peng	375	354	02/01/01
_____	A2.	2001/0054115	12/20/01	Ferguson, et al.	709	248	04/09/01

Other Documents

Examiner Initial*

_____ A3. Box, Donald F, et al. "Adaptive – An Object-Oriented Framework for Flexible and Adaptive Communication Protocols" IFIP Conference Online, December 1992, URL:http://www.cs.wustl.edu/schmidt/PDF/HPN-93.pdf

_____ A4. Kuroda, Masahiro, et al. "A Study of Autonomous Data Coherency Protocol for Mobile Devices" Computer Communications and Networks, 1999. Proceedings Eight International Conference, Boston, MA Oct 11-13, 1999

Examiner: Date Considered:

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

OIPE JC50 MAR 3 0 2005 PATENT & TRADEMARK OFFICE

EXPRESS MAIL LABEL NO.: EV 524683237 US

Applicant:	Shawn Domenic Loveland	
Serial No.:	10/082,918	Att'y Docket No.: 13768.255
Filing Date:	February 26, 2002	Group: 2684
Confirmation No.:	4771	
For:	SYNCHRONIZING OVER A NUMBER OF SYNCHRONIZATION MECHANISMS USING FLEXIBLE RULES	

References Cited by Applicants

While the filing of Information Disclosure Statements is voluntary, the procedure is governed by the guidelines of Section 609 of the Manual of Patent Examining Procedure and 37 C.F.R. §§ 1.97 and 1.98. To be considered a proper Information Disclosure Statement, Form PTO-1449 shall be accompanied by a copy of each listed patent or publication or other item of information and a translation of the pertinent portions of foreign documents (if an existing translation is readily available to the applicant), an explanation of relevance of each reference not in the English language, and should be submitted in a timely manner as set out in MPEP Sec. 609.

Examiners will consider all citations submitted in conformance with 37 C.F.R. § 1.98 and MPEP Sec. 609 and place their initials adjacent the citations in the spaces provided on this form. Examiners will also initial citations not in conformance with the guidelines which may have been considered. A reference may be considered by the Examiner for any reason whether or not the citation is in full conformance with the guidelines. A line will be drawn through a citation if it is not in conformance with the guidelines AND has not been considered. A copy of the submitted form, as reviewed by the Examiner, will be returned to the applicant with the next communication. The original of the form will be entered into the application file.

Each citation initialed by the Examiner will be printed on the issued patent in the same manner as references cited by the Examiner on Form PTO-892.

The reference designations "A1," "A2," etc. (referring to Applicant's reference 1, Applicant's reference 2, etc.) will be used by the Examiner in the same manner as Examiner's reference designations "A," "B," "C," etc. on Office Action Form PTO-1142.

KCS0000005131V001

Examiner: Date Considered:

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

EP26 384 (4)

A Study of Autonomous Data Coherency Protocol for Mobile Devices

Masahiro Kuroda[1], Takashi Sakakura[1], Takashi Watanabe[2], Tadanori Mizuno[2]
and Yoshiki Shimotsuma[1]

[1] Information Technology R&D Center, Mitsubishi Electric Corporation
5-1-1 Ofuna, Kamakura, Kanagawa, 247-8501 Japan

[2] Shizuoka University
3-5-1 Johoku, Hamamatsu, Shizuoka, 432-8011 Japan

Abstract

The optimistic consistency scheme has been established with respect to data consistency and availability in distributed systems. Wireless networks are becoming popular in data communication and suitable for data sharing among users using multicast capability, but have hidden node problems. This paper proposes a simple data coherency protocol for mobile devices that is less data traffic in data collaboration using multicast communication feature and capable of automatic recovery from unpredictable disconnection, such as hidden node problem, by data versioning scheme using version vector and update log management. We evaluated efficiency of data sharing over multicast communication and the recovery cost from failure caused by hidden nodes and confirmed the efficiency of the protocol.

I. INTRODUCTION

The advance of the mobile computing infrastructure enables "anytime, anywhere" collaborative information services. These services need to ensure data coherency among mobile devices sharing information in wireless networks. Currently various wireless networks are available for mobile computing, but they are less reliable, higher latency, and more costly than wired networks. There are two main approaches to solve these issues. One approach is to design a light-weight wireless transport protocol and translate the protocol into a wired protocol using a proxy model [1]. Second approach is to cache data in a site and send the difference data between two sites to the destination site. As for the latter case, there is an optimistic data consistency scheme [2,3], with respect to data consistency and data availability. The traditional optimistic consistency scheme, such as those deployed in Coda [2] and Ficus [3], were basically aimed to offer data consistency and availability for devices using reliable and low latency networks, such as LAN. These schemes were also targeted to Unix file systems.

The timestamped anti-entropy protocol [5] uses data versioning and can be applied to various types of data. The protocol is based on replica maintenance using a version vector, an acknowledgement vector, and message logs. Each node exchanges version information periodically with its peer node and keeps the latest data in it. This protocol assumes nodes involved in the exchange have timestamps that are comparable among the nodes by having frequent data exchange and can be extended to nodes that do not have comparable timestamps. Bayou's anti-entropy protocol for update propagation [6] is close to [5], but has a support for conflict detection and resolution based on per-write dependency for database operations.

Our optimistic data consistency model [9] is close to the timestamped anti-entropy protocol. The model deploys data versioning and the interface of conflict reconciliation is defined for various types of applications. The model is also independent of communication media for data replication. We can choose dynamically any wireless communication media including wireless multicast networks, such as W-CDMA [15]. Multicast networks are originally suitable for data sharing among mobile users.

We propose a data coherency protocol based on our data consistency model with data snooping mechanism of wireless multicast communications to attain information sharing among mobile users. This protocol offers consistent data view to mobile users by solving hidden node problems and by involving a less network traffic. Mobile users can join an information-sharing group or leave the group without caring about connected or disconnected and recover data missed during being hidden.

The first section describes our data consistency model and data versioning as a base function of the Autonomous Data Coherency Protocol. The next section proposes a data coherency protocol. The data snooping mechanism, operation modes, data recovery and the state transition of the protocol are discussed.

The rest of this paper describes a prototype implementation and its evaluation. In the evaluation, the data sharing performance is discussed. We conclude with a summary of this paper and future perspective of the protocol.

II. DATA SYNCHRONIZATION MECHANISM

The data sharing systems in mobile environment assume unstable network communications and need to support disconnected operations. We designed the data coherency protocol on a data consistency model that is intended to support unstable wireless communications.

Our model uses the suggestion of the Mobile Network

0-7803-5794-9/99/$10.00 © 1999 IEEE

BEST AVAILABLE COPY

BNSDOCID: <XP__ ..... 10359569A__I. >

Computer Reference Specification (MNCRS) [11]. The part of its goal is the standardization of data synchronization interface. We proposed a differential data type object *Diffable* in addition to the base replication type object *Reconcilable* for low bandwidth wireless network to satisfy this interface.

As shown in Figure 1, SyncStore is a container of data objects, and data objects in the container are kept consistent between a pair of containers by exchanging versioning information. Each SyncStore has a version vector to maintain consistency states of the data objects and the SyncStore itself. SyncStore manages update logs and its differential data as well. Every modification to an object in a SyncStore from an application results in generating an update log and its differential data. The Synchronizer exchanges update logs between a pair of SyncStores using the information of the version vectors.

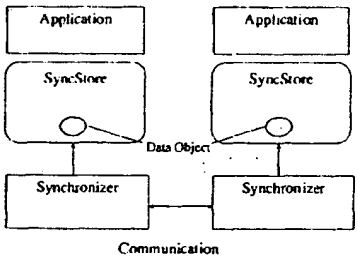


Fig. 1 Components of data synchronization mechanism

A. *Data Versioning*

The data versioning using version vectors to detect concurrent update conflicts was proposed by Parker, etc. [12]. The data versioning deployed in our model is similar to the Golding's[5], but is based on an incremental counter with an interface to define application specific conflict resolution strategy. A version vector is a list, which is stored in a SyncStore, and is used for detection of concurrent update conflicts and for reduction of update logs comparing with the version vector of other SyncStores.

A version vector contains elements of the form $(ssid_i, vcount_i)$, where $ssid_i$ is the i-th SyncStore identifier and $vcount_i$ is an incremental counter maintained by the i-th SyncStore. Therefore, the version vector is expressed as;

$vv^i = vv_k^i$ and $vv_k^i = (ssid_k^i, vcount_k^i)$ $\{k=1,2,\ldots,n\}$

The j-th component in the version vector of the i-th SyncStore means that the i-th SyncStore knows the number of the updates performed at the j-th SyncStore up until the time denoted by $vcount_j^i$. The size n of the version vector vv^i infers that the i-th SyncStore knows n SyncStores including itself.

Assume each call to SyncStore's *markAsUpdated* method will cause its version vector to be appropriately updated and the update passed to the method will be logged. Each logged update has a field *ssid* and a field *vcount* attached to it, where *ssid* indicates the SyncStore at which it was performed, and *vcount* specifies how many times it was performed.

Using the version vectors and update logs presented above, we can compute the difference of a SyncStores from another, detect concurrent update conflicts, and reduce the amount of logged updates.

Let I_{ss} denote the i-th SyncStore that is initiating data synchronization, and R_{ss} denote the j-th SyncStore that is responding to the synchronization.

B. *Difference Comparison*

Assuming R_{ss} has received vv^i from I_{ss}, it then will compare with its vv^j. Let $vcount_j^i$ denote the i-th element of the i-th SyncStore.

If $vcount_j^i > vount_j^j$, I_{ss} is newer than R_{ss}. R_{ss} receives the differential data extracted from the logged updates in I_{ss} after sending its vv^i as an acknowledgment.

If $vcount_j^i < vount_j^j$, R_{ss} is newer than I_{ss}. R_{ss} sets up differential data from its logged updates by checking the *vcount* that is attached to each update and is bigger than the $vount_j^i$, then sends the differential data to I_{ss}.

If $vcount_j^i = vount_j^j$, it is assumed that a concurrent update occurred. R_{ss} reconciles the conflict by invoking its application and brings the reconciled result into next data update.

C. *Update Log Reduction*

We extend the use of version vectors in a SyncStore by not only maintaining the version vector reflecting its latest state but also storing the version vectors of all other SyncStores that are known directly or indirectly. Thus, for example, when I_{ss} synchronizes with R_{ss}, R_{ss} will send not only its own version vector but also the other SyncStores' (except I_{ss}'s) version vectors it knows about I_{ss}. After each cycle of the synchronization, I_{ss} will check if it already holds the version vectors of all the SyncStores it knows about through its own version vector. If so, it will compute the minimum *vcount*, v_{min} where vv^i_{min} is calculated as the minimum *vcount* of a version vector.

$v_{min} = \min\{vv^k_{min} | k=1,\ldots,n\}$ and

$vv^i_{min} = \min\{vv_k^i | k=1,\ldots,n\}$

The update logs with a *vcount* that is equal to or smaller than v_{min} are no longer needed by anyone, so that a node can discard the logs.

III. AUTONOMOUS DATA COHERENCY PROTOCOL

We define the Autonomous Data Coherency Protocol (ADCP) which deploys the data synchronization mechanism described in the previous section and a data snooping mechanism on a multicast data communication.

Figure 2 shows a model of the ADCP assuming a multicast data communication media, such as wireless LAN or CDMA cell, as a shared data bus of centralized shared-memory multiprocessor [16].

A pair of black nodes with the bold line in Figure 2 is in a

BNSDOCID: <XP ____10359569A_1 >

process of data synchronization. Other nodes monitor data transactions on the bus and get necessary data from the bus. We call this function as *data snooper*. The *data snooper* takes data synchronization messages autonomously giving no side-effect on data synchronization sessions, then the synchronizer applies the messages into its SyncStore if the messages match requirements of the node. From the autonomous synchronization behavior, we call this operation mode of the ADCP as *sneak mode*. According to the analogy of the centralized shared-memory multiprocessor, an address on the bus corresponds to an identifier of a SyncStore, the data is the contents of a data synchronization message, and the node cache is the SyncStore. Each data snooping node examines the adaptability of messages by checking the *vcount* in the messages, applies the differential data to its SyncStore, and updates its own version vector.

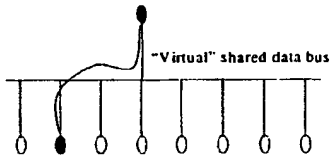


Fig. 2 Model of ADCP

Once all the nodes have the same data, no updates log is required as long as updates executed by nodes in the mode are serialized by CSMA/CA protocols, such as IEEE 802.11, through packet acknowledgement and through RTS/CTS. This is similar to access a shared bus from the viewpoint of the link-layer protocols. They receive update data, which is serialized by a media, on a multicast data communication bus. We call this operation mode as *declared mode*.

The ADCP can be applied to a mobile device having more than two communication handsets, such as node having both W-CDMA[14] and Bluetooth[15]. This kind of nodes can be deployed as a gateway in data sharing systems.

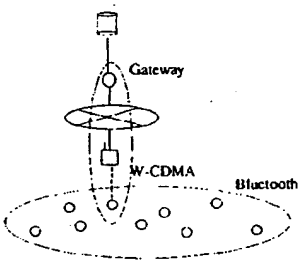


Fig. 3 Node with multiple handsets

Figure 3 shows a sample of ADCP systems. The ADCP allows data in wired network applied to an ad-hoc network, and vice versa. We can configure data sharing systems connected to heterogeneous wired and wireless networks with a solution for hidden node problems.

A. *Data Snooper*

The *data snooper* is configured as a part of medium access control (Figure 4). We do not discuss its implementation because it is beyond the scope of this paper. We assume radio medium access control protocols for broadcast and multicast transmission, such as proposed by Tourrilhes [17].

The synchronizer uses a datagram interface as its transport communication to allow the *data snooper* monitoring the data synchronization messages. It prepares a port to listen for a data synchronization request from others, and a port for messages from the *data snooper*.

A list of data sharing nodes which is deducted from the version vector and an encryption key depending on medium access control are configured into the *data snooper* via an interface of the datagram transport by the synchronizer. All data on the multicast communication medium is monitored if the sharing nodes send data synchronization messages on that medium. The sharing nodes have the same encryption key at the medium access control level and share the messages. The *data snooper* decrypts all the data on the medium by the key, monitors the data, and queues the data to the monitoring port as a data synchronization message if the data is a data synchronization message.

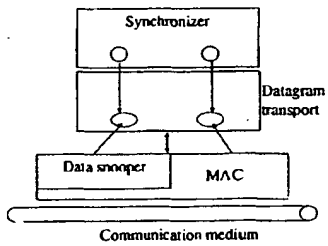


Fig. 4 Data snooper and medium access control

We implemented the *data snooper* on Ethernet by enhancing the device driver to check data in the interrupt routine, and successfully tested that the *data snooper* could get a message from an IEEE 802.11 station via an Ethernet-802.11 bridge (Figure 4).

B. *Sneak Mode*

The synchronizer checks the *vcount* if it detects others' data synchronization message. It executes the following processes; we call this process mode as *sneak mode* since the process gives no effect on a pair-wise data synchronization.

Let S_{ss} denote the k-th SyncStore that gets a synchronization message by snooping data exchanged between I_{ss} and R_{ss}, and *inc* denote the unit of *vcount*.

i) vcountii <vcountkk and vcountjj <vcountkk

Drop the message.

ii) $vcount_i^i = vcount_k^k + inc$ or $vcount_j^i = vcount_k^k + inc$

Register the message as an update log, and update the

BNSDOCID: <XP_____10359569A_I_>

vcount of I_{ss}, R_{ss} and S_{ss} in its version vector to the new version.

iii) $vcount_i^i > vcount_k^k + inc$ or $vcount_j^j > vcount_k^k + inc$

Register the message as a "future" update log without applying to the data. A lacked *vcount* of log will be retrieved from another node later by requesting with the *vcount*. When S_{ss} acquires a complete series of update logs and the lacked *vcounts* of update log, all logs are applied to the data.

iv) $vcount_i^i = vcount_k^k$ or $vcount_j^j = vcount_k^k$

Assume a conflict occurred either between I_{ss} and S_{ss} or between R_{ss} and S_{ss}, the conflict is resolved by application program. If both updates are applied to S_{ss}, one update is applied at this synchronization and the other reconciled update is applied next time, when S_{ss} synchronizes with another SyncStore.

The new version of a snooped node will be reflected to the other nodes by executing data synchronization with them. In a large-scale system, we can define a data synchronization domain to reduce the data exchange [9].

C. *Declared Mode*

When data update occurs at a node in *declared mode*, data message is sent to the shared nodes without generating any *vcount* and update log. The nodes in the session take the message and apply to its copy of data with no condition.

An explicit data sharing session is established by a declaration message and the transition protocol from *sneak mode* to *declared mode*.

1) Start of a shared session

A shared session starts with a declaration message that a chair node sends. A node on that medium takes the message by the *data snooper*, and the synchronizer is notified of the message. The declaration message contains the *vcount* v^i_{min}. v^i_{min} is the oldest *vcount* in the version vector in the chair node, calculated as follows;

$$v^i_{min} = \min\{vv_k{}^i | k = 1,...n\}$$

where k represents the id of n number of nodes.

On either sending or detecting a declaration message, a node gets into another state ceasing both data synchronization and data snooping. Nodes detected the message try to respond to the node with the first lacked *vcount* or the expected *vcount* of update log.

Figure 5 shows the declaration protocol of the mode. The "Initiator" represents the chair node while the "Responder" represents each of responding node.

Responding messages are serialized by the medium access control if more than one node try to respond simultaneously. Nodes that failed in sending a responding message have a race again to respond to the chair node. The chair node waits for timeout from the last responded message. Then the chair node determines v_{min} that is the initial differential data supplied to responding nodes, from the collected $vv_r{}^r$ as follows;

$$v_{min} = \min\{vv_r{}^r | r = 1, i-1, i+1, ...t\}$$

where r is id of number t of responded nodes.

After having determined v_{min}, the chair node sends the differential data from v_{min} +*inc* to the *vcount* applied to its SyncStore.

All responded nodes send an acknowledgement message after receiving the data. Those nodes discard the *vcount* of differential data if it is already stored in their SyncStore. All nodes move to the *declared mode* after the completion of this process.

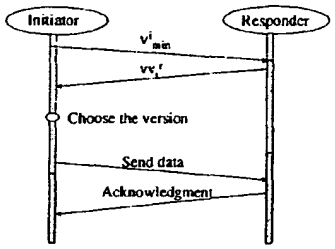


Fig. 5 Declaration protocol for Declared Mode

2) Updating Data

Under the *declared mode*, data is updated by sending an acquiring message to the chair node. A "data updating" state is registered in all nodes of the session by acquiring the access right, therefore no other nodes can update the shared data.

Once a node has succeeded in acquiring the access right, the synchronizer allows its application to update the data by releasing a lock for the SyncStore.

The *declared mode* state is registered in the synchronizer. The data management mechanism in this state generates the differential data not to generate update logs but directly to reflect to the data.

The synchronizer receives differential data in a process of executing the update and sends a data synchronization message with sequential id in the *declared mode* session instead of the *vcount*. The other nodes receive the synchronization message and apply to their data without generating the update logs as well.

3) Cancellation of a Shared Session

The *declared mode* is cancelled by the chair node, which declared the start of the session. When the other nodes receive a cancellation message sent by the chair node, make one version of update log since the declared session has started, and go to the *sneak mode*.

If a node in the *declared mode* notices that some version of differential data is missing by checking the sequential ids of updates, it moves to a disabled state and waits for the cancellation of the session. A node that has some problems in the session establishing process also goes to the state.

BNSDOCID: <XP._ ... 10359569A_1_>

D. *Missing Differential Data and its Recovery*

The ADCP is enabled by the data snooping mechanism. One of the advantages is that the mechanism does not affect any progress of data synchronizing sessions executed on the same multicast communication medium.

To request missing data caused by problems such as hidden nodes, a snooping node synchronizes with a node which has executed data synchronization recently, or to a node in earlier order in the version vector, if no data synchronization message is detected during a certain period. Furthermore, a node receives differential data by snooping, multicasts its version by executing data synchronization with a node.

If a node has some missing versions of the differential data, it sends a request message for the oldest missing data first. A winner of acquiring the medium having requested missing data responds to the request. The version of differential data provided by the responder is taken by not only the requested node but also nodes that missed the data. A conflict, however, may occur at the missed version of data. Reconcile process by an application is executed on each logged update from the first missed version up to the newest version, and make another version of differential data in this case. The data consistency is recovered by synchronizing with the version eventually.

E. *State Transition of Node*

We describe the state transition of a node shown in Figure 6.

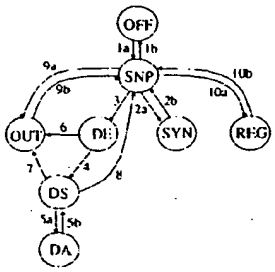


Fig. 6 State transition of node

In the off state (OFF), a node is powered off or the data synchronization on the medium is disabled.

1a) Enabling a synchronizer, a node state is brought into the snooping state (SNP).

1b) Disabling the synchronizer, the state goes to OFF.

2a) If the node starts or accepts data synchronization in SNP, the state moves to the syncing state (SYN).

2b) As soon as the synchronization process finishes, the state moves to SNP.

3) Sending or detecting a declaration message, the node changes the state from SNP to the declaration establishing state (DE).

4) Accepting or sending an acknowledgment in DE, the node gets into the declared snooping state (DS).

5a) Acquiring a communication channel on a data update, all the nodes in the session change the state from DS to the declared acquired state (DA).

5b) The node returns to DS once finished sending differential data of the update.

6) If a node has some problem in DE, the state goes to the out of session (OUT). All kinds of synchronization operations are inhibited in this state.

7) If a node in DS misses a version of differential data, the state goes to OUT.

8) Sending or accepting a cancellation message in DS, all nodes in the session go to SNP.

9a) If a node in SNP does not receive a declaration message, the node moves to OUT.

9b) Detecting a cancellation message of the session, the state is released to SNP.

10a) Sending or detecting a registration message, the node goes to the registration (REG) state.

10b) The state goes back to SNP by finishing the registration.

All nodes in a system work in this state transition, and the system can manage the problems in mobile communication environment, such as hidden node problem, out of communication cell, powered off by controlling the states and data recovery in the snooping state.

IV. Evaluation System, Application, and Evaluation Items

We describe the evaluation system, an application for the evaluation, and evaluation items to esteem that data sharing using multicast capability is efficient. The evaluation is performed in an aspect of durability for being out of communication reach. We evaluated communication cost for data recovery from missing data that is caused by hidden node problems.

A. *Evaluation System*

We deployed Ethernet as a communication medium with multicast capability, 16 client nodes are connected to the Ethernet. A gateway server is also connected to the network, and a database server is connected to the clients via the gateway. A Java ADCP software is installed on all the clients and the gateway.

B. *Application*

The ADCP is preferably applied to applications that share data in a community such as collaboration work in a field. An application used for this evaluation is a voting system for nomadic auctions, and the number of members is 16. Tables of product records are stored in the database server. Each member has a field in a record to register a price while a record represents a deal for each product. Status field is

BNSDOCID: <XP_____10359569A_I_>

maintained by a broker setting statuses such as "opened" or "closed". The gateway retrieves a table from the database server per auction session, makes a data object with the table and register it into its SyncStore. The object equips methods for accessing data at every SQL command level such as "update" or "select". Differential data of the object is extracted as a SQL statement as well. The broker of a session, who will be a chair node of the *declared mode*, gets the initialized table from the gateway by data synchronization. Every member has a SyncStore where data sharing relations to all other nodes are installed. The broker declares a beginning of the session, once the members are gathered as attendants of the session. Data object of initial data is delivered to every member's SyncStore via the declaration establishing state.

Any attendant can price a product at any time. A pricing operation is reflected to the other attendants by extracting the differential data as an SQL statement and multicasting it in the ADCP.

The broker closes the auction session after setting the closed state to all records in the object. The broker sends the cancellation message of the *declared mode*, and writes back the object data in one version of differential data, that is the results of the session, to the backend database server via the gateway.

C. Methodology of Evaluation

It might be obvious that the ADCP can lessen communication traffic comparing to a pair-wise data synchronization if the number of data sharing nodes is more than two. However, problems in mobile environment lead to more communication traffic in running the ADCP for the recovery. Therefore, we have measured an amount of communication traffic in the application while making a hidden node situation by disconnecting clients from the viewpoint of the link-layer protocols.

Moreover, we compared the data recovery costs in the *declared mode* with the *sneak mode*.

D. Measurement Conditions

To see how the node number affects the communication traffic in both modes, we varied the number of attendants from 2 to 16, while one of the attendants is always the broker. The delivery cost is included in the result. The 1924 bytes of initial data contain 10 records of products. Each modification generates 100 bytes of SQL statement as the differential data. The auction session lasts for t seconds. Data modifications on nodes follow the Poisson distribution, predetermined number of nodes being hidden at the time $t/2$, and data recovery is executed after closing the session in the cases of simulating hidden nodes.

Additionally, attendants execute data synchronization after every data modification, and the broker executes data synchronization with a proper node to deliver status information change in the *sneak mode*, and the recovery process is always held in the *sneak mode*.

V. Result of Measurements

A. Communication Traffic without Hidden Nodes

Figure 7 shows the comparison between the *declared mode* and the *sneak mode*, while the X axis presents the number of attendant nodes and the Y axis presents the total bytes of the traffic. The traffic in the *declared mode* stays low as expected while the traffic in the *sneak mode* rises rapidly as the number of nodes increases.

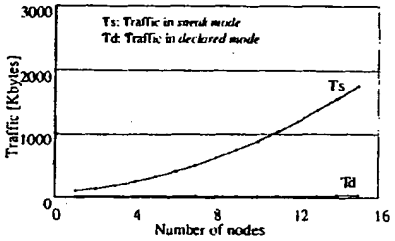


Fig. 7 Communication traffic without hidden nodes

To configure the ADCP working, each node needs to have the data sharing relations with other nodes managed in the version vector. Every data modifications in the *sneak mode* result in sending a version vector aside from the differential data as the process of data synchronization.

The cost for exchanging the version vector, Cost(n), is estimated as;

$$Cost(n) = (64n + 112)(n + 1) + 428; \quad n: \text{number of nodes},$$

where the constants are estimated from the implementation codes.

This result suggests that the number of data sharing nodes in the *sneak mode* are limited by the cost for exchanging version vector comparing to the *declared mode*.

B. Communication Traffic with Hidden Nodes

Total communication traffic including traffic for data recovery in fixed number(15+1) of attendants is measured as Figure 8. The number of nodes that are disconnected from the network in the middle of the session is presented by the X axis. Both modes show the same tendency in the total data traffic.

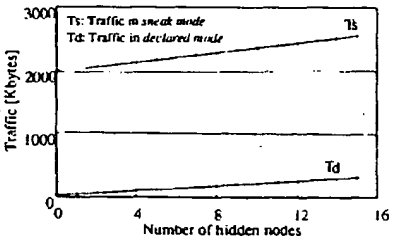


Fig. 8 Communication traffic with hidden nodes

The constant difference between two modes is assumed as

BNSDOCID: <XP_____10359569A >

the version vector sending cost from the result of figure 7. The number of failed node affects linearly to the total traffic.

C. *Estimated Recovery Cost*

Data recovery is processed after the auction session is closed. In the case of the *declared mode*, the state of node changes from DS to SNP, then the recovery is processed in the *sneak mode*. The traffic difference from the 0 hidden node at each number of hidden nodes can be thought as the recovery cost, and no significant difference is observed between the two modes in tendency.

Whereas C_{miss} denotes the total amount of missed differential data, Nh denotes the number of hidden nodes in the session, the recovery cost is expressed as follows;

Recovery cost = Nh·Cost(16) + C_{miss}

The difference in communication costs between the two modes should be brought from the parameter C_{miss}. The C_{miss} in the *declared mode* is the total of differential data during the session, while the C_{miss} in the *sneak mode* is the sum from the first hidden node occurring till the end of session. The difference depends on a proportion of the C_{miss} to the whole, the C_{miss} was relatively low in this estimation.

This result suggests that the ADCP work in data recovery as well as in the normal case.

VI. CONCLUSION

We introduced a simple data coherency protocol ADCP that deploys a data synchronization mechanism and a data snooping mechanism on a multicast data network. This protocol allows mobile devices to disconnect unpredictably and keep data shared consistent among the devices. We evaluated the practicability of the protocol by estimating data recovery cost in data traffic from failures caused by such as hidden node problem. The methodology used in the estimation was simple, however we could confirm the efficiency of the protocol.

We will further evaluate the protocol, and augment the protocol to meet large-scale system requirements and multi-hop communication environment.

VII. ACKNOWLEDGEMENTS

We would like to thank Mr. Ryoji Ono for his indispensable contributions to this work, especially in the evaluation efforts and data preparation.

VIII. REFERENCES

[1] B.Zenel and D.Duchamp, "General Purpose Proxies: Solved and Unsolved Problems," In Proceedings of Hot-OS VI, May 1997

[2] Mahadev Satyanarayanan, et al, "Coda : A Highly Available File System for a Distributed Workstation Environment, " IEEE Transactions on Computers, 39(4), April 1990.

[3] Richard G. Guy, et al, "Implementation of the Ficus Replicated File System", USENIX Conference Proceedings, USENIX, June 1990.

[4] C.H. Papadimitrio, "The Serializability of Concurrent Database Updates, " Journal of the ACM, 26(4), October 1979.

[5] Rechard A.Golding, "Weak consistency group communication and membership," Ph.D. thesis, published as technical report UCSC-CRL-92-52. Computer and Information Sciences Board, University of California, Santa Cruz, December 1992.

[6] Douglas B. Terry, et al, "Managing Update Conflicts in Bayou, A Weakly Connected Replicated Storage System," In Proceedings of the 15th ACM Symposium on Operating Systems Principles, ACM, 1995.

[7] Sunil K. Sarin, Nancy A. Lynch, "Discarding Obsolete Information in a Replicated Database System," IEEE Transactions on Software Engineering, SE-13 (1), pp.39-47, Jan. 1987.

[8] Karin Pertersen, Mike J. Spreitzer, et al, "Flexible Update Propagation for Weakly Consistent Replication," Proceedings of the 16th ACM Symposium on Operating Systems Principles (SOSP-16), Oct. 1997.

[9] Masahiro Kuroda, et al, "Data Transfer Evaluation of Nomadic Data Consistency Model for Large-scale Mobile Systems," IEICE Transactions on Information and Systems, Vol.E82-D, No.4, Apr. 1999.

[10] Masahiro Kuroda, et al, "Wide-Area Messaging System on Nomadic Data Consistency," The 13th International Conference on Information Networking, January, 1999.

[11] Mobile network computer reference specification, http://www.mncrs.org

[12] D. Stott Parker, et al, "Detection of Mutual Inconsistency in Distributed Systems," IEEE transactions on Software Engineering, 9(3), May 1983.

[13] David Ratner, et al, "Dynamic Version Vector Maintenance," Technical Report CSD-970022, University of California, Los Angeles, June 1997

[14] D. L. Schilling , S. G. Glisic and P. A. Leppanen (Ed), "Overwiew of wideband CDMA," Wireless Communications: TDMA vs. CDMA, Kluwer, 1997.

[15] Jaap Haartsen, Mahmound Naghshineh, et al, "Bluetooth: Vision, Goals, and Architecture," ACM Mobile Computing and Communications Review, Volume 2, Number 4.

[16] D.A.Patterson, J.L.Hennessy, "Computer Architecture a Quantitative Approach Second Edition," Morgan Kaufmann Publishers, Inc..

[17] Jean Tourrilhes, "Robust Broadcast : Improving the reliability of broadcast transmissions on CSMA/CA," HP external report, HPL-98-38.

BNSDOCID: <XP_____10359569A__I_>

This Page is Inserted by IFW Indexing and Scanning Operations and is not part of the Official Record

BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- ☐ BLACK BORDERS
- ☐ IMAGE CUT OFF AT TOP, BOTTOM OR SIDES
- ☒ FADED TEXT OR DRAWING
- ☒ BLURRED OR ILLEGIBLE TEXT OR DRAWING
- ☐ SKEWED/SLANTED IMAGES
- ☒ COLOR OR BLACK AND WHITE PHOTOGRAPHS
- ☐ GRAY SCALE DOCUMENTS
- ☒ LINES OR MARKS ON ORIGINAL DOCUMENT
- ☐ REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY
- ☐ OTHER: _____

IMAGES ARE BEST AVAILABLE COPY.
As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.

XP-002315831

EP 26384 (C)

ADAPTIVE

An Object-Oriented Framework for Flexible and Adaptive Communication Protocols

Donald F. Box, Douglas C. Schmidt and Tatsuya Suda
dbox@ics.uci.edu, schmidt@ics.uci.edu and suda@ics.uci.edu
Department of Information and Computer Science,
University of California, Irvine, CA 92717 [1]

Abstract

Traditional transport systems do not adequately provide the functionality or flexibility required by existing and future multimedia applications. Conventional protocol architectures based on a static configuration of relatively few protocols are incapable of providing the level of performance the channel is capable of producing while still performing the processing needed by the application. Multimedia applications require transport systems that can be configured to match the the functional requirements of diverse multimedia traffic sources as well as capable of adapting to the dynamism inherent in multimedia applications and heterogeneous internetworks.

This paper describes ADAPTIVE, a transport system architecture to support multimedia applications for high-speed networks. The ADAPTIVE system applies object-oriented design and implementation techniques to build an integrated framework for protocol specification, composition, prototyping and experimentation. It utilizes a hierarchical specification technique that allows both the policies of a communication session to be specified and the actual mechanisms used to carry out these policies. Its monitoring and analysis facilities provide a rich environment for controlled experimentation through the use of rapid prototyping and integrated instrumentation.

1 Introduction

Traditional transport systems do not adequately provide the functionality or flexibility needed by existing and future multimedia applications and high speed networks. Applications currently must either (1) accept wholesale the functionality and behavior of an available protocol (*e.g.*, TCP, UDP, TP4, or VMTP), or (2) attempt to provide its own transport subsystem by building on lower level communication service primitives. Due to the diversity of application requirements and the paucity of available protocols on most systems, approach (1) often leads to lowest-common-denominator solutions that actually only satisfy the requirements of a narrow range of their target applications. Approach (2) leads to multiple, ad hoc, implementations that are not easily extended, modified, or shared. This also places the burden of protocol processing on the application programmer, who may not be fluent in the design and implementation of communication protocols. To alleviate this situation, future transport systems must provide communication service that is flexible and adaptive to (1) application diversity, (2) network diversity, and (3) host system diversity.

Application Diversity: Distributed multimedia applications impose unique performance constraints on the underlying communication medium and the supporting transport system that are more demanding and dynamic than those previously encountered in traditional data applications. The presence of these applications increases the dynamism of the underlying network and their supporting transport systems due to the high degree of variance in traffic characteristics exhibited by the applications' data sources (*e.g.*, highly bursty, high bandwidth variable bit rate video sources, relatively steady, low bandwidth digitized voice sources, short transactional-based sources). Transport systems providing communication service that utilizes traditional communication protocol suites typically offer very few options with respect to both the *quality* of service (*e.g.*, high throughput, low delay) and the *functionality* of service (*e.g.*, reliable in-order data stream, best-effort datagram) provided. Existing and future multimedia applications require various levels of performance (*e.g.*, peak/average bandwidth, maximum delay, low jitter) and behavior (*e.g.*, synchronization, network-kernel-application delivery, error correction), that are not adequately addressed in existing systems.

Network Diversity: The diversity of network characteristics encountered by distributed multimedia applications are due to (1) the heterogeneity of internetworking environments, (2) dynamic or multipath routing, and (3) fluctuations in network state caused by the traffic sources described above. Network characteristics that vary across network environments include *channel speed* (*e.g.*, 10Mbps for Ethernet, 100Mbps for FDDI, 155Mbps or 622Mbps for ATM), *maximum data transfer unit* (*e.g.*, 1500 octets for Ethernet, 9188 octets for SMDS, 48 octets for ATM), *available service types* (*e.g.*, datagram, virtual circuit, multicast, broad-

[1] This paper appeared in the proceedings of the fourth IFIP conference on High Performance Networking in Liege, Belgium, December 1992.

BNSDOCID: <XP_____2315831A_I_>

BEST AVAILABLE COPY

cast) and *access control scheme* (*e.g.*, CSMA/CD, token-passing, switch-based). Network characteristics that may vary dynamically over the lifetime of an association include the aforementioned characteristics, which may fluctuate either due to a change in routing, the use of multipath routing, or a change in the number or location of participants in a communication session. Additionally, network characteristics such as packet loss rate and delay can vary greatly over the lifetime of an association due to transient network congestion.

Host System Diversity: A large degree of diversity exists in the degree and nature of support provided by host systems for communication protocols. This diversity appears in both the available hardware (*e.g.*, CPU, network interface, memory hierarchy) and the supporting system software. Software-related issues such as scheduling mechanisms (*e.g.*, *x*-kernel[1] lightweight processes vs. STREAMS[2] `service` routines), user-kernel data delivery mechanisms (*e.g.*, BSD socket layer [3] vs. *x*-kernel upcall mechanism), buffer management schemes (*e.g.*, BSD `mbufs` vs. STREAMS `mblk_ts`) and protocol composition and demultiplexing mechanisms (*e.g.*, STREAMS modules vs. *x*-kernel protocol and session objects). Hardware issues that are variable across host systems include processor architectures (*e.g.*, uniprocessor vs. shared memory multiprocessor [4] vs. message passing multiprocessor[5, 6]), explicit support for protocol processing (*e.g.*, performing all protocol processing off-board processors[7, 8], specialized hardware to assist a single protocol function [9]), effects of interrupts on overall system performance (*e.g.*, number of interrupts required to move data between the host system memory and the network interface, performance penalty from interrupt-driven processing due to the amount of context a processor must save across interrupts, cache invalidation and pipeline flushing).

The ADAPTIVE System: ADAPTIVE is "A Dynamically Assembled Protocol Transformation, Intergration, and Validation Environment." The ADAPTIVE system [10] has been designed to address the diversity described above by providing: (1) a flexible and adaptive kernel of protocol mechanisms that provide a framework for protocol composition, (2) a unified scheme for specifying both the policies and the mechanisms that are used to provide communication services, and (3) an integrated environment for the specification, collection, and presentation of performance data. As shown in Figure 1, ADAPTIVE's three main subsystems are:

1. *Map Applications and Networks To Transport Systems (MANTTS)* – MANTTS interacts with the entities of a communication session to select the policies and mechanisms that will satisfy an application's communication requirements given the diverse needs of an application and the dynamic state of the network. Section 3 describes MANTTS in detail.
2. *Transport Kernel Objects (TKO)* – TKO instantiates precisely-tailored *transport system session contexts* from a library of reusable protocol mechanisms. These sessions maintain one or more *streams*, each of which corresponds to an independent unidirectional data stream between two logical endpoints of communication. Section 4 describes TKO in detail.
3. *UNIform Transport Evaluation Subsystem (UNITES)* – UNITES provides an infrastructure for traffic monitoring, performance evaluation and protocol instrumentation. Section 5 describes UNITES in detail.

2 ADAPTIVE Design Principles

Adequately supporting the diversity of application requirements and network characteristics described in Section 1 requires a flexible transport system architecture that provides communication service appropriate for the specific traffic sources and underlying network technologies [11, 12, 13]. ADAPTIVE allows the behavior of a communication session to be precisely tailored to the required service by implementing a protocol in terms of a set of independently recombinable protocol mechanisms. This independence is achieved through the strict use of uniform abstract interfaces to each set of functionally-similar mechanisms. Using this composition scheme facilitates the following:

2.1 Controlled Protocol Experimentation

By holding all other mechanisms within a session constant, the effects of choices within one subset of the mechanisms can be accurately observed without undue interaction with the rest of the protocol. For example, the effect on protocol performance due to changing the Connection Management function from one that is implicit timer-based to one that is explicit handshake-based can be attributed to the mechanism selection, as all other factors can be held constant. Previous comparisons of various protocol mechanisms [14, 15, 16, 17] have been done largely based on their implementations within the context of a complete protocol, thus making it difficult to isolate a single mechanism from its interactions with the rest of the system. More accurate conclusions may be reached as to the suitability of a given mechanism using controlled experimentation techniques.

2.2 Flexible Protocol Engineering

By leveraging off of established software engineering techniques, the task of *correctly* implementing a communication protocol can be made less complex than using traditional implementation methods. ADAPTIVE provides a framework of reusable mechanism *objects* [18] that allow protocols to be developed from new and existing component mechanisms that are independently implemented, tested, and maintained. ADAPTIVE implements protocol mechanisms

BNSDOCID: <XP_____2315831A__I_>

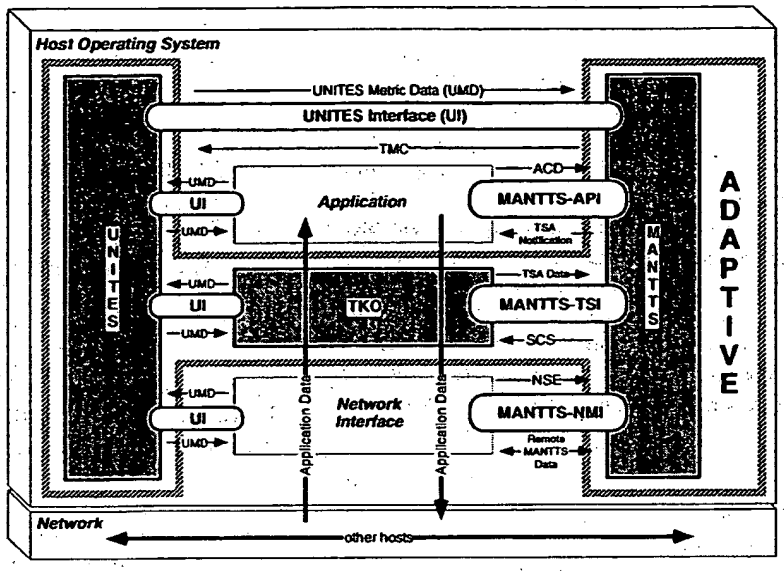


Figure 1: ADAPTIVE System Architecture

to comply with uniform abstract interfaces, allowing the one implementation of a protocol mechanism to be replaced by another (*e.g.*, *go-back-n* replacing *selective repeat* error recovery) written to the same interface without affecting the implementation of the other constituent mechanisms. Protocol mechanisms are implemented as C++ objects [19] that encapsulate both the current *state* of a protocol and the *operations* that are performed to implement the mechanism as one unified abstract data type. Instances of these data types are then instantiated and configured at run-time to provide the desired protocol function. Implementing protocol mechanisms as objects yields several desirable results:

1. *Information Hiding* – details specific to the internal implementation of a given mechanism are hidden behind a uniform interface [20]. By enforcing the principle of *separation of concerns*, this uniform interface creates a firewall between a mechanism's *clients* (*e.g.*, the application programmer or protocol implementer) and the mechanism's *provider* (*e.g.*, the mechanism implementer).

2. *Reuse via Inheritance* – as mechanisms are implemented in terms of C++ classes, the commonality of a set of mechanisms can be shared via inheritance. Using inheritance, a common base class provides the portion of the mechanism that is shared by all members of the set, and each mechanism is implemented by *deriving* a new sub-class from the base, which requires the implementer to provide only the portion of the mechanism that distinguishes the mechanism from the rest of the set. This technique allows both the reuse of interface (*e.g.*, several error reporting mechanisms which share the same interface for reporting which packets are missing) and the reuse of implementation (*e.g.*, several stream synchronization mechanisms which use the same underlying implementation for attaching new data streams).

3. *Rapid Prototyping* – utilizing the collection of protocol mechanisms provided with ADAPTIVE, combined with the techniques described above, protocol designers can rapidly develop new protocols by specifying the desired configuration of available mechanisms. Alternatively, protocol *mechanism* designers may use the library of available mechanisms as a reliable and consistent base with which new protocol mechanisms may be designed, prototyped and tested.

2.3 Adaptive Protocol Operation

In addition to the flexibility described above, a transport system must exhibit *adaptability* to sufficiently accommodate the dynamism that exist in both the application (*e.g.*, alternate coding schemes based on subject activity, adding/subtracting data streams or participants to a communication session) and the network (*e.g.*, bandwidth availability and packet loss rate fluctuations, latency variations due to a switch from terrestrial to satellite links). ADAPTIVE protocol configurations are capable of three classes of adaptivity:

1. *Parametric Adaptivity* – which varies the behavior of a communication session by adjusting some subset of its *parameters* (*e.g.*, inter-packet gap, transfer unit size, remote context update rate). Parametric adaptivity is suited to transient changes in the state of the network due to congestion as well as quantitative

BNSDOCID: <XP_____2315831A__I. >

changes in application behavior (*e.g.*, A/D sample rate increases/decreases).

2. *Functional Adaptivity* – which varies the behavior of a communication session by changing some subset of its *mechanisms* (*e.g.*, changing from selective repeat to go-back-n error recovery schemes, enabling/disabling gap or duplicate suppression). Functional adaptivity is required to adjust to fundamental changes in the state of the network due to sustained packet loss, increased latency, or changes in routing as well as qualitative changes in application behavior or requirements (*e.g.*, changing video coding schemes may require different error detection behavior, adding participants to a unicast data stream requires a different error recovery mechanism).

3. *Quantitative Adaptivity* – which varies the behavior of a communication session by adding or subtracting data streams. Quantitative adaptivity is required to accommodate multi-stream applications that selectively disable/enable multiple medium sources (*e.g.*, a teleconferencing application that switches from audio only to audio and video). Quantitative adaptivity is also required to accommodate multi-user collaborative applications that dynamically add or subtract participants from a workgroup.

ADAPTIVE provides various mechanisms which support the three types of transport system adaptivity described above:

1. *Explicit Mechanism Replacement Support* – by building protocol mechanisms based on uniform interfaces that hide the variance in different implementations, a single protocol mechanism (*e.g.*, update remote contexts) can be implemented by multiple different policies (*e.g.*, periodic updates, request-based updates). As described in Section 4, by providing explicit interface and implementation support for run-time mechanism replacement, ADAPTIVE offers an efficient and consistent framework for adaptive protocol operation.

2. *Application Feedback/Feedforward Control* – by providing callback mechanisms by which applications can be notified of changes in operating environment (*i.e.*, the network, the transport system, remote communication entities), and allowing manipulation of running session configurations via a uniform interface, protocol adaptivity can be placed under direct application control. As described in Section 3, ADAPTIVE provides this facility with multiple levels of granularity and scope.

3. *Network Feedback* – by utilizing information collected by the ADAPTIVE/UNITES subsystem, protocol adaptivity can be enabled by various conditions observed in the underlying network and local and remote transport systems. UNITES provides information on both the state of the network (*e.g.*, packet loss rate, channel utilization) and the state of local and remote ADAPTIVE entities (*e.g.*, buffer utilization, retransmission counts). Section 5 describe the metric collection facilities of ADAPTIVE in detail.

3 Map Applications and Networks To Transport Systems (MANTTS)

ADAPTIVE is a transformational system that configures and instantiates transport system configurations based on application requirements and network characteristics. The ADAPTIVE/MANTTS subsystem provides the Application Programmatic Interface (API) to the ADAPTIVE system through the use of ADAPTIVE Communication Descriptors (ACDs). ACDs provide a flexible mechanism for applications to describe (1) grade of service requirements, (2) application-transport system interactions, and (3) instrumentation/measurement configurations. MANTTS performs a series of transformations on an ACD to synthesize a Session Configuration Specification (SCS), which is used by the ADAPTIVE/TKO subsystem to instantiate and instrument a communication session.

3.1 Hierarchical Specification

Flexible and adaptive transport systems are of little utility if they lack an effective facility for applications to specify the characteristics required from a communication session. Various schemes for specifying an application's *quality* of service (QoS) requirements (*e.g.*, error rate, throughput, delay) as well as it's *functionality* of service (FoS) requirements (*e.g.*, connection-oriented vs. connectionless, best effort vs. acknowledged vs. reliable delivery) exist [21, 22, 23]. Existing schemes have been designed for transport systems that are either inflexible and/or non-adaptive to diversity in application or network characteristics. For a specification scheme to provide applications with an adequate interface to flexible and adaptive transport services, explicit support must be offered for the following:

1. *Variable Granularity* – both for QoS and FoS parameters, a specification scheme must provide fine grain control to applications that are aware of and require precise specification of a communication session configuration. Courser grain *macro*-level specification is also required for applications that are not aware of or are unconcerned with every detail of a session's configuration.

2. *Application-based Specification* – to allow most applications to specify a communication session in terms of the application domain, a specification scheme must provide sufficient insulation from the underlying protocol implementation. Application-based specification allows an application to specify high level communication *policies* (*e.g.*, deliver all data reliably) and relies on the transport system to decide on the actual *mechanisms* to be used (*e.g.*, PAR, ARQ, FEC).

BNSDOCID: <XP._____2315831A_I >

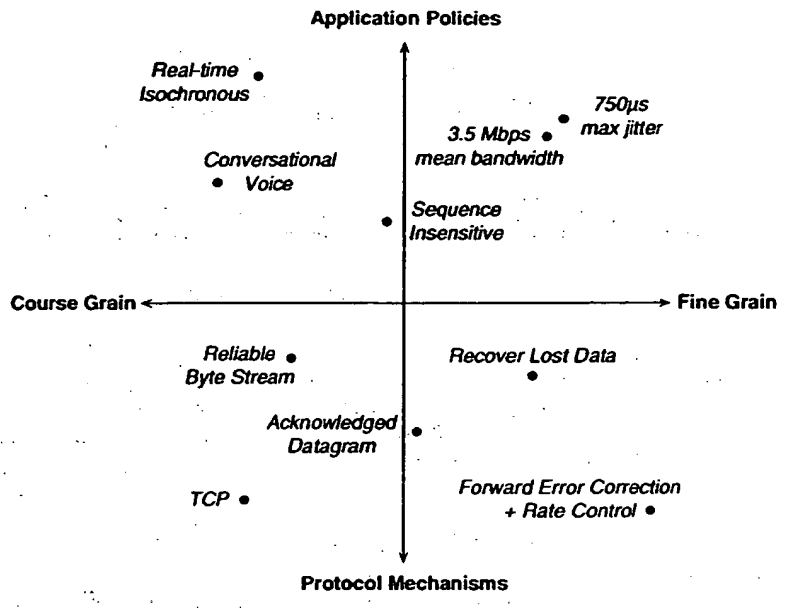


Figure 2: Hierarchical Specification

3. *Mechanism-based Specification* – provisions must be made for applications that require low-level control of the exact configuration of a communication session. Mechanism-based specification permits the application to bypass the application-based specification scheme by directly specifying the *mechanisms* used by a communication session. Provisions should be made for rejecting inconsistent protocol configurations resulting from incomplete or incompatible specifications.

4. *Application-Transport System Interaction* – the previous three requirements primarily address the initial configuration of a communication session. To effectively support the diversity and dynamism inherent in multimedia applications, explicit provisions for application-transport system interactions are required. These provisions take two forms:

   (a) *Transport System–Application Data Delivery*, which specifies the policies and mechanisms the transport system must use to deliver received data to the application. This entails dictating *when* to deliver the data (*e.g.*, immediately upon reception, periodically, or based on reception of related data) as well as *how* to deliver the data (*e.g.*, using an upcall mechanism[24] or read/write system calls).

   (b) *Application-guided Adaptation*, which specifies both the *conditions* the transport system needs to react to (*e.g.*, end-to-end delay exceeding some threshold, a remote application requesting an additional data stream on a connection) as well as the *actions* that are to be taken (*e.g.*, change retransmission mechanism, notify application via a callback).

The following section describes the ADAPTIVE Communication Descriptor, a hierarchical interface to flexible and adaptive transport services that satisfies the aforementioned requirements.

3.2 ADAPTIVE Communication Descriptor (ACD)

Applications request communication services from ADAPTIVE by providing MANTTS with a set of ADAPTIVE Communication Descriptors (ACDs). For a given communication session, the application furnishes a separate ACD per data stream that describes the behavior requested for that stream. Each ACD consists of five major components as follows:

1. **Quality of Service (QoS):** The QoS contains the *quantitative* description of the desired service. It allows the application to specify the a range of values to be used for each parameter (*e.g.*, minimum acceptable, expected maximum, expected mean, expected variance), providing a set of default values (*e.g.*, *don't care, maximum allowed, unknown*) for applications that are not capable of providing complete information. QoS parameters include throughput, connection duration, delay, jitter, and loss probability.

2. **Functionality of Service (FoS):** Applications specify the *qualitative* behavior of desired service using the FoS. The FoS describes the policies (*e.g.*, recover lost

BNSDOCID: <XP_____2315831A__I_>

Transport Service Class	Example Applications	Average Thruput	Burst Factor	Delay Sens	Jitter Sens	Order Sens	Loss Tolerance	Priority Delivery	Multi-cast
Interactive Isochronous	Voice Conversation	low	low	high	high	low	high	no	no
	Tele-Conferencing	mod	mod	high	high	low	mod	yes	yes
Distributional Isochronous	Full-Motion Video (comp)	high	high	high	mod	low	mod	yes	yes
	Full-Motion Video (raw)	very-high	low	high	high	low	mod	yes	yes
Real-Time Non-Isochronous	Manufacturing Control	mod	mod	high	var	high	low	yes	yes
Non-Real-Time Non-Isochronous	File Transfer	mod	low	low	N/D	high	none	no	no
	TELNET	very-low	high	high	low	high	none	yes	no
	On-Line Transaction Processing	low	high	high	low	var	none	no	no
	Remote File Service	low	high	high	low	var	none	no	yes

Figure 3: Transport Service Classes

data, suppress duplicates, encryption) that are to be carried out by the transport system. In contrast to the QoS, which describes *when* and *how much* data will be transmitted, the FoS describes *what* processing must be done before transmission and reception.

3. **Data Synchronization and Delivery (DSD):** The DDS specifies the the policies to be used in synchronizing multiple data streams within one communication session (*i.e.*, what tolerance of intra-stream drift is acceptable, what action to take given a loss of synchronization), and the mechanisms to be used to ultimately deliver the data to the application (*e.g.*, via read/write calls, via upcalls into application, via in-kernel direct routing to a device).

4. **Transport Service Adjustment (TSA):** The TSA allows applications to participate in the dynamic configuration of the communication session. The TSA is a set of $< condition, action >$ pairs, where the *condition* specifies what event the application is interested in responding to, (*e.g.*, resource request denied, latency exceeds 10ms), and the *action* specifies the response to be taken, either as a callback to the application, or a call to an internal ADAPTIVE routine. These internal routines range from macro-level operations, (*e.g.*, abort connection) to very fine grain actions that implement both *parametric*, *functional*, and em quantitative adaptivity. MANTTS provides a special condition value that, when used in conjunction with these functional adaptivity operations, allows the application to "escape" the normal configuration process and hard-wire a protocol configuration. The session configuration that results from this direct specification method can then be validated by ADAPTIVE/MANTTS to guarantee that a meaningful protocol will be produced (*i.e.*, that fundamental mechanism incompatibilities do not exist).

5. **Transport Metric Configuration (TMC):** To accommodate protocol development, prototyping and measurement, the TMC allows the application to specify what performance metrics it is interested in monitoring. Each metric is specified by (1) *what* is to be measured and *where* (*e.g.*, host system throughput, per-stream transmission count, transmission delay), (2) the sampling and reporting rate (*e.g.*, sample every k milliseconds, report every n seconds), and (3) the reporting action to be taken (*e.g.*, add sample(s) to a repository, callback to application). The TMC allows any application using ADAPTIVE services to instrument a communication session.

3.3 MANTTS Operation

ADAPTIVE Communication Descriptors provide the API to ADAPTIVE. Once the ACDs have been created by the application and passed to ADAPTIVE, MANTTS must then transform these configuration requests that are expressed in terms of application-domain requirements into a *Session Configuration Specifier (SCS)* that can be used to directly instantiate a communication session. This transformation process examines the parameters of an ACD and attempts to match it to a pre-configured *Transport Service Class (TSC)* that represents a common set of communication requirements shared by a class of applications (*e.g.*, Real-Time Non-Isochronous, Interactive Isochronous). Figure 3 shows a representative set of transport service classes and the parameters they encompass.

4 Transport Kernel Objects (TKO)

Transport Kernel Objects (TKO) is a protocol composition framework that provides flexible data transport service to applications. It provides a set of uniform abstract interfaces and a library of mechanism implementations for the various functions required to compose multimedia communication protocols. TKO is implemented as a collection of C++ *classes* that allow protocols to be composed using *objects* that implement the mechanisms used in a particular protocol configuration. As shown in Figure 4, TKO consists of two major subsystems:

1. *TKO Operating Services Interface Library (TKO-OSIL)* – a set of C++ classes that provide an efficient uniform interface to the basic operating system services required by all protocols. TKO-OSIL allows protocols to be implemented in a portable and consistent manner.

BNSDOCID: <XP_____2315831A__I_>

2. *TKO Mechanism Class Library (TKO-MCL)* – a set of C++ classes that provide implementations of the various protocol mechanisms that comprise a communication session. TKO-MCL is partitioned into mechanism *families* that allow several alternate implementations of a protocol function to share both interface and implementation.

The remainder of this section describes these two subsystems.

4.1 TKO-Operating Services Interface Library (TKO-OSIL)

Implementing efficient communication protocols for general purpose computers requires operating system support for protocol development and operation. The services required from the operating environment include scheduling, buffer management, multiplexing/demultiplexing and context management. Most existing systems provide some subset of these services (*e.g.*, BSD-UNIX[3], UNIX System V STREAMS[2], *x*-kernel[1]), but with very little consistency across environments. For example, all three of the previously mentioned systems provide some form of buffer management (*e.g.*, BSD `mbuf`, STREAMS `mblk`, *x*-kernel `Msg`), but each has somewhat different semantics and interfaces for the basic set of operations (*e.g.*, logical vs physical copying, appending/truncating messages). TKO-OSIL provides a consistent interface to these basic operating system services for use by TKO-MCL protocol implementations by providing the following three C++ classes:

1. `TKEvent` – the basic abstraction for temporal events. Many protocols must respond to temporal events such as retransmission timer expiration or periodic update requests [25]. The `TKEvent` class defines an infrastructure for event management, providing operations like `TKEvent::schedule`, `TKEvent::happen`, and `TKEvent::cancel`. `TKEvent` objects schedule themselves to happen one or more times (*i.e.*, they are intermittent or periodic), they may be cancelled, and they are triggered to happen asynchronously by the operating system's timer facility. To accommodate the synchronization of multimedia applications and protocols to isochronous devices (*e.g.*, D/A converters, frame buffers), `TKEvent` allows periodic events to enable or disable drift compensation to overcome fluctuations in system scheduling services.

2. `TKMessage` – the basic abstraction for incoming and outgoing network messages. Previous work has shown that memory-to-memory copying is a significant source of transport system overhead [26]. Therefore, some form of buffer management is necessary to avoid unnecessary copying when moving messages between protocol entities and when adding or deleting headers and trailers [27]. The `TKMessage` class provides a uniform interface for services that create, copy, prepend, and split messages. `TKMessage` objects are internally divided into two distinct regions: the *header* and the *data*. The data region supports efficient logical copying operations and segmenting and reassembling of data chunks. The header region supports operations (*e.g.*, `TKMessage::prepend` and `TKMessage::unprepend`) that efficiently prepend header information onto a message and later strip it off. Explicit support is also provided for combining/separating component sub-messages belonging to multiple data streams for subsequent delivery to the network or application.

3. `TKSession` – the basic abstraction for a communication session. A protocol implementation must retain a collection of state variables for the proper operation of the protocol. In a multiprotocol environment, this includes both (1) information that a protocol must maintain on a per-session basis for addressing, internal buffer management, and protocol specific operations, and (2) some mechanism for associating the state variables of a session to the global state of the specific protocol the session is associated with, specifically, which *operations* or *methods* are to be performed as part of the protocol processing. `TKSession` encapsulates this information behind a uniform abstract interface that allows basic protocol operations (*e.g.*, `TKSession::send`, `TKSession::recv`, `TKSession::control`) to be properly dispatched to the appropriate protocol function. `TKSession` is implemented in two parts: (1) *global variables and functions* – responsible for `TKSession` creation and management and demultiplexing incoming `TKMessages` to the appropriate `TKSession`, and (2) *instance variable and functions* – responsible for performing the protocol specific operations on incoming and outgoing `TKMessages`.

These three classes provide the foundation for the operation and composition of protocols using the TKO Mechanism Class Library described below.

4.2 TKO Mechanism Class Library (TKO-MCL)

TKO-MCL is implemented as a C++ class library of reusable C++ protocol mechanisms. Each TKO-MCL class is an implementation of a single protocol function (*e.g.*, error detection, encryption, transmission control), that encapsulates both the *state* and *method* needed to perform the desired function. A TKO protocol is composed from multiple lightweight TKO-MCL objects, each of which performs a different protocol function. The remainder of this section provides a description of TKO-MCL and discusses several performance enhancements available to TKO-MCL protocol implementors.

BNSDOCID: <XP_____2315831A__I_>

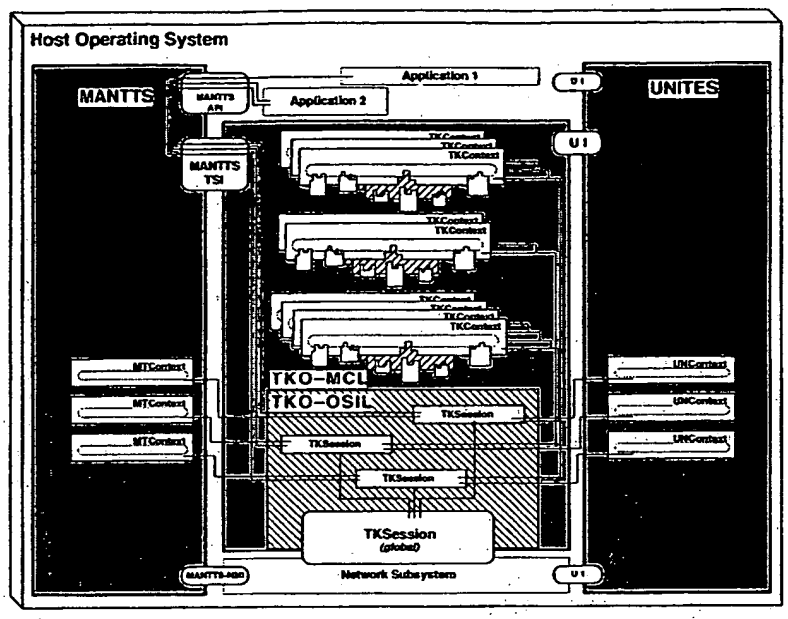


Figure 4: Transport Kernel Objects

4.2.1 Mechanism Families

To efficiently support flexible configuration and adaptive reconfiguration, TKO-MCL is organized as a C++ inheritance hierarchy. TKO-MCL takes advantage of C++ language mechanisms for (1) *encapsulation* to bind operations and their associated context allowing object-oriented protocol composition, (2) *dynamic binding* to allow protocol operations to be transparently and automatically selected at run-time, and (3) *inheritance* which allows multiple protocol mechanisms to be implemented as specializations of a single mechanism. As shown in Figure 5, the TKO-MCL class hierarchy is partitioned into multiple *Mechanism Families*, each of which provides one or more implementations of a given protocol function (*e.g.*, error reporting, encoding, stream synchronization). Each Mechanism Family consists of two distinct types of classes, a single Abstract Base Class (ABC), that defines the interface or *signature* for the protocol mechanism and optionally implements any shared or default behavior, from which one or more Concrete Derived Classes (CDCs) are derived, each of which represents a particular implementation of the abstract protocol function its family represents. Within a Mechanism Family, new mechanism implementations are usually implemented by deriving directly from the Abstract Base Class, but can alternatively be derived indirectly via a Concrete Derived Class when only a small amount of behavior in an existing implementation needs to be changed. Using derivation or *subclassing* as an implementation technique offers the following advantages:

- Shared interfaces allow multiple implementations to be transparently "plugged in" to perform a given protocol function. This interface consists of a collection of methods or C++ *member functions* that provide consistent and controlled access to the services provided by a mechanism implementation. The dynamic binding of *virtual* member functions in C++ ensures that the appropriate code is executed based upon the class a particular implementation is an instance of. A more detailed discussion of this appears in Section 4.2.2.

- Shared implementations allow a mechanism implementation to be expressed in terms of its *differences* from its base class. Reusing existing implementations via specialization allows new protocols to be implemented more rapidly and aids the task of protocol maintenance, as defects that are repaired in a base class are automatically repaired in any derived classes.

As shown in Figure 5, TKO-MCL provides a standard set of Mechanism Families that correspond to the basic mechanisms used in protocol processing (*e.g.*, Connection Management, Remote Context Management, Reliability Management, Stream Synchronization Management, Transmission Management). The Reliability Management Mechanism Family shown in Figure 5 is an example of a *Composite Component*, which is described in Section 4.2.3. As described above, each family contains a single Abstract Base Class that defines the basic interface to the mechanism, and multiple Concrete Derived Classes, that represent specific policy decisions that are used to implement a given mechanism.

BNSDOCID: <XP_____2315831A__I_>

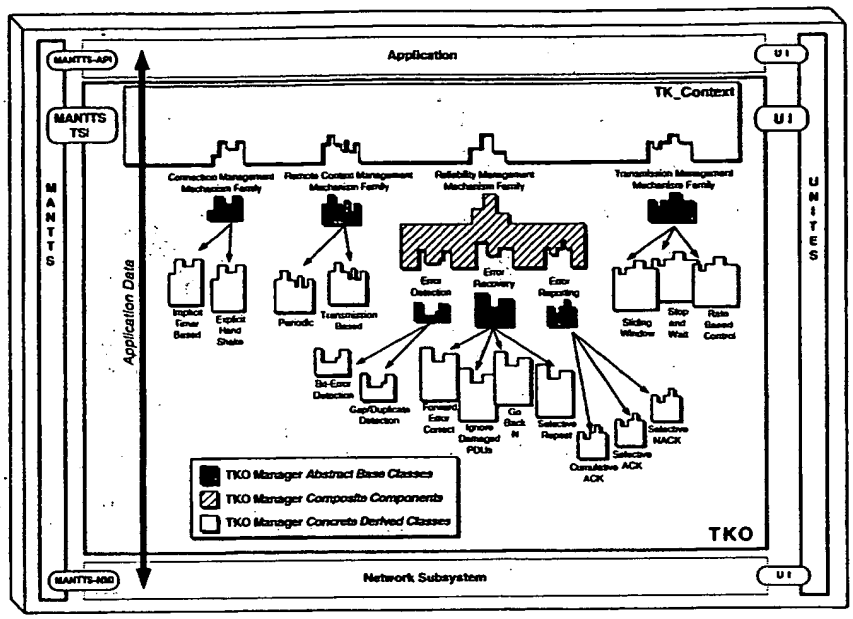


Figure 5: TKO Mechanism Class Library

4.2.2 Context Architecture

TKO provides an additional C++ class, `TKContext`, that links together a selection of various TKO-MCL mechanism implementations to form a cohesive protocol. TKO utilizes one `TKContext` per unidirectional data stream, combining multiple, possibly different, `TKContexts` to form a communication session. As shown in Figure 4, a single `TKSession` object is used to provide a rendezvous point for managing the `TKContexts` associated with the multiple data streams attached to a session. Each `TKContext` maintains a set of pointers to Abstract Base Classes, one for each TKO-MCL Mechanism Family. Operational `TKContexts` are created by setting these pointers to instances the appropriate Concrete Derived Classes.

4.2.3 Optimizations

As previously described, `TKContexts` maintain pointers to base classes and rely on language mechanisms to dynamically bind the appropriate executable code at run-time. Although studies have shown that it is possible to efficiently implement operating systems and communication protocols using these techniques [28, 29], ADAPTIVE/TKO provides several optimizations that streamline the creation and operation of commonly instantiated protocol configurations.

Composites: Figure 5 shows that Reliability Management is implemented as a *Composite Component*. Composites allow multiple related mechanism families to be bundled together into one larger mechanism. Composites are useful for enforcing relationships between multiple sub-mechanisms (*e.g.*, requiring go-back-N error recovery to use cumulative acknowledgments) while still allowing the sub-mechanisms to be independently used elsewhere (*e.g.*, using cumulative acknowledgment with sliding window flow control). Composites also allow the larger mechanism they represent to be replaced in one operation, which greatly reduces the complexity of run-time reconfiguration.

Preconfigured Contexts: TKO allows entire `TKContexts` to be preconfigured for commonly used protocol configurations. This entails implementing the class as a collection of actual instances of the constituent mechanisms, instead of a collection of *pointers* to instances that must be created separately and linked to the `TKContext` at run-time. This preconfiguration technique offers encreased performance by (1) eliminating one to two levels of indirection due to the pointer dereference and virtual function resolution and (2) by allowing instances of preconfigured contexts to be cached for faster instantiation.

5 UNIform Transport and Evaluation Subsystem (UNITES)

One of the primary goals of the ADAPTIVE system is to provide a framework for controlled protocol experimentation. ADAPTIVE provides an integrated experimentation environment by utilizing UNITES' metric specification, collection, analysis and presentation facilities. Performance data gathered by UNITES can be used to evaluate various protocol mechanisms and configurations with respect to (1) the level of service provided to the application, (2) the utilization of the underlying communication channel, and (3) the internal

BNSDOCID: <XP_____2315831A__I_>

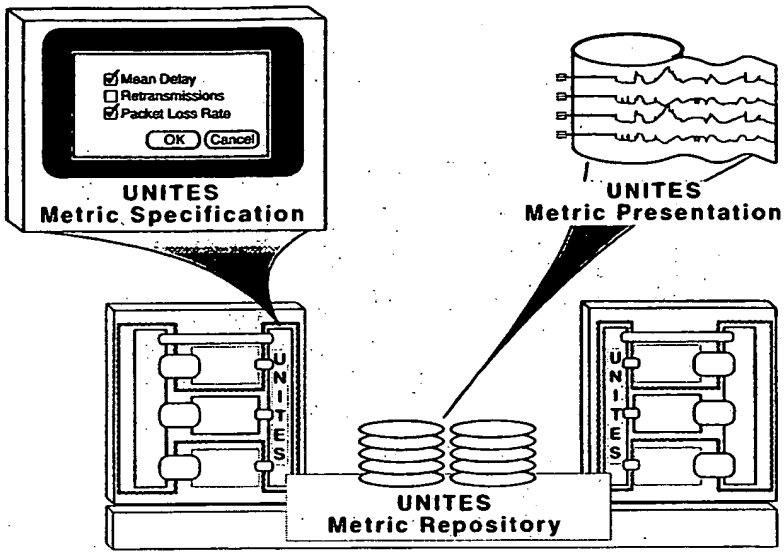


Figure 6: UNITES Architecture

performance characteristics of a given set of protocol mechanisms.

As shown in Figure 6, the UNITES Metric Repository stores the collected performance data in a shared database to minimize the intrusion made by the metric collection process [30]. Users may access this information via (1) UNITES-provided interactive graphic displays, (2) the UNITES C++ run-time library, or (3) standard network management protocols such as SNMP or CMIP. This metric data is available on either a systemwide, per-host, or per-connection basis. The performance monitoring process can be initiated when application programs use the Transport Measurement Component (TMC) parameter in the ADAPTIVE Communication Descriptor (ACD) to indicate the metrics they are interested in monitoring. ADAPTIVE then selectively instruments the instantiated TKO configurations and automatically collects the performance data during the operation of the system.

Metric collection may also be specified independent of a communication session using either a graphics-based or language-based interface to UNITES. Sjodin *et al.* [31] defines a specification language that indicates what measurements to collect and what traffic to generate. UNITES provides similar functionality with its UNITES Metric Specification Language (UMSL), but also provides a graphical interface that allows complex metric collection configurations to be specified using common user-interface elements (*e.g.*, check boxes, edit text fields, buttons, menus). This interface can be used to generate UMSL code for subsequent modification or to be used directly to configure a UNITES metric collection configuration.

UNITES supports two primary classes of metrics, *black box* and *white box*. Black box metrics require no knowledge of or interaction with the internal implementation of a protocol configuration. Black box metrics include application-based and host system-based metrics (*e.g.*, throughput, latency, and jitter) and network based metrics (*e.g.*, bit error rates, network utilization, and packet lengths). White box metrics require internal instrumentation of a protocol configuration and may be collected on a mechanism, mechanism family, connection, application, host system or system-wide basis. White box metrics include retransmission count, buffer utilization, instruction length, and scheduling and dispatching overhead. Both black box and white box metrics contribute to pinpointing performance bottlenecks in protocol configurations.

6 Summary

ADAPTIVE provides an integrated framework for protocol composition, evaluation and experimentation. It utilizes object-oriented design and implementation techniques to create an infrastructure for protocol composition that allows both flexible configuration and adaptive reconfiguration of communication protocols. The ADAPTIVE system integrates the hierarchical specification of application requirements and protocol configurations with the monitoring and reporting of performance metrics to create a transport system capable of adapting to network and application diversity and dynamism.

We are currently designing and implementing a prototype implementation written in C++ that runs under System V STREAMS. We plan to use this prototype to experiment with different transport system configurations that support multimedia applications (*e.g.*, network voice and video) running on several different networks (*e.g.*, Ethernet, Tree Network [32], DQDB, and FDDI).

BNSDOCID: <XP_____2315831A__I_>

Acknowledgments

We would like to thank Hung Huang, Unmesh Rathi, and Girish Kotmire for their help in designing the ADAPTIVE system.

BNSDOCID: <XP_____2315831A__I_>

References

[1] N. C. Hutchinson and L. L. Peterson, "Design of the *x*-Kernel," in *Proceedings of the SIGCOMM '88 Symposium*, (Stanford, Calif.), pp. 65–75, August 1988.

[2] UNIX Software Operations, *UNIX System V Release 4 Programmer's Guide: STREAMS*. Prentice Hall, 1990.

[3] S. J. Leffler, M. McKusick, M. Karels, and J. Quarterman, *The Design and Implementation of the 4.3BSD UNIX Operating System*. Addison-Wesley, 1989.

[4] J. Jain, M. Schwartz, and T. Bashkow, "Transport Protocol Processing at GBPS Rates," in *Proceedings of the Symposium on Communications Architectures and Protocols (SIGCOMM)*, (Philadelphia, PA), pp. 188–199, ACM, Sept. 1990.

[5] M. Zitterbart, "Parallel Protocol Implementations on Transputers – Experiences with OSI TP4, OSI CLNP, and XTP," in *Proceedings of the First IEEE Workshop on the Architecture and Implementation of High Performance Communication Subsystems*, Feb. 1992.

[6] T. F. L. Porta and M. Schwartz, "Design, Verification, and Analysis of a High Speed Protocol Parallel Implementation Architecture," in *Proceedings of the First IEEE Workshop on the Architecture and Implementation of High Performance Communication Subsystems*, Feb. 1992.

[7] H. Kanakia and D. R. Cheriton, "The VMP Network Adapter Board (NAB): High-Performance Network Communication for Multiprocessors," in *Proceedings of the Symposium on Communications Architectures and Protocols (SIGCOMM)*, (Stanford, CA), pp. 175–187, ACM, Aug. 1988.

[8] P. Steenkiste, "Analysis of the Nectar Communication Processor," in *Proceedings of the First IEEE Workshop on the Architecture and Implementation of High Performance Communication Subsystems*, Feb. 1992.

[9] M. L. Bailey, M. A. Pagels, and L. L. Peterson, "The *x*-chip: An Experiment in Hardware Demultiplexing," in *Proceedings of the First IEEE Workshop on the Architecture and Implementation of High Performance Communication Subsystems*, Feb. 1992.

[10] D. C. Schmidt, D. F. Box, and T. Suda, "ADAPTIVE: A Flexible and Adaptive Transport System Architecture to Support Lightweight Protocols for Multimedia Applications on High-Speed Networks," in *Proceedings of the 1st Symposium on High-Performance Distributed Computing (HPDC-1)*, (Syracuse, New York), pp. 174–186, IEEE, September 1992.

[11] M. Zitterbart, B. Stiller, and A. Tantawy, "A Model for Flexible High-Performance Communication Subsystems," Tech. Rep. TC 17801 (78023), IBM Research Division, February 1992.

[12] B. Heinrichs, "Versatile Protocol Processing for Multimedia Communications," in *4th IEEE ComSoc International Workshop on Multimedia Communications*, (Monterey, California), pp. 160–169, IEEE, 1992.

[13] C. Tschudin, "Flexible Protocol Stacks," in *Proceedings of the Symposium on Communications Architectures and Protocols (SIGCOMM)*, (Zurich Switzerland), pp. 197–205, ACM, Sept. 1991.

[14] W. Doeringer, D. Dykeman, M. Kaiserswerth, B. Meister, H. Rudin, and R. Williamson, "A Survey of Light-Weight Transport Protocols for High-Speed Networks," *IEEE Transactions on Communication*, vol. 38, pp. 2025–2039, November 1990.

[15] D. C. Feldmeier and E. W. Biersack, "Comparison of Error Control Protocols for High Bandwidth-Delay Product Networks," in *Protocols for High-Speed Networks II*, IFIP, 1991. a.

[16] B. W. Meister, "A Performance Study of the ISO Transport Protocol," *IEEE Transactions on Computers*, vol. 40, pp. 253–262, March 1991.

[17] L. Svobodova, "Measured Performance of Transport Service in LANs," in *Computer Networks and ISDN Systems*, 1989.

[18] B. Meyer, *Object Oriented Software Construction*. Englewood Cliffs, NJ: Prentice Hall, 1989.

[19] Bjarne Stroustrup and Margret Ellis, *The Annotated C++ Reference Manual*. Addison-Wesley, 1990.

[20] D. L. Parnas, P. Clements, and D. Weiss, "Enhancing Reusability with Information Hiding," *ITT Proceeding of the Workshop on Reusability in Programming*, 1983.

[21] M. Zitterbart and B. Stiller, "A Concept for A Flexible High Performance Transport System," in *Telecommunications and Multimedia Applications in Computer Science*, pp. 365–374, Oct. 1991.

[22] CCITT, Geneva, *CCITT Recommendation I.211: B-ISDN Service Aspects*, 1991.

[23] EC, "IBC Application Analysis, research and Developement in Advanced Communications Technologies in Europe," Tech. Rep. R1071, Commission of the European Communities, xxx 1991.

[24] D. D. Clark, "The Structuring of Systems Using Upcalls," in *Proceedings of the 10th Symposium on Operating System Principles*, (Shark Is., WA), 1985.

[25] A. N. Netravali, W. D. Roome, and K. Sabnani, "Design and Implementation of a High Speed Transport Protocol," *IEEE Transactions on Communications*, 1990.

[26] D. D. Clark, V. Jacobson, J. Romkey, and H. Salwen, "An Analysis of TCP Processing Overhead," *IEEE Communications Magazine*, vol. 27, pp. 23–29, June 1989.

[27] S. W. O'Malley, M. B. Abbott, N. C. Hutchinson, and L. L. Peterson, "A Transparent Blast Facility," *Journal of Internetworking*, vol. 1, December 1990.

[28] R. Campbell, V. Russo, and G. Johnson, "The Design of a Multiprocessor Operating System," in *Proceedings of the USENIX C++ Workshop*, pp. 109–126, USENIX Association, November 1987.

[29] J. M. Zweig, "The Conduit: a Communication Abstraction in C++," in *Proceedings of the 2nd USENIX C++ Conference*, pp. 191–203, USENIX Association, April 1990.

[30] O. Endriss, M. Steinbrunn, and M. Zitterbart, "NETMON-II a monitoring tool for distributed and multiprocessor systems," *Performance Evaluation*, pp. 191–201, 1991.

[31] P. Gunningberg, M. Bjorkman, E. Nordmark, S. Pink, P. Sjodin, and J.-E. Stromquist, "Application Protocols and Performance Benchmarks," *IEEE Communications Magazine*, vol. 27, pp. 30–36, June 1989.

BNSDOCID: <XP_____2315831A__I_>

[32] H. K. Huang, T. Suda, and Y. Noguchi, "LAN With Collision Avoidance: Switch Implementation and Simulation Study," in *Proceedings of the 15th Conference on Local Computer Networks*, 1990.

BNSDOCID: <XP_____2315831A__I_>

This Page is Inserted by IFW Indexing and Scanning Operations and is not part of the Official Record

BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- ☐ BLACK BORDERS
- ☐ IMAGE CUT OFF AT TOP, BOTTOM OR SIDES
- ☒ FADED TEXT OR DRAWING
- ☒ BLURRED OR ILLEGIBLE TEXT OR DRAWING
- ☐ SKEWED/SLANTED IMAGES
- ☒ COLOR OR BLACK AND WHITE PHOTOGRAPHS
- ☐ GRAY SCALE DOCUMENTS
- ☒ LINES OR MARKS ON ORIGINAL DOCUMENT
- ☐ REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY
- ☐ OTHER: _____

IMAGES ARE BEST AVAILABLE COPY.
As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	PATENT NUMBER	GROUP ART UNIT	FILE WRAPPER LOCATION
10/082,918		2687	04B0

Change of Address/Power of Attorney

The following fields have been set to Customer Number 47973 on

- Correspondence Address
- Power of Attorney

The address of record for Customer Number 47973 is:
WORKMAN NYDEGGER/MICROSOFT
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UT 84111

The Practitioners of record for Customer Number 47973 are:

PTO INSTRUCTIONS:

Please take the following action when the correspondence address has been changed to a customer number:
1) Add 'ADDRESS CHANGE TO CUSTOMER NUMBER' on the next available content line of the File Jacket.
2) Put a line through the old address on the File Jacket and enter the Customer Number as the new address.
3) File this Notice in the File Jacket.

Please take the following action when the correspondence address has NOT been changed:
1) File this Notice in the File Jacket

OIPE
NOV 12 2004
PATENT & TRADEMARK OFFICE 1600

11-15-04

2684
41

Express Mail Label No. EV 485 808 715 US

PATENT APPLICATION
Docket No. 13768.255

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

RECEIVED
NOV 19 2004
Technology Center 2600

In re application of	Shawn Domenic Loveland	
Serial No.:	10/082,918	Art Unit 2684
Filed:	February 26, 2002	
Conf. No.:	4771	
For:	SYNCHRONIZING OVER A NUMBER OF SYNCHRONIZATION MECHANISMS USING FLEXIBLE RULES	
Examiner:	Khai Minh Nyguyen	
Customer No.:	022913	

AMENDMENT "A"

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

Dear Sir:

In response to the Office action of August 25, 2004 (paper no. 3), please amend the above-identified application as follows:

Amendments to the Claims are reflected in the listing of claims which begins on page 2 of this paper.

Remarks/Arguments begin on page 17 of this paper.

CERTIFICATE OF MAILING BY "EXPRESS MAIL" (37 CFR 1.10) Applicant(s): Shawn Domenic Loveland				Docket No. 13768.255
Application No. 10/082,918	Filing Date 02/26/2002	Examiner NGUYEN, KHAI MINH	Customer No. 022913	Group Art Unit 2684

PTO JC50 NOV 12 2004 PATENT & TRADEMARK OFFICE

Invention: **SYNCHRONIZING OVER A NUMBER OF SYNCHRONIZATION MECHANISMS USING FLEXIBLE RULES**

RECEIVED
NOV 19 2004
Technology Center 2600

I hereby certify that the following correspondence:

Amendment Transmittal Letter (1 pg, in triplicate); Amendment "A" (22 pgs); postcard; and Certificate of Express Mailing Label No. EV 485 808 715 US.

(Identify type of correspondence)

is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 CFR 1.10 in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on

November 12, 2004
(Date)

Kelli Clark
(Typed or Printed Name of Person Mailing Correspondence)

(Signature of Person Mailing Correspondence)

EV 485 808 715 US
("Express Mail" Mailing Label Number)

Note: Each paper must have its own certificate of mailing.

AMENDMENT TRANSMITTAL LETTER (Large Entity) Applicant(s): Shawn Domenic Loveland					Docket No. 13768.255
Application No. 10/082,918	Filing Date 02/26/2002	Examiner NGUYEN, KHAI MINH	Customer No. 022913	Group Art Unit 2684	Confirmation No. 4771

OIPE JC50 NOV 12 2004 PATENT & TRADEMARK OFFICE

Invention: **SYNCHRONIZING OVER A NUMBER OF SYNCHRONIZATION MECHANISMS USING FLEXIBLE RULES**

RECEIVED
NOV 19 2004
Technology Center 2600

COMMISSIONER FOR PATENTS:

Transmitted herewith is an amendment in the above-identified application.

The fee has been calculated and is transmitted as shown below.

CLAIMS AS AMENDED

	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST # PREV. PAID FOR		NUMBER EXTRA CLAIMS PRESENT		RATE	ADDITIONAL FEE
TOTAL CLAIMS	58	-	60	=	0	x	$18.00	$0.00
INDEP. CLAIMS	6	-	7	=	0	x	$88.00	$0.00
Multiple Dependent Claims (check if applicable) ☐								$0.00
TOTAL ADDITIONAL FEE FOR THIS AMENDMENT								$0.00

☒ No additional fee is required for amendment.

☐ Please charge Deposit Account No. in the amount of

☐ A check in the amount of to cover the filing fee is enclosed.

☒ The Director is hereby authorized to charge payment of the following fees associated with this communication or credit any overpayment to Deposit Account **23-3178**

- ☒ Any additional filing fees required under 37 C.F.R. 1.16.
- ☒ Any patent application processing fees under 37 CFR 1.17.

☐ Payment by credit card. Form PTO-2038.

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

Signature

Dated: **November 12, 2004**

ERIC M. KAMERATH
Registration No. 46,081
Customer No. 022913

I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to "Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450" [37 CFR 1.8(a)] on

_____ .
(Date)

Signature of Person Mailing Correspondence

Typed or Printed Name of Person Mailing Correspondence

cc:

AMENDMENTS TO THE CLAIMS

The listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Currently Amended) In a network that includes a first computer system having a first data store and second computer system having a second data store, a method for synchronizing the first and second data stores in a flexible manner considering the circumstances that exist at the time of synchronization, the method comprising the following:

an act of the first computer system determining that a data item is to be synchronized;

an act of the first computer system identifying which of ~~the~~ a plurality of synchronization mechanisms are available to use for synchronization;

an act of the first computer system consulting a set of one or more flexible selection rules to select ~~one of the available~~ a synchronization ~~mechanisms~~mechanism, the set of one or more flexible rules taking into consideration value, from having access to synchronized data, relative to at least one of (i) an economic cost for synchronization using each available synchronization mechanism, (ii) network security for each available synchronization mechanism, or (iii) security of the second computer system, and thereby selecting an available synchronization mechanism appropriate for the data item given the one or more flexible selection rules; and

an act of the first computer system using the selected synchronization mechanism to synchronize the data item with the second computer.

2. (Original) A method in accordance with Claim 1, wherein the first computer system is a synchronization server, and the second computer system is a mobile device.

3. (Original) A method in accordance with Claim 1, wherein the first computer system is a mobile device, and the second computer system is a synchronization server.

4. (Original) A method in accordance with Claim 3, wherein the act of the first computer system determining that a data item is to be synchronized comprises the following:

an act of the mobile device determining on its own that the data item is to be synchronized.

5. (Original) A method in accordance with Claim 3, wherein the act of the first computer system determining that a data item is to be synchronized comprises the following:

an act of the mobile device receiving a user-issued instruction to synchronize the data item.

6. (Original) A method in accordance with Claim 3, wherein the act of the first computer system determining that a data item is to be synchronized comprises the following:

an act of the mobile device receiving a signal from the synchronization server that represents to the mobile device that the data item is to be synchronized.

7. (Original) A method in accordance with Claim 3, wherein the second data store is incorporated within a common sphere of trust.

8. (Original) A method in accordance with Claim 7, wherein the second data store is incorporated within a corporate network.

9. (Original) A method in accordance with Claim 3, wherein the second data store is incorporated within the Internet.

10. (Original) A method in accordance with Claim 3, wherein the mobile device comprises a mobile telephone.

11. (Original) A method in accordance with Claim 3, wherein the mobile device comprises a personal digital assistant.

12. (Original) A method in accordance with Claim 3, wherein the mobile device comprises a laptop computer.

13. (Original) A method in accordance with Claim 3, wherein the mobile device comprises a tablet personal computer.

14. (Original) A method in accordance with Claim 1, wherein the plurality of synchronization mechanisms comprises at least one wireless synchronization mechanism.

15. (Original) A method in accordance with Claim 14, wherein the at least one wireless synchronization mechanism uses a GPRS network.

16. (Original) A method in accordance with Claim 14, wherein the at least one wireless synchronization mechanism uses an 802.11a network.

17. (Original) A method in accordance with Claim 14, wherein the at least one wireless synchronization mechanism uses an 802.11b network.

18. (Original) A method in accordance with Claim 14, wherein the at least one wireless synchronization mechanism uses Bluetooth network.

19. (Original) A method in accordance with Claim 14, wherein the at least one wireless synchronization mechanism uses a cellular network.

20. (Original) A method in accordance with Claim 1, wherein the plurality of synchronization mechanisms comprises an analog dialup synchronization mechanism.

21. (Original) A method in accordance with Claim 1, wherein the plurality of synchronization mechanisms comprises a Virtual Private Network (VPN).

22. (Original) A method in accordance with Claim 1, further comprising the following:

an act of receiving instructions to change the set of flexible selection rules; and

an act of changing the set of selection rules in response to the instruction.

23. (Original) A method in accordance with Claim 22, wherein the act of receiving instructions to change the set of flexible selection rules comprises the following:

an act of receiving instructions to change the set of flexible selection rules from a user of the first computer system.

24. (Original) A method in accordance with Claim 22, wherein the act of receiving instructions to change the set of flexible selection rules comprises the following:

an act of receiving instructions to change the set of flexible selection rules from an agent of the second computer system.

25. (Original) A method in accordance with Claim 24, wherein the act of receiving instructions to change the set of flexible selection rules from an agent of the second computer system comprises the following:

an act of receiving instructions to change the set of flexible selection rules from a network administrator of a network that includes the second computer system.

26. (Original) A method in accordance with Claim 25, further comprising the following:

an act of receiving instructions to change the set of flexible selection rules from a user.

27. (Original) A method in accordance with Claim 26, wherein the act of changing the set of selection rules in response to the instruction, comprises the following:

an act of fulfilling the instructions received from the network administrator of the second computer system to the extent that there is a conflict between the instructions received from the network administrator of the second computer system and the instructions received from the user of the first computer system.

28. (Original) A method in accordance with Claim 1, wherein the act of the first computer system consulting a set of flexible selection rules comprises the following:

an act of the first computer system selecting one of the available synchronization mechanisms without synchronous intervention from a user of the first computer system.

29. (Original) A method in accordance with Claim 1, wherein the act of determining that a data item is to be synchronized comprises the following:

an act of the first computer system receiving a notification from the second computer system that a data item is available to synchronize;

an act of the first computer system notifying the user of the availability of the data item; and

an act of receiving a user-instruction to synchronize the data item.

30. (Original) A method in accordance with Claim 1, wherein the act of consulting a set of flexible selection rules to select one of the available synchronization mechanisms comprises the following:

an act of selecting the synchronization mechanism at least based on the time of day.

31. (Original) A method in accordance with Claim 1, wherein the act of consulting a set of flexible selection rules to select one of the available synchronization mechanisms comprises the following:

an act of selecting the synchronization mechanism at least based on the day of the week.

32. (Original) A method in accordance with Claim 1, wherein the act of consulting a set of flexible selection rules to select one of the available synchronization mechanisms comprises the following:

an act of selecting the synchronization mechanism at least based on the value of the data.

33. (Original) A method in accordance with Claim 1, wherein the act of consulting a set of flexible selection rules to select one of the available synchronization mechanisms comprises the following:

an act of selecting the synchronization mechanism at least based on the economic cost of using a network associated with the synchronization mechanism.

34. (Original) A method in accordance with Claim 1, wherein the act of consulting a set of flexible selection rules to select one of the available synchronization mechanisms comprises the following:

an act of selecting the synchronization mechanism at least based on the security of a network associated with the synchronization mechanism.

35. (Original) A method in accordance with Claim 1, wherein the act of consulting a set of flexible selection rules to select one of the available synchronization mechanisms comprises the following:

an act of selecting the synchronization mechanism at least based on the security of the first computer system.

36. (Original) A method in accordance with Claim 35, wherein the act of selecting the synchronization mechanism at least based on the security of the first computer system comprises the following:

an act of selecting the selecting the synchronization mechanism at least based on the security features inherent in devices of the same type as the first computer system

37. (Original) A method in accordance with Claim 35, wherein the act of selecting the synchronization mechanism at least based on the security of the first computer system comprises the following:

an act of selecting the selecting the synchronization mechanism at least based on current security settings of the first computer system

38. (Original) A method in accordance with Claim 1, wherein the act of consulting a set of flexible selection rules to select one of the available synchronization mechanisms comprises the following:

an act of selecting the synchronization mechanism at least based on the location of the user of the first computer system.

39. (Original) A method in accordance with Claim 1, wherein the act of consulting a set of flexible selection rules to select one of the available synchronization mechanisms comprises the following:

an act of determining that there are no current synchronization mechanisms that are selectable based on the flexible set of rules;

an act of reevaluating the flexible selection rules at a later time; and

an act of repeating the reevaluation until at least one of the available synchronization mechanisms is selectable based on the flexible selection rules.

40. (Original) A method in accordance with Claim 1, further comprising the following:

after using the selected synchronization mechanism to synchronize the data item, an act of determining that the conditions for synchronization are no longer met in light of the flexible selection rules; and

an act of automatically reversing the synchronization if it has been determined that the conditions for synchronization are no longer met.

41. (Original) A method in accordance with Claim 1, wherein the act of the first computer system determining that a data item is to be synchronized comprises the following:

an act of the first computer system determining whether to synchronize a data item by consulting a set of flexible selection rules; and

an act of the first computer system synchronize the data item with the second computer if the first computer system determines that the data item is to be synchronized.

42. (Currently Amended) A computer program product for use in a network that includes a first computer system having a first data store and second computer system having a second data store, the computer program product for implementing a method for synchronizing the first and second data stores in a flexible manner considering the circumstances that exist at the time of synchronization, the computer program product comprising one or more computer-readable media having stored thereon the following:

computer-executable instructions for determining that a data item is to be synchronized;

computer-executable instructions for identifying which of ~~the~~ a plurality of synchronization mechanisms are available to use for synchronization;

computer-executable instructions for consulting a set of one or more flexible selection rules to select ~~one of the available~~ a synchronization ~~mechanisms~~mechanism, the set of one or more flexible rules taking into consideration value, from having access to synchronized data, relative to at least one of (i) an economic cost for synchronization using each available synchronization mechanism, (ii) network security for each available synchronization mechanism, or (iii) security of the second computer system, and thereby selecting an available synchronization mechanism appropriate for the data item given the one or more flexible selection rules; and

computer-executable instructions for using the selected synchronization mechanism to synchronize the data item with the second computer.

43. (Original) A computer program product in accordance with Claim 42, wherein the one or more computer-readable media are physical storage media.

44-45. (Canceled).

46. (Currently Amended) In a network that includes a first computer system having a first data store and second computer system having a second data store, a method for synchronizing the first and second data stores in a flexible manner considering the circumstances that exist at the time of synchronization, the method comprising the following:

an act of the first computer system determining whether to synchronize a data item by consulting a set of one or more flexible selection rules, the set of one or more flexible rules taking into consideration value, from having access to synchronized data, relative to at least one of (i) an economic cost for synchronization using each available synchronization mechanism, (ii) network security for each available synchronization mechanism, or (iii) security of the second computer system, and thereby also determining an available synchronization mechanism appropriate for the data item given the one or more flexible selection rules; and

an act of the first computer system ~~synchronize~~ synchronizing the data item with the second computer if the first computer system determines that the data item is to be synchronized based on the one or more flexible selection rules and each available synchronization mechanism.

47. (Original) A method in accordance with Claim 46, wherein the first computer system is a synchronization server, and the second computer system is a mobile device.

48. (Original) A method in accordance with Claim 46, wherein the first computer system is a mobile device, and the second computer system is a synchronization server.

49. (Original) A method in accordance with Claim 46, further comprising the following:

an act of receiving instructions to change the set of flexible selection rules; and

an act of changing the set of flexible selection rules in response to the instruction.

50. (Original) A method in accordance with Claim 49, wherein the act of receiving instructions to change the set of flexible selection rules comprises the following:

an act of receiving instructions to change the set of flexible selection rules from a user of the first computer system.

51. (Original) A method in accordance with Claim 49, wherein the act of receiving instructions to change the set of flexible selection rules comprises the following:

an act of receiving instructions to change the set of flexible selection rules from an agent of the second computer system.

52. (Original) A method in accordance with Claim 51, wherein the act of receiving instructions to change the set of flexible selection rules from an agent of the second computer system comprises the following:

an act of receiving instructions to change the set of flexible selection rules from a network administrator of trusted network that includes the second computer system.

53. (Original) A method in accordance with Claim 52, further comprising the following:

an act of receiving instructions to change the set of flexible selection rules from a user.

54. (Original) A method in accordance with Claim 53, wherein the act of changing the set of flexible selection rules in response to the instruction, comprises the following:

an act of fulfilling the instructions received from the network administrator of the second computer system to the extent that there is a conflict between the instructions received from the network administrator of the second computer system and the instructions received from the user of the first computer system.

55. (Original) A method in accordance with Claim 46, further comprising the following:

after using the selected synchronization mechanism to synchronize the data item, an act of determining that the conditions for synchronization are no longer met in light of the flexible selection rules; and

an act of automatically reversing the synchronization if it has been determined that the conditions for synchronization are no longer met.

56. (Original) A method in accordance with Claim 46, wherein the act of the first computer system synchronize the data item with the second computer comprises the following:

an act of the first computer system identifying which of a plurality of synchronization mechanisms are available to use for synchronization;

an act of the first computer system consulting a set of flexible selection rules to select one of the available synchronization mechanisms; and

an act of the first computer system using the selected synchronization mechanism to synchronize the data item with the second computer.

57. (Currently Amended) A computer program product for use in a network that includes a first computer system having a first data store and second computer system having a second data store, the computer program product for implementing a method for synchronizing the first and second data stores in a flexible manner considering the circumstances that exist at the time of synchronization, the computer program product comprising one or more computer-readable media having stored thereon the following:

computer-executable instructions for determining whether to synchronize a data item by consulting a set of one or more flexible selection rules, the set of one or more flexible rules taking into consideration value, from having access to synchronized data, relative to at least one of (i) an economic cost for synchronization using each available synchronization mechanism, (ii) network security for each available synchronization mechanism, or (iii) security of the second computer system, and thereby also determining an available synchronization mechanism appropriate for the data item given the one or more flexible selection rules; and

computer-executable instructions for ~~synchronize~~ synchronizing the data item with the second computer if the first computer system determines that the data item is to be synchronized based on the one or more flexible selection rules and each available synchronization mechanism.

58. (Original) A computer program product in accordance with Claim 57, wherein the one or more computer-readable media comprise physical storage media.

59. (Currently Amended) A network system comprising the following:

a synchronization server comprising a data store, a networking module, and a processing module configured to access the data store as well as communicate over a network using the networking module;

a mobile device having a data store, a networking module, and a processing ~~modules~~ module configured to access the data store of the mobile device as well as communicate with the synchronization server over the network using the networking module of the mobile device, the processing device of the mobile device configured to perform the following:

determine that a data item is to be synchronized;

identify which of ~~the~~ a plurality of synchronization mechanisms are available to use for synchronization;

consult a set of one or more flexible selection rules to select ~~one of the available~~ a synchronization ~~mechanisms~~mechanism, the set of one or more flexible rules taking into consideration value, from having access to synchronized data, relative to at least one of (i) an economic cost for synchronization using each available synchronization mechanism, (ii) network security for each available synchronization mechanism, or (iii) security of the second computer system, and thereby select an available synchronization mechanism appropriate for the data item given the one or more flexible selection rules; and

use the selected synchronization mechanism to synchronize the data item.

60. (Currently Amended) A network system comprising the following:

a synchronization server comprising a data store, a networking module, and a processing module configured to access the data store as well as communicate over a network using the networking module;

a mobile device having a data store, a networking module, and a processing ~~modules~~ module configured to access the data store of the mobile device as well as communicate with the synchronization server over the network using the networking module of the mobile device, the processing device of the synchronization server configured to perform the following:

determine that a data item is to be synchronized;

identify which of ~~the~~ a plurality of synchronization mechanisms are available to use for synchronization;

consult a set of one or more flexible selection rules to select ~~one of the available~~ a synchronization ~~mechanisms~~mechanism, , the set of one or more flexible rules taking into consideration value, from having access to synchronized data, relative to at least one of (i) an economic cost for synchronization using each available synchronization mechanism, (ii) network security for each available synchronization mechanism, or (iii) security of the second computer system, and thereby select an available synchronization mechanism appropriate for the data item given the one or more flexible selection rules; and

use the selected synchronization mechanism to synchronize the data item.

REMARKS

Applicants and Applicants' attorney express appreciation to the Examiner for the courtesies extended during the recent interview held on October 7, 2004. The amendments and arguments presented in this paper are consistent with the proposed amendments and arguments discussed during the Interview.

Claims 1-43 and 46-60 are pending, of which claims 1 and 44 are independent method claims with corresponding independent computer program product claims 42 and 57, respectively. As indicated above, claims 44-45 have been canceled and claims 1, 42, 46, 57, 59, and 60 have been amended by this paper.[1]

The Office Action rejected each of the pending independent claims (1, 42, 46, 57, 59, and 60) under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent Application Publication No. 2003/0125057 by Pesola ("*Pesola*"), and rejected the remaining dependent claims as either anticipated under 35 U.S.C. § 102(e) by *Pesola* or under 35 U.S.C. § 103(a) as being unpatentable over *Pesola* in view of U.S. Patent Application Publication No. 2003/0036398 by Asakawa ("*Asakawa*"), U.S. Patent Application Publication No. 2003/0119524 by Carlsson ("*Carlsson*"), U.S. Patent Application Publication No. 2002/0197984 by Monin et al. ("*Monin*"), or U.S. Patent No. 6,285,680 to Steinka et al. ("*Steinka*").[2]

Applicants invention, as claimed for example in independent method claim 1, relates to synchronizing first and second data stores in a flexible manner considering the circumstances that exist at the time of synchronization. The method includes the first computer system determining that a data item is to be synchronized; the first computer system identifying which

[1]Support for the amendments can be found throughout the Specification, and particularly at paragraphs [0023], [0041] [0047]-[0052].

[2]Applicants do not acquiesce the prior art status or asserted teachings of the cited art, and specifically reserve the right to challenge those asserted teaching and/or the prior art status of the cited art in the future.

of a plurality of synchronization mechanisms are available to use for synchronization; the first computer system consulting a set of one or more flexible selection rules to select a synchronization mechanism, the set of one or more flexible rules taking into consideration value, from having access to synchronized data, relative to at least one of (i) an economic cost for synchronization using each available synchronization mechanism, (ii) network security for each available synchronization mechanism, or (iii) security of the second computer system, and thereby selecting an available synchronization mechanism appropriate for the data item given the one or more flexible selection rules; and the first computer system using the selected synchronization mechanism to synchronize the data item with the second computer. Independent claim 42 recites similar limitations from the perspective of a computer program product.

Applicants invention, as claimed for example in independent method claim 46, also relates to synchronizing first and second data stores in a flexible manner considering the circumstances that exist at the time of synchronization. The method includes the first computer system determining whether to synchronize a data item by consulting a set of one or more flexible selection rules, the set of one or more flexible rules taking into consideration value, from having access to synchronized data, relative to at least one of (i) an economic cost for synchronization using each available synchronization mechanism, (ii) network security for each available synchronization mechanism, or (iii) security of the second computer system, and thereby also determining an available synchronization mechanism appropriate for the data item given the one or more flexible selection rules; and the first computer system synchronizing the data item with the second computer if the first computer system determines that the data item is to be synchronized based on the one or more flexible selection rules and each available

synchronization mechanism. Independent claim 57 recites similar limitations from the perspective of a computer program product.

Applicants invention, as claimed for example in independent system claim 59, relates to a network system. The network system includes a synchronization server comprising a data store, a networking module, and a processing module configured to access the data store as well as communicate over a network using the networking module; a mobile device having a data store, a networking module, and a processing module configured to access the data store of the mobile device as well as communicate with the synchronization server over the network using the networking module of the mobile device, the processing device of the mobile device configured to perform the following: determine that a data item is to be synchronized; identify which of a plurality of synchronization mechanisms are available to use for synchronization; consult a set of one or more flexible selection rules to select a synchronization mechanism, the set of one or more flexible rules taking into consideration value, from having access to synchronized data, relative to at least one of (i) an economic cost for synchronization using each available synchronization mechanism, (ii) network security for each available synchronization mechanism, or (iii) security of the second computer system, and thereby select an available synchronization mechanism appropriate for the data item given the one or more flexible selection rules; and use the selected synchronization mechanism to synchronize the data item. Independent claim 60 recites similar limitations from the perspective of a processing device of a synchronization server.

"A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." MPEP § 2131. That is, "for anticipation under 35 U.S.C. 102, the reference must teach every aspect of the claimed

invention either explicitly or impliedly." MPEP § 706.02. Applicants also note that "[i]n determining that quantum of prior art disclosure which is necessary to declare an applicant's invention 'not novel' or 'anticipated' within section 102, the stated test is whether a reference contains an 'enabling disclosure.'" MPEP § 2121.01. In other words, a cited reference must be enabled with respect to each claim limitation. During examination, the pending claims are given their broadest reasonable interpretation, *i.e.*, they are interpreted as broadly as their terms reasonably allow, consistent with the specification. MPEP §§ 2111 & 2111.01.

Pesola discloses a system and method for synchronizing managed data. ¶ [0008]. The system and method includes establishing a communication link between first and second computing devices, automatically identifying the managed data stored on the first computing device for synchronization, automatically transferring synchronization information associated with the managed data stored on the first computing device to the second computing device over the communication link, reconciling differences in the managed data stored on the first and second computing devices based on the synchronization information to generate reconciliation information, and transferring the reconciliation information from the second computing device to the first computing device to synchronize the managed data. *Id.*

However, among other things, *Pesola* fails to teach, suggest, motivate, or enable consulting a set of one or more flexible selection rules to select a synchronization mechanism, the set of one or more flexible rules taking into consideration value, from having access to synchronized data, relative to at least one of (i) an economic cost for synchronization using each available synchronization mechanism, (ii) network security for each available synchronization mechanism, or (iii) security of the second computer system, and thereby selecting an available synchronization mechanism appropriate for the data item given the one or more flexible selection

rules, as recited in each of the pending independent claims, as recited in independent claims 1, 47, 59 and 60; or determining whether to synchronize a data item by consulting a set of one or more flexible selection rules, the set of one or more flexible rules taking into consideration value, from having access to synchronized data, relative to at least one of (i) an economic cost for synchronization using each available synchronization mechanism, (ii) network security for each available synchronization mechanism, or (iii) security of the second computer system, and thereby also determining an available synchronization mechanism appropriate for the data item given the one or more flexible selection rules, as recited in independent claims 44 and 47.

The Examiner seemed to concur with this analysis during the Interview and noted in the Interview Summary that the proposed amendments to the independent claims appear to distinguish over the cited references, and that upon receiving Applicants' formal response the Examiner will consider the references further and update the search if necessary.

Based on at least the foregoing reasons, therefore, Applicants respectfully submit that the cited art fails to anticipate or make obvious Applicants' invention, as claimed, for example, in independent claims 1, 42, 46, 57, 59, and 60. Applicants note for the record that the other rejections and assertions of record with respect to the independent and dependent claims are now moot, and therefore need not be addressed individually. Accordingly, Applicants do not acquiesce to any assertions in the Office Action that are not specifically addressed above, and hereby reserve the right to challenge those assertions in the future, if necessary or desired.

In the event that the Examiner finds any remaining impediment to a prompt allowance of this application that may be clarified through a telephone interview, the Examiner is requested to contact the undersigned attorney.

Dated this 12th day of November, 2004.

Respectfully submitted,

RICK D. NYDEGGER
Registration No. 28,651
ERIC M. KAMERATH
Registration No. 46,081
Attorneys for Applicant

Customer No. 022913

EMK:kc
KC0000003201V001

PATENT APPLICATION FEE DETERMINATION RECORD
Effective October 1, 2001

Application or Docket Number: 10/082918

CLAIMS AS FILED - PART I

	(Column 1)	(Column 2)
TOTAL CLAIMS	60	
FOR	NUMBER FILED	NUMBER EXTRA
TOTAL CHARGEABLE CLAIMS	60 minus 20=	* 40
INDEPENDENT CLAIMS	7 minus 3 =	* 4
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	370.00	OR	BASIC FEE	740.00
X$ 9=		OR	X$18=	720
X42=		OR	X84=	
+140=		OR	+280=	336
TOTAL		OR	TOTAL	1796

11/12/04

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	* 58	Minus	**	=
Independent	* 6	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=	
X42=		OR	X84=	
+140=		OR	+280=	
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=	
X42=		OR	X84=	
+140=		OR	+280=	
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
X$ 9=		OR	X$18=	
X42=		OR	X84=	
+140=		OR	+280=	
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20."
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3."
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

Need to Scan

UNITED STATES DEPARTMENT OF COMMERCE
Patent and Trademark Office
Address: COMMISSIONER OF PATENTS AND TRADEMARK
Washington, D.C. 20231

APPLICATION NUMBER	FILING DATE	FIRST NAMED APPLICANT	ATTORNEY DOCKET NO.
10/082,918	02/26/02	Loveland et al.	13768.255

EXAMINER	
Khai Nguyen	
ART UNIT	PAPER NUMBER
2687	4

DATE MAILED:

INTERVIEW SUMMARY

All participants (applicant, applicant's representative, PTO personnel):

(1) Eric Kamerath Reg No. 46081 (3) Khai Nguyen

(2) Nick Corsaro (4)

Date of Interview

Type: ☐ Telephonic ☐ Televideo Conference ☒ Personal (copy is given to ☐ applicant ☐ applicant's representative).

Exhibit shown or demonstration conducted: ☐ Yes ☒ No If yes, brief description:

Agreement ☐ was reached. ☐ was not reached.

Claim(s) discussed: Independent Claims

Identification of prior art discussed: US 2003/0125057 A1 Pesola

Description of the general nature of what was agreed to if an agreement was reached, or any other comments: Applicants proposed Amendments to the Independent Claims, appear to distinguish over the cited References. Upon Recieving Applicant's Formal Reposse the Examiner will consider the Reference and update Search if Necessary.

(A fuller description, if necessary, and a copy of the amendments, if available, which the examiner agreed would render the claims allowable must be attached. Also, where no copy of the amendments which would render the claims allowable is available, a summary thereof must be attached.)

☐ It is not necessary for applicant to provide a separate record of the substance of the interview.

Unless the paragraph above has been checked to indicate to the contrary. A FORMAL WRITTEN REPLY TO THE LAST OFFICE ACTION IS NOT WAIVED AND MUST INCLUDE THE SUBSTANCE OF THE INTERVIEW. (See MPEP Section 713.04). If a reply to the last Office action has are ready been filed, APPLICANT IS GIVEN ONE MONTH FROM THIS INTERVIEW DATE TO FILE A STATEMENT OF THE SUBSTANCE OF THE INTERVIEW.

Examiner Note: You must sign this form unless it is an attachment to another form.

Nick Corsaro 10/07/04

Khai Nguyen 10/07/04

FORM PTOL-413 (REV. 2-98)

Manual of Patent Examining Procedure, Section 713.04 Substance of Interview must Be Made of Record

Except as otherwise provided, a complete written statement as to the substance of any face-to-face or telephone interview with regard to an application must be made of record in the application, whether or not an agreement with the examiner was reached at the interview.

§1.133 Interviews

* * * * *

(b) In every instance where reconsideration is requested in view of an interview with an examiner, a complete written statement of the reasons presented at the interview as warranting favorable action must be filed by the applicant. An interview does not remove the necessity for reply to Office action as specified in §§ 1.111 and 1.135. (35 U.S.C. 132)

§ 1.2. Business to be transacted in writing. All business with the Patent or Trademark Office should be transacted in writing. The personal attendance of applicants or their attorneys or agents at the Patent and Trademark Office is unnecessary. The action of the Patent and Trademark Office will be based exclusively on the written record in the Office. No attention will be paid to any alleged oral promise, stipulation, or understanding in relation to which there is disagreement or doubt.

The action of the Patent and Trademark Office cannot be based exclusively on the written record in the Office if that record is itself incomplete through the failure to record the substance of interviews.

It is the responsibility of the applicant or the attorney or agent to make the substance of an interview of record in the application file, unless the examiner indicates he or she will do so. It is the examiner's responsibility to see that such a record is made and to correct material inaccuracies which bear directly on the question of patentability.

Examiners must complete a two-sheet carbon interleaf Interview Summary Form for each interview held after January 1, 1978 where a matter of substance has been discussed during the interview by checking the appropriate boxes and filling in the blanks in neat handwritten form using a ball point pen. Discussions regarding only procedural matters, directed solely to restriction requirements for which interview recordation is otherwise provided for in Section 812.01 of the Manual of Patent Examining Procedure, pointing out typographical errors or unreadable script in Office actions or the like, or resulting in an examiner's amendment that fully sets forth the agreement are excluded from the interview recordation procedures below.

The Interview Summary Form shall be given an appropriate paper number, placed in the right hand portion of the file, and listed on the "Contents" list on the file wrapper. In a personal interview, the duplicate copy of the Form is removed and given to the applicant (or attorney or agent) at the conclusion of the interview. In the case of a telephonic interview, the copy is mailed to the applicant's correspondence address either with or prior to the next official communication.

The Form provides for recordation of the following information:

- Application Number of the application
- Name of applicant
- Name of examiner
- Date of interview
- Type of interview (personal or telephonic)
- Name of participant(s)) (applicant, attorney or agent, etc.)
- An indication whether or not an exhibit was shown or a demonstration conducted
- An identification of the claims discussed
- An identification of the specific prior art discussed
- An indication whether an agreement was reached and if so, a description of the general nature of the agreement (may be by attachment of a copy of amendments or claims agreed as being allowable). (Agreements as to allowability are tentative and do not restrict further action by the examiner to the contrary.)
- The signature of the examiner who conducted the interview .
- Names of other Patent and Trademark Office personnel present.

The Form also contains a statement reminding the applicant of his responsibility to record the substance of the interview.

It is desireable that the examiner orally remind the applicant of his obligation to record the substance of the interview in each case unless both applicant and examiner agree that the examiner will record same. Where the examiner agrees to record the substance of the interview, or when it is adequately recorded on the Form or in an attachment to the Form, the examiner should check a box at the bottom of the Form informing the applicant that he need not supplement the Form by submitting a separate record of the substance of the interview.

It should be noted, however, that the Interview Summary Form witl not normally be considered a complete and proper recordation of the interview unless it includes, or is supplemented bv the applicant or the examiner to include, all of the applicable items required below concerning the substance of the interview:

A complete and proper recordation of the substance of any interview should include at least the following applicable items:

1) A brief description of the nature of any exhibit shown or any demonstration conducted;
2) an identification of the claims discussed,
3) an identification of specific prior art discussed,
4) an identification of the principal proposed amendments of a substantive nature discussed, unless these are already described on the Interview Summary Form completed by the examiner,
5) a brief identification of the general thrust of the principal arguments presented to the examiner. The identification of arguments need not be lengthy or elaborate. A verbatim or highly detailed description of the arguments is not required. The identification of the arguments is sufficient if the general nature or thrust of the principal arguments made to the examiner can be understood in the context of the application file. Of course, the applicant may desire to emphasize and fully describe those arguments which he feels were or might be persuasive to the examiner,
6) a general indication of any other pertinent matters discussed, and
7) if appropriate, the general results or outcome of the interview unless already described in the Interview Summary Form completed by the examiner.

Examiners are expected to carefully review the applicant's record of the substance of an interview. If the record is not complete or accurate, the examiner will give the applicant one month from the date of the notifying letter to complete the reply and thereby avoid abandonment of the application (37 CFR 1.135(c)).

Examiner to Check for Accuracy

Applicant's summary of what took place at the interview should be carefully checked to determine the accuracy of any argument or statement attributed to the examiner during the interview. If there is an inaccuracy and it bears directly on the question of patentability, it should be pointed out in the next Office letter. If the claims are allowable for other reasons of record, the examiner should send a letter setting forth his or her version of the statement attributed to him. If the record is complete and accurate, the examiner should place the indication "Interview record OK" on the paper recording the substance of the interview along with the date and the examiner's initials.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/082,918	02/26/2002	Shawn Domenic Loveland	13768.255	4771

22913 7590 08/25/2004

WORKMAN NYDEGGER (F/K/A WORKMAN NYDEGGER & SEELEY)
60 EAST SOUTH TEMPLE
1000 EAGLE GATE TOWER
SALT LAKE CITY, UT 84111

EXAMINER	
NGUYEN, KHAI MINH	

ART UNIT	PAPER NUMBER
2684	3

DATE MAILED: 08/25/2004

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

Office Action Summary	Application No.	Applicant(s)	
	10/082,918	LOVELAND, SHAWN DOMENIC	
	Examiner	Art Unit	
	Khai M Nguyen	2684	

-- 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 *26 February 2002*.

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) *1-60* 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) *1-60* 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 _____ 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 2.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1-8, 10-14, 22-60 are rejected under 35 U.S.C. 102(e) as being anticipated by Pesola (U.S. Pub-20030125057).

Regarding claim 1, Pesola teaches in a network (fig.1) that includes a first computer system having a first data store (fig.1, paragraph 0008) and second computer system having a second data store (fig.1, paragraph 0008), a method for synchronizing the first and second data stores in a flexible manner considering the circumstances that exist at the time of synchronization (fig.1, paragraph 0008, 0019), the method comprising the following:

an act of the first computer system determining that a data item is to be synchronized (fig.1, paragraph 0005, 0008);

an act of the first computer system identifying which of the plurality of synchronization mechanisms are available to use for synchronization (fig.1, paragraph 0008, 0015);

an act of the first computer system consulting a set of flexible selection rules to select one of the available synchronization mechanisms (fig.1, paragraph 0008, 0016, 0019);

and an act of the first computer system using the selected synchronization mechanism to synchronize the data item with the second computer (fig.1, paragraph 0008, 0018-0019).

Regarding claim 2, Pesola teaches a method in accordance with claim 1, wherein the first computer system is a synchronization server, and the second computer system is a mobile device (fig.1, paragraph 0005, 0008, 0013).

Regarding claim 3, Pesola teaches a method in accordance with claim 1, wherein the first computer system is a mobile device, and the second computer system is a synchronization server (fig.1, paragraph 0004, 0008, 0013).

Regarding claim 4, Pesola teaches a method in accordance with claim 3, wherein the act of the first computer system determining that a data item is to be synchronized (fig.1, paragraph 0005, 0008) comprises the following:

an act of the mobile device determining on its own that the data item is to be synchronized (fig.1, paragraph 0004, 0013).

Regarding claim 5, Pesola teaches a method in accordance with claim 3, wherein the act of the first computer system determining that a data item is to be synchronized (fig.1, paragraph 0005, 0008) comprises the following:

an act of the mobile device receiving a user-issued instruction to synchronize the data item (fig.1, fig.2, paragraph 0005, 0013, 0022, 0024).

Regarding claim 6, Pesola teaches a method in accordance with claim 3, wherein the act of the first computer system determining that a data item is to be synchronized (fig.1, paragraph 0005, 0008) comprises the following:

an act of the mobile device receiving a signal from the synchronization server that represents to the mobile device that the data item is to be synchronized (fig.1, fig.2, paragraph 0005, 0013, 0025).

Regarding claim 7, Pesola teaches a method in accordance with claim 3, wherein the second data store is incorporated within a common sphere of trust (fig.1, paragraph 0008).

Regarding claim 8, Pesola teaches a method in accordance with claim 7, wherein the second data store is incorporated within a corporate network (fig.1, paragraph 0005, 0008).

Regarding claim 10, Pesola teaches a method in accordance with claim 3, wherein the mobile device comprises a mobile telephone (fig.1, paragraph 0004, 0013).

Regarding claim 11, Pesola teaches a method in accordance with claim 3, wherein the mobile device comprises a personal digital assistant (fig.1, paragraph 0004, 0013).

Regarding claim 12, Pesola teaches a method in accordance with claim 3, wherein the mobile device comprises a laptop computer (fig.1, paragraph 0004, 0013).

Regarding claim 13, Pesola teaches a method in accordance with claim 3, wherein the mobile device comprises a tablet personal computer (fig.1, paragraph 0004, 0013).

Regarding claim 14, Pesola teaches a method in accordance with claim 1, wherein the plurality of synchronization mechanisms comprises at least one wireless synchronization mechanism (fig.1, paragraph 0005, 0008).

Regarding claim 22, Pesola teaches a method in accordance with claim 1, further comprising the following:

an act of receiving instructions to change the set of flexible selection rules (fig.1, paragraph 0019, 0022); and

an act of changing the set of selection rules in response to the instruction (fig.1, paragraph 0006, 0019, 0022).

Regarding claim 23, Pesola teaches a method in accordance with claim 22, wherein the act of receiving instructions to change the set of flexible selection rules (fig.1, paragraph 0006, 0019, 0022) comprises the following:

an act of receiving instructions to change the set of flexible selection rules from a user of the first computer system (fig.1, paragraph 0006, 0019, 0022).

Regarding claim 24, Pesola teaches a method in accordance with claim 22, wherein the act of receiving instructions to change the set of flexible selection rules (fig.1, paragraph 0008, 0016, 0019) comprises the following:

an act of receiving instructions to change the set of flexible selection rules from an agent of the second computer system (fig.1, paragraph 0006, 0008, 0019, 0022).

Regarding claim 25, Pesola teaches a method in accordance with claim 24, wherein the act of receiving instructions to change the set of flexible selection rules from an agent of the second computer system (fig.1, paragraph 0006, 0008, 0019, 0022) comprises the following:

an act of receiving instructions to change the set of flexible selection rules from a network administrator of a network that includes the second computer system (fig.1, fig.2, paragraph 0006, 0008, 0019, 0022).

Regarding claim 26, Pesola teaches a method in accordance with claim 25, further comprising the following:

an act of receiving instructions to change the set of flexible selection rules from a user (fig.1, paragraph 0016, 0022).

Regarding claim 27, Pesola teaches a method in accordance with claim 26, wherein the act of changing the set of selection rules in response to the instruction (fig.1, paragraph 0006, 0019, 0022), comprises the following:

an act of fulfilling the instructions received from the network administrator of the second computer system to the extent that there is a conflict between the instructions received from the network administrator of the second computer system and the instructions received from the user of the first computer system (fig.1, fig.2, paragraph 0008, 0013, 0022).

Regarding claim 28, Pesola teaches a method in accordance with claim 1, wherein the act of the first computer system consulting a set of flexible selection rules (paragraph 0008) comprises the following:

an act of the first computer system selecting one of the available synchronization mechanisms without synchronous intervention from a user of the first computer system (fig.1, paragraph 0009).

Regarding claim 29, Pesola teaches a method in accordance with claim 1, wherein the act of determining that a data item is to be synchronized (paragraph 0008) comprises the following:

an act of the first computer system receiving a notification from the second computer system that a data item is available to synchronize (fig.1,fig.2, paragraph 0008, 0022);

an act of the first computer system notifying the user of the availability of the data item; and an act of receiving a user-instruction to synchronize the data item (fig.1, fig.2, paragraph 0005, 0008, 0013, 0022).

Regarding claim 30, Pesola teaches a method in accordance with claim 1, wherein the act of consulting a set of flexible selection rules to select one of the available synchronization mechanisms (fig.1, paragraph 0008, 0016, 0019) comprises the following:

an act of selecting the synchronization mechanism at least based on the time of day (paragraph 0009).

Regarding claim 31, Pesola teaches a method in accordance with claim 1, wherein the act of consulting a set of flexible selection rules to select one of the

available synchronization mechanisms (fig.1, paragraph 0008, 0016, 0019) comprises the following:

an act of selecting the synchronization mechanism at least based on the day of the week (paragraph 0009).

Regarding claim 32, Pesola teaches a method in accordance with claim 1, wherein the act of consulting a set of flexible selection rules to select one of the available synchronization mechanisms (fig.1, paragraph 0008, 0016, 0019) comprises the following:

an act of selecting the synchronization mechanism at least based on the value of the data (fig.1, fig.2, paragraph 0016, 0025).

Regarding claim 33, Pesola teaches a method in accordance with claim 1, wherein the act of consulting a set of flexible selection rules to select one of the available synchronization mechanisms (fig.1, paragraph 0008, 0016, 0019) comprises the following:

an act of selecting the synchronization mechanism at least based on the economic cost of using a network associated with the synchronization mechanism (fig.1, paragraph 0014).

Regarding claim 34, Pesola teaches a method in accordance with claim 1, wherein the act of consulting a set of flexible selection rules to select one of the available synchronization mechanisms (fig.1, paragraph 0008, 0016, 0019) comprises the following:

an act of selecting the synchronization mechanism at least based on the security of a network associated with the synchronization mechanism (fig.1, fig.2, paragraph 0014, 0019).

Regarding claim 35, Pesola teaches a method in accordance with claim 1, wherein the act of consulting a set of flexible selection rules to select one of the available synchronization mechanisms (fig.1, paragraph 0008, 0016, 0019) comprises the following:

an act of selecting the synchronization mechanism at least based on the security of the first computer system (fig.1, paragraph 0008, 0014, 0019).

Regarding claim 36, Pesola teaches a method in accordance with claim 35, wherein the act of selecting the synchronization mechanism at least based on the security of the first computer system (fig.1, paragraph 0008, 0014, 0019) comprises the following:

an act of selecting the selecting the synchronization mechanism at least based on the security features inherent in devices of the same type as the first computer system (fig.1, paragraph 0008, 0019).

Regarding claim 37, Pesola teaches a method in accordance with claim 35, wherein the act of selecting the synchronization mechanism at least based on the security of the first computer system (fig.1, paragraph 0008, 0014, 0019) comprises the following:

an act of selecting the selecting the synchronization mechanism at least based on current security settings of the first computer system (fig.1, fig.2, paragraph 0008, 0019, 0024).

Regarding claim 38, Pesola teaches a method in accordance with claim 1, wherein the act of consulting a set of flexible selection rules to select one of the available synchronization mechanisms (fig.1, paragraph 0008, 0016, 0019) comprises the following:

an act of selecting the synchronization mechanism at least based on the location of the user of the first computer system (fig.1, fig.2, paragraph 0008, 0019, 0024).

Regarding claim 39, Pesola teaches a method in accordance with claim 1, wherein the act of consulting a set of flexible selection rules to select one of the available synchronization mechanisms (fig.1, paragraph 0008, 0016, 0019) comprises the following:

an act of determining that there are no current synchronization mechanisms that are selectable based on the flexible set of rules (fig.1, paragraph 0019);

an act of reevaluating the flexible selection rules at a later time (fig.1, paragraph 0004, 0019); and

an act of repeating the reevaluation until at least one of the available synchronization mechanisms is selectable based on the flexible selection rules (paragraph 0005-0006).

Regarding claim 40, Pesola teaches a method in accordance with claim 1, further comprising the following:

after using the selected synchronization mechanism to synchronize the data item (fig.1, paragraph 0005), an act of determining that the conditions for synchronization are no longer met in light of the flexible selection rules (fig.1, paragraph 0015); and

an act of automatically reversing the synchronization if it has been determined that the conditions for synchronization are no longer met (fig.1, paragraph 0008, 0015).

Regarding claim 41, Pesola teaches a method in accordance with claim 1, wherein the act of the first computer system determining that a data item is to be synchronized (paragraph 0008) comprises the following:

an act of the first computer system determining whether to synchronize a data item by consulting a set of flexible selection rules (fig.2, paragraph 0008, 0024); and

an act of the first computer system synchronize the data item with the second computer if the first computer system determines that the data item is to be synchronized (fig.1, fig.2, paragraph 0008, 0015).

Regarding claim 42, Pesola teaches a computer program product for use in a network that includes a first computer system having a first data store and second computer system having a second data store (paragraph 0008), the computer program product for implementing a method for synchronizing the first and second data stores in a flexible manner considering the circumstances that exist at the time of synchronization (fig.1, paragraph 0008, 0019), the computer program product comprising one or more computer-readable media having stored (paragraph 0008) thereon the following:

computer-executable instructions for determining that a data item is to be synchronized (fig.1, fig.2, paragraph 0005); computer-executable instructions for

identifying which of the plurality of synchronization mechanisms are available to use for synchronization (fig.1, fig.2, paragraph 0005, 0022, 0024);

computer-executable instructions for consulting a set of flexible selection rules to select one of the available synchronization mechanisms (fig.1, fig.2, paragraph 0008, 0016, 0019) ; and computer-executable instructions for using the selected synchronization mechanism to synchronize the data item with the second computer (fig.1, fig.2, paragraph 0008, 0018-0019).

Regarding claim 43, Pesola teaches a computer program product in accordance with claim 42, wherein the one or more computer-readable media are physical storage media (paragraph 0022).

Regarding claim 44, Pesola teaches in a network that includes a first computer system having a first data store and second computer system having a second data store (fig.1, paragraph 0008), a method for synchronizing the first and second data stores in a flexible manner considering the circumstances that exist at the time of synchronization (fig.1, paragraph 0008, 0019), the method comprising the following:

an act of the first computer system determining that a data item is to be synchronized (fig.1, paragraph 0005, 0008); and

a step for flexibly using an appropriate synchronization mechanism considering the then-existing circumstances (fig.1, paragraph 0019).

Regarding claim 45, Pesola teaches a method in accordance with claim 44, wherein the step for flexibly using an appropriate synchronization considering the then-existing circumstances (fig.1, paragraph 0019) comprises the following:

an act of the first computer system identifying which of the plurality of synchronization mechanisms are available to use for synchronization (fig.1, paragraph 0005, 0008), an act of the first computer system consulting a set of flexible selection rules to select one of the available synchronization mechanisms (fig.1, fig.2, paragraph 0005, 0019); and

an act of the first computer system using the selected synchronization mechanism to synchronize the data item with the second computer (fig.1, fig.2, paragraph 0008, 0023).

Regarding claim 46, Pesola teaches in a network that includes a first computer system having a first data store and second computer system having a second data store (paragraph 0008), a method for synchronizing the first and second data stores in a flexible manner considering the circumstances that exist at the time of synchronization (paragraph 0004-0005, 0008, 0019), the method comprising the following:

an act of the first computer system determining whether to synchronize a data item by consulting a set of flexible selection rules (fig.1, fig.1, paragraph 0008, 0019); and

an act of the first computer system synchronize the data item with the second computer if the first computer system determines that the data item is to be synchronized (fig.1, fig.2, paragraph 0008, 0023).

Regarding claim 47, Pesola teaches a method in accordance with claim 46, wherein the first computer system is a synchronization server, and the second computer system is a mobile device (fig.1, paragraph 0005, 0008, 0013).

Regarding claim 48, Pesola teaches a method in accordance with claim 46, wherein the first computer system is a mobile device, and the second computer system is a synchronization server (fig.1, paragraph 0004, 0008, 0013).

Regarding claim 49, Pesola teaches a method in accordance with claim 46, further comprising the following:

an act of receiving instructions to change the set of flexible selection rules (fig.1, paragraph 0019, 0022); and

an act of changing the set of flexible selection rules in response to the instruction (fig.1, paragraph 0006, 0019, 0022).

Regarding claim 50, Pesola teaches a method in accordance with claim 49, wherein the act of receiving instructions to change the set of flexible selection rules (fig.1, paragraph 0006, 0019, 0022) comprises the following:

an act of receiving instructions to change the set of flexible selection rules from a user of the first computer system (fig.1, paragraph 0006, 0019, 0022).

Regarding claim 51, Pesola teaches a method in accordance with claim 49, wherein the act of receiving instructions to change the set of flexible selection rules (fig.1, paragraph 0008, 0016, 0019) comprises the following:

an act of receiving instructions to change the set of flexible selection rules from an agent of the second computer system (fig.1, paragraph 0006, 0008, 0019, 0022).

Regarding claim 52, Pesola teaches a method in accordance with claim 51, wherein the act of receiving instructions to change the set of flexible selection rules from an agent of the second computer system (fig.1, paragraph 0006, 0008, 0019, 0022) comprises the following:

an act of receiving instructions to change the set of flexible selection rules from a network administrator of trusted network that includes the second computer system (fig.1, fig.2, paragraph 0006, 0008, 0019, 0022).

Regarding claim 53, Pesola teaches a method in accordance with claim 52, further comprising the following:

an act of receiving instructions to change the set of flexible selection rules from a user (fig.1, paragraph 0016, 0022).

Regarding claim 54, Pesola teaches a method in accordance with claim 53, wherein the act of changing the set of flexible selection rules in response to the instruction (fig.1, paragraph 0006, 0019, 0022), comprises the following:

an act of fulfilling the instructions received from the network administrator of the second computer system to the extent that there is a conflict between the instructions received from the network administrator of the second computer system and the instructions received from the user of the first computer system (fig.1, fig.1, paragraph 0008, 0013, 0022).

Regarding claim 55, Pesola teaches a method in accordance with claim 46, further comprising the following:

after using the selected synchronization mechanism to synchronize the data item (fig.1, paragraph 0005), an act of determining that the conditions for synchronization are no longer met in light of the flexible selection rules (fig.1, paragraph 0015); and

an act of automatically reversing the synchronization if it has been determined that the conditions for synchronization are no longer met (fig.1, paragraph 0008, 0015).

Regarding claim 56, Pesola teaches a method in accordance with claim 46, wherein the act of the first computer system synchronize the data item with the second computer (paragraph 0008) comprises the following:

an act of the first computer system identifying which of a plurality of synchronization mechanisms are available to use for synchronization (fig.1, paragraph 0005, 0008);

an act of the first computer system consulting a set of flexible selection rules to select one of the available synchronization mechanisms (fig.1, fig.2, paragraph 0005, 0019); and

an act of the first computer system using the selected synchronization mechanism to synchronize the data item with the second computer (fig.1, fig.2, paragraph 0008, 0023).

Regarding claim 57, Pesola teaches a computer program product for use in a network that includes a first computer system having a first data store and second computer system having a second data store (paragraph 0005, 0008), the computer program product for implementing a method for synchronizing the first and second data stores in a flexible manner considering the circumstances that exist at the time of synchronization (fig.1, paragraph 0008, 0019), the computer program product comprising one or more computer-readable media having stored thereon the following:

computer-executable instructions for determining whether to synchronize a data item by consulting a set of flexible selection rules (fig.2, paragraph 0008, 0024); and

computer-executable instructions for synchronize the data item with the second computer if the first computer system determines that the data item is to be synchronized (fig.1, fig.2, paragraph 0008, 0015).

Regarding claim 58, Pesola teaches a computer program product in accordance with claim 57, wherein the one or more computer-readable media comprise physical storage media (paragraph 0022).

Regarding claim 59, Pesola teaches a network system comprising the following:

a synchronization server comprising a data store (paragraph 0013, 0017-0018), a networking module, and a processing module configured to access the data store as well as communicate over a network using the networking module (paragraph 0015);

a mobile device having a data store, a networking module, and a processing modules configured to access the data store of the mobile device as well as communicate with the synchronization server over the network using the networking module of the mobile device, the processing device of the mobile device configured to perform the following (fig.2, paragraph 0015, 0021):

determine that a data item is to be synchronized (fig.1, fig.2, paragraph 0005);

identify which of the plurality of synchronization mechanisms are available to use for synchronization (fig.1, fig.2, paragraph 0005, 0022, 0024);

consult a set of flexible selection rules to select one of the available synchronization mechanisms (fig.1, fig.2, paragraph 0008, 0016, 0019); and

use the selected synchronization mechanism to synchronize the data item (fig.1, fig.2, paragraph 0008, 0018-0019).

Regarding claim 60, Pesola teaches a network system comprising the following:

a synchronization server comprising a data store, a networking module (paragraph 0013, 0017-0018), and a processing module configured to access the data

store as well as communicate over a network using the networking module (paragraph 0015);

a mobile device having a data store, a networking module, and a processing modules configured to access the data store of the mobile device as well as communicate with the synchronization server over the network using the networking module of the mobile device, the processing device of the synchronization server configured to perform the following (fig.2, paragraph 0013, 0015, 0017-0018, 0021):

determine that a data item is to be synchronized (fig.1, fig.2, paragraph 0005);

identify which of the plurality of synchronization mechanisms are available to use for synchronization (fig.1, fig.2, paragraph 0005, 0022, 0024);

consult a set of flexible selection rules to select one of the available synchronization mechanisms (fig.1, fig.2, paragraph 0008, 0016, 0019); and

use the selected synchronization mechanism to synchronize the data item (fig.1, fig.2, paragraph 0008, 0018-0019).

Claim Rejections - 35 USC § 103

2. 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.

Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Pesola (U.S. Pub-20030125057) in view of Asakawa (U.S. Pub-20030036398).

Regarding claim 9, Pesola teaches a method in accordance with claim 3, wherein the second data store is incorporated (fig.1, paragraph 0005, 0008).

Pesola fails to specifically disclose a data store is incorporated within the internet. However, Asakawa teaches a data store is incorporated within the internet (fig.1, paragraph 0003). Therefore, it would been obvious to one of ordinary skill in the art at the time the invention was made to use a data store is incorporated within the internet as taught by Asakawa with Pesola teaching in order to provide a single device can simultaneously be part of more than one network.

Claim 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over Pesola (U.S. Pub-20030125057) in view of Carlsson (U.S. Pub-20030119524).

Regarding claim 15, Pesola teaches a method in accordance with claim 14, wherein the at least one wireless synchronization mechanism uses a network (fig.1, paragraph 0005, 0008).

Pesola fails to specifically disclose a wireless synchronization mechanism uses a GPRS network. However, Carlsson teaches a wireless synchronization mechanism uses a GPRS network (fig.1, paragraph 0012). Therefore, it would been obvious to one

of ordinary skill in the art at the time the invention was made to use a wireless synchronization mechanism uses a GPRS network as taught by Carlsson with Pesola teaching in order to help determine the location of the mobile terminal.

Claims 16-19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Pesola (U.S. Pub-20030125057) in view of Monin (U.S. Pub-20020197984).

Regarding claims 17-19, Pesola teaches a method in accordance with claim 14, wherein the at least one wireless synchronization mechanism uses an network (fig.1, paragraph 0005, 0008).

Pesola fails to specifically disclose a wireless synchronization mechanism uses 802.11a, 802.11b, Bluetooth, cellular network. However, Monin teaches a wireless synchronization mechanism uses 802.11a, 802.11b, Bluetooth, cellular network (paragraph 0014). Therefore, it would been obvious to one of ordinary skill in the art at the time the invention was made to use a wireless synchronization mechanism uses 802.11a, 802.11b, Bluetooth, cellular network as taught by Carlsson with Monin teaching in order to linking together a network of wireless local network access points at respective physical locations.

Claim 20-21 is rejected under 35 U.S.C. 103(a) as being unpatentable over Pesola (U.S. Pub-20030125057) in view of Steinka (U.S. Pat-6285680).

Regarding claims 20-21, Pesola teaches a method in accordance with claim 1, wherein the plurality of synchronization mechanisms comprises dialup synchronization mechanism and the plurality of synchronization mechanisms a network (fig.1, fig.2, paragraph 0005, 0013).

Pesola fails to specifically disclose the plurality of synchronization mechanisms comprises an analog dialup synchronization mechanism and the plurality of synchronization mechanisms a VPN network. However. Steinka teaches the plurality of synchronization mechanisms comprises an analog dialup synchronization mechanism and the plurality of synchronization mechanisms a VPN network (fig.1, col.3, lines 34-42, col.8, lines 25-37). Therefore, it would been obvious to one of ordinary skill in the art at the time the invention was made to use the plurality of synchronization mechanisms comprises an analog dialup synchronization mechanism and the plurality of synchronization mechanisms a VPN network as taught by Steinka with Pesola teaching in order to provides selective mobile device access to multiple hot resources through a common WAN connection.

Conclusion

3. The prior art made of record and not relied upon is considered pertinent to applicant's disclose.

a) Siemens (U.S. Pub-20020068522) discloses Hierarchical call control with selective broadcast audio messaging system.

4. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Khai M Nguyen whose telephone number is 703.305.3906. The examiner can normally be reached on 8:00-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nay Maung can be reached on 703.308.7745. 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).

Khai Nguyen
Au:2684
Initial : KN

8/13/2004

NICK CORSARO

NICK CORSARO
PRIMARY EXAMINER

Notice of References Cited	Application/Control No. 10/082,918	Applicant(s)/Patent Under Reexamination LOVELAND, SHAWN DOMENIC	
	Examiner Khai M Nguyen	Art Unit 2684	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
	A	US-2003/0125057 A1	07-2003	Pesola, Troy Raymond	455/502
	B	US-2002/0068552 A1	06-2002	Siemens, Gerhard	455/415
	C	US-2002/0197984 A1	12-2002	Monin et al.	455/419
	D	US-2003/0119524 A1	06-2003	Carlsson, Hans	455/456
	E	US-6,285,680 B1	09-2001	Steinka et al.	370/431
	F	US-2003/0036398 A1	02-2003	Asakawa, Stuart D.	455/503
	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.

INFORMATION DISCLOSURE CITATION

(Use several sheets if necessary)

Docket Number (Optional)	Application Number
13768.255	Not yet assigned
Applicant(s)	
Shawn D. Loveland	
Filing Date	**Group Art Unit**
February 26, 2002	Not yet assigned

U.S. PATENT DOCUMENTS

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

J1050 U.S. PTO 10/082918 02/26/02

FOREIGN PATENT DOCUMENTS

	REF	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	Translation YES	Translation NO

OTHER DOCUMENTS *(Including Author, Title, Date, Pertinent Pages, Etc.)*

KN	1	EFFICIENT DATA SHARING WITH CONDITIONAL REMOTE MEMORY TRANSFERS, Hummel, S.F., Computer Architecture News, Vol. 24, No. 5, 1996, Pages 9-17.

EXAMINER	DATE CONSIDERED
Khanh Pham	8/11/04

EXAMINER: Initial if citation considered, whether or not citation is in conformance with MPEP Section 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

L Number	Hits	Search Text	DB	Time stamp
1	0	8002.11a and 802.11b	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/08/12 20:05
2	859	802.11a and 802.11b	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/08/12 20:05
4	3	(802.11a and 802.11b) and 455/502.ccls.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/08/12 20:06
3	213	(802.11a and 802.11b) and 455/$.ccls.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/08/12 20:07
5	0	((802.11a and 802.11b) and 455/$.ccls.) and synchoroni$5	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/08/12 20:09
6	47	((802.11a and 802.11b) and 455/$.ccls.) and synchroni$5	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/08/12 20:09

L Number	Hits	Search Text	DB	Time stamp
1	491	455/502.ccls.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/08/11 15:03
2	491	455/502.ccls.1 and syschoro$5	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/08/11 15:03
3	319	(455/502.ccls.1 and syschoro$5) and network	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/08/11 15:04
4	1	((455/502.ccls.1 and syschoro$5) and network) and indentif$6	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/08/11 15:10
5	104	((455/502.ccls.1 and syschoro$5) and network) and execut$5	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/08/11 15:33
6	104	((455/502.ccls.1 and syschoro$5) and network) and execut$5 (((455/502.ccls.1 and syschoro$5) and network) and execut$5) and 455/507.ccls.	USPAT; US-PGPUB; EPO; JPO; DERWENT; IBM_TDB	2004/08/11 15:33

Express Mail Label No. EL 813 857 071 US

02.27.02 A

jc541 U.S. PTO 02/26/02

UTILITY PATENT APPLICATION TRANSMITTAL
(Large Entity)

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Docket No. 13768.255
Total Pages in this Submission 4

TO THE ASSISTANT COMMISSIONER FOR PATENTS
Box Patent Application
Washington, D.C. 20231

Transmitted herewith for filing under 35 U.S.C. 111(a) and 37 C.F.R. 1.53(b) is a new utility patent application for an invention entitled:

SYNCHRONIZING OVER A NUMBER OF SYNCHRONIZATION MECHANISMS USING FLEXIBLE RULES

and invented by:

Shawn D. Loveland

J1050 U.S. PTO 10/082918 02/26/02

If a CONTINUATION APPLICATION, *check appropriate box and supply the requisite information:*

☐ **Continuation** ☐ **Divisional** ☐ **Continuation-in-part (CIP)** of prior application No.: _____

Which is a:

☐ **Continuation** ☐ **Divisional** ☐ **Continuation-in-part (CIP)** of prior application No.: _____

Which is a:

☐ **Continuation** ☐ **Divisional** ☐ **Continuation-in-part (CIP)** of prior application No.: _____

Enclosed are:

Application Elements

1. ☒ Filing fee as calculated and transmitted as described below

2. ☒ Specification having 40 pages and including the following:

   a. ☒ Descriptive Title of the Invention
   b. ☐ Cross References to Related Applications *(if applicable)*
   c. ☐ Statement Regarding Federally-sponsored Research/Development *(if applicable)*
   d. ☐ Reference to Microfiche Appendix *(if applicable)*
   e. ☒ Background of the Invention
   f. ☒ Brief Summary of the Invention
   g. ☒ Brief Description of the Drawings *(if drawings filed)*
   h. ☒ Detailed Description
   i. ☒ Claim(s) as Classified Below
   j. ☒ Abstract of the Disclosure

UTILITY PATENT APPLICATION TRANSMITTAL
(Large Entity)

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Docket No. 13768.255
Total Pages in this Submission 4

Application Elements (Continued)

3. ☒ Drawing(s) *(when necessary as prescribed by 35 USC 113)*
   a. ☒ Formal Number of Sheets 3
   b. ☐ Informal Number of Sheets

4. ☒ Oath or Declaration
   a. ☒ Newly executed *(original or copy)* ☐ Unexecuted
   b. ☐ Copy from a prior application (37 CFR 1.63(d)) *(for continuation/divisional application only)*
   c. ☒ With Power of Attorney ☐ Without Power of Attorney
   d. ☐ *DELETION OF INVENTOR(S)*
   Signed statement attached deleting inventor(s) named in the prior application, see 37 C.F.R. 1.63(d)(2) and 1.33(b).

5. ☐ Incorporation By Reference *(usable if Box 4b is checked)*
The entire disclosure of the prior application, from which a copy of the oath or declaration is supplied under Box 4b, is considered as being part of the disclosure of the accompanying application and is hereby incorporated by reference therein.

6. ☐ Computer Program in Microfiche *(Appendix)*

7. ☐ Nucleotide and/or Amino Acid Sequence Submission *(if applicable, all must be included)*
   a. ☐ Paper Copy
   b. ☐ Computer Readable Copy *(identical to computer copy)*
   c. ☐ Statement Verifying Identical Paper and Computer Readable Copy

Accompanying Application Parts

8. ☒ Assignment Papers *(cover sheet & document(s))*

9. ☐ 37 CFR 3.73(B) Statement *(when there is an assignee)*

10. ☐ English Translation Document *(if applicable)*

11. ☒ Information Disclosure Statement/PTO-1449 ☒ Copies of IDS Citations

12. ☐ Preliminary Amendment

13. ☒ Acknowledgment postcard

14. ☒ Certificate of Mailing
   ☐ First Class ☒ Express Mail *(Specify Label No.):* EL 813 857 071 US

UTILITY PATENT APPLICATION TRANSMITTAL
(Large Entity)

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Docket No.
13768.255
Total Pages in this Submission
4

Accompanying Application Parts (Continued)

15. ☐ Certified Copy of Priority Document(s) *(if foreign priority is claimed)*

16. ☒ Additional Enclosures *(please identify below):*

Form PTO 2038 in the amount of $1,836.00

Request That Application Not Be Published Pursuant To 35 U.S.C. 122(b)(2)

17. ☐ Pursuant to 35 U.S.C. 122(b)(2), Applicant hereby requests that this patent application not be published pursuant to 35 U.S.C. 122(b)(1). Applicant hereby certifies that the invention disclosed in this application has not and will not be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication of applications 18 months after filing of the application.

Warning

An applicant who makes a request not to publish, but who subsequently files in a foreign country or under a multilateral international agreement specified in 35 U.S.C. 122(b)(2)(B)(i), must notify the Director of such filing not later than 45 days after the date of the filing of such foreign or international application. A failure of the applicant to provide such notice within the prescribed period shall result in the application being regarded as abandoned, unless it is shown to the satisfaction of the Director that the delay in submitting the notice was unintentional.

UTILITY PATENT APPLICATION TRANSMITTAL
(Large Entity)

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Docket No.
13768.255
Total Pages in this Submission
4

Fee Calculation and Transmittal

CLAIMS AS FILED

For	#Filed	#Allowed	#Extra		Rate	Fee
Total Claims	60	- 20 =	40	x	$18.00	$720.00
Indep. Claims	7	- 3 =	4	x	$84.00	$336.00
Multiple Dependent Claims (check if applicable) ☐						$0.00
					BASIC FEE	$740.00
OTHER FEE *(specify purpose)*	Assignment Recordation Fee					$40.00
					TOTAL FILING FEE	$1,836.00

☒ A check in the amount of to cover the filing fee is enclosed.

☒ The Commissioner is hereby authorized to charge and credit Deposit Account No. **23-3178** as described below. A duplicate copy of this sheet is enclosed.

- ☐ Charge the amount of as filing fee.
- ☒ Credit any overpayment.
- ☒ Charge any additional filing fees required under 37 C.F.R. 1.16 and 1.17.
- ☐ Charge the issue fee set in 37 C.F.R. 1.18 at the mailing of the Notice of Allowance, pursuant to 37 C.F.R. 1.311(b).

Signature

Dated: **February 26, 2002**

Adrian J. Lee
Attorney for Applicant
Registration No. 42,785

cc:

CERTIFICATE OF MAILING BY "EXPRESS MAIL" (37 CFR 1.10) Applicant(s):			Docket No. 13768.255
Serial No. **Not yet assigned**	Filing Date **February 26, 2002**	Examiner **Not yet assigned**	Group Art Unit **Not yet assigned**

Invention: **SYNCHRONIZING OVER A NUMBER OF SYNCHRONIZATION MECHANISMS USING FLEXIBLE RULES**

I hereby certify that this **(See correspondence listed below)**
(Identify type of correspondence)

is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 CFR 1.10 in an envelope addressed to: The Commissioner of Patents and Trademarks, Washington, D.C. 20231-0001 on **February 26, 2002**
(Date)

Ilona D. Craske
(Typed or Printed Name of Person Mailing Correspondence)

(Signature of Person Mailing Correspondence)

EL 813 857 071 US
("Express Mail" Mailing Label Number)

Submitted:	Pages
Utility Patent Application Transmittal Letter (Large Entity - triplicate)	4
Form PTO-2038 in the amount of **$1,836.00 (in triplicate)**	1
Patent application	40
Drawings	3
Assignment with cover sheet	4
Declaration	2
Certificate of Mailing Express Mail **EL 813 857 071 US**	1
IDS Transmittal w/ PTO-1449 & 1 cited reference	14
Postcard	

Copyright 1995 Legalsoft

Express Mailing Label No. EL 813 857 071 US

PATENT APPLICATION
Docket No. 13768.255

UNITED STATES PATENT APPLICATION

of

Shawn D. Loveland

for

SYNCHRONIZING OVER A NUMBER OF SYNCHRONIZATION MECHANISMS USING FLEXIBLE RULES

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

BACKGROUND OF THE INVENTION

1. The Field of the Invention

[0001] The present invention relates to computer network operations. In particular, the present invention relates to methods, systems, and computer program products for synchronizing by flexibly using multiple synchronization mechanisms while considering the then-existing economic and/or security considerations involved with synchronization over a particular mechanism to a particular device.

2. Background and Relevant Art

[0002] Computer networks allow more individuals more ready access to more information than ever before. The Internet is a conglomerate of interconnected computer networks that spreads far and wide throughout the world. An individual need only have an Internet-enabled computer (or device) and an Internet connection to be able to access information from across the globe.

[0003] Mobile devices such as mobile telephones, Personal Digital Assistants (PDAs) and laptop computers also may have the ability to access various objects (e.g., documents) for particular remote network locations. However, accessing documents over a network may be quite time consuming and costly and thus remote access may be unacceptable in many applications. Accordingly, with the memory capabilities of mobile devices increasing, many mobile devices have caching mechanisms that allow them to locally store synchronized copies of more relevant objects that are also stored in another network location.

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

[0004] Synchronization ensures that the copy of a document on the mobile device is an identical replica of a remote copy of the document. After synchronization, however, changes may be made to both of the remote copy or the local copy. Accordingly, the local and remote copies may become quite different after some time. However, the copies are once again made identical during the next synchronization.

[0005] Conventional synchronization mechanisms give the user very little control over synchronization. Basically, the user just selects items to synchronize and selects a single synchronization mechanism to use. This rigid approach ignores some factors that are relevant to whether, when, and how to synchronize.

[0006] For example, some data is more valuable than others. Yet, the conventional technique does not consider the value of the data once the items for synchronization are selected. For example, a user may select to synchronize an in-box. However, the in-box contains high-value e-mails (such as an e-mail offering a highly coveted job) as well as low value e-mails (such as unwanted spam). Yet, all of the e-mails are synchronized in the exact same manner.

[0007] Also current synchronization mechanisms do not consider the costs associated with synchronization. For example, synchronization mechanisms may involve networks with a wide variety of costs and latencies. For example, synchronization over an analog dialup that uses a Global System for Mobile communication (GSM) network has a relatively low bandwidth of approximately 9.6 to 14.4 kilobits per second. A connection over a General Packet Radio Server (GPRS) network allows somewhat faster throughput speeds of up to 115 kilobits per second. However, current GPRS networks are relatively expensive. A connection over an 802.11b (also called "WiFi") wireless network can attain speeds of up to 11 megabits per second, orders of magnitude greater than GSM or GPRS. In addition, use

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

of 802.11b networks is typically free to those who have access to the network. However, 802.11b networks are typically less available as they currently span much less of the globe than do GSM or GPRS networks.

[0008] Current synchronization techniques also typically do not consider security concerns associated with synchronization. For example, the channel used for synchronization may have various levels of inherent security that guard against eavesdropping. For example, physical network connections are very secure, 802.11b networks are somewhat secure, with GSM dialup networks being somewhat less secure, and with GPRS networks being less secure. Also, the devices to which data may be synchronized may have varying levels of security. For example, some devices give access to any locally stored document to anyone who happens to possess the device, even if that person just stole the device from the legitimate user. Other devices are more secure by requiring a password when first logging in. Others are even more secure by having the screen saver turn on after a short period of lack of use, and require a password to restore the device once the screen saver is on. Others are yet even more secure by having an encrypted file system.

[0009] Accordingly, what is desired as mechanisms that use a synchronization mechanism that is appropriate given the economic and security concerns that exist at the time of the synchronization.

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

BRIEF SUMMARY OF THE INVENTION

[0010] The principles of the present invention provide for systems, methods and computer program products for performing synchronization in a flexible manner. Instead of just allowing the user a choice as to what to synchronize and then having the user manually synchronize, one or more of the pair of computer systems involved with the synchronization automatically considers the then-existing circumstances to determine whether, when and how to synchronize. In one described example, the synchronization occurs between a mobile device and a synchronization server. The methods of the present invention may be performed by either synchronizing computer system (e.g., by either the mobile device or the synchronization server).

[0011] It is first determined that a data item is to be synchronized. This may be accomplished in response to a user-issued instruction, or in response to a message from the other device indicating that the data item ought to be synchronized. The determination may also have been made by consulting a flexible set of rules that are dictated by a network administrator of the synchronization server as well as by the mobile device user.

[0012] Once it has been determined that a data item is to be synchronized, the computer system identifies the available synchronization mechanisms, and then once again consults with the flexible rules to determine which of the available synchronization mechanisms to use. The computer system then synchronizes using the selected synchronization mechanism.

[0013] The flexible selection rules may be set and changed by a network administrator and by a user of the mobile device. The flexible selection rules take into consideration the value of the data, the economic cost of synchronization, the security of the synchronization mechanism, and the security of the mobile device. Accordingly, it is much less likely that the flexible rules will allow for highly sensitive data to be shared with an insecure device or

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

over an insecure synchronization channel. Likewise, it is much less likely that a less valuable item of data will be synchronized over an expensive network.

[0014] The synchronization rules also take into consideration the location of the mobile device and user. If none of the available synchronization mechanisms are selectable based on the flexible rules, then the synchronization may be delayed, and then the synchronization mechanism may be repeatedly reevaluated until there is a selectable synchronization mechanism.

[0015] Should synchronization occur, and later a security condition for synchronization changes, then the effects of the synchronization may be reversed. For example, suppose that the flexible rules indicate that synchronization to a mobile device is proper since the mobile device has configuration settings in which a screen saver is activated after five minutes of non-use, and that a user password is required to restore the device each time the screen saver is activated. Later, suppose the user deactivates the screen saver. The synchronization server may query the mobile device to determine that the screen saver has been deactivated. Since the original conditions for synchronization are no longer met, the synchronization server may issue an instruction to erase the data item from the mobile device, or (if change tracking is enabled) then may instruct the mobile device to roll back the data item to its pre-synchronization state.

[0016] Accordingly, the principles of the present invention perform synchronization in a much more appropriate manner considering the surrounding circumstances. In addition, the effects of synchronization may be reversed if security changes so require. Furthermore, the network administrator (and the mobile user) has much more control over when synchronization occurs. This results in a more secure, cost effective, and efficient synchronization design.

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

[0017] Additional features and advantages of the invention will be set forth in the description that follows, and in part will be obvious from the description, or may be learned by the practice of the invention. The features and advantages of the invention may be realized and obtained by means of the instruments and combinations particularly pointed out in the appended claims. These and other features of the present invention will become more fully apparent from the following description and appended claims, or may be learned by the practice of the invention as set forth hereinafter.

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

BRIEF DESCRIPTION OF THE DRAWINGS

[0018] In order to describe the manner in which the above-recited and other advantages and features of the invention can be obtained, a more particular description of the invention briefly described above will be rendered by reference to specific embodiments thereof which are illustrated in the appended drawings. Understanding that these drawings depict only typical embodiments of the invention and are not therefore to be considered to be limiting of its scope, the invention will be described and explained with additional specificity and detail through the use of the accompanying drawings in which:

[0019] Figure 1 illustrates an example of a telephonic device that may implement the principles of the present invention.

[0020] Figure 2 illustrates an example network environment that provides a suitable operating environment for the present invention.

[0021] Figure 3 illustrates a flowchart of a method for flexibly synchronizing in accordance with the present invention.

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0022] The present invention extends to systems, methods and computer program products for performing synchronization in a flexible manner. Two computer systems in a network each have a local store that contains a copy of a data item that is to be synchronized between the two computer systems. One of the computer systems may be, for example, a mobile device while the other may be a synchronization server. In order to determine whether to synchronize a data item, and what synchronization mechanism to use, one of the computer systems references a flexible set of rules that may be influenced by instructions from a network administrator or a mobile device user.

[0023] The flexible set of rules takes into consideration the value of the data, the cost associated with synchronization, the security of the synchronization mechanisms, the security of the mobile device, and/or the location of the mobile device and user in dictating whether and how to synchronize. If synchronization occurs, and the security conditions for synchronization are later not satisfied (e.g., the mobile device's configuration settings have been changed to make the device much less secure), the effects of the synchronization may be reversed. In essence, the principles of the present invention synchronize the appropriate data onto the appropriate device in a manner appropriate to maximize the mobile user's value, benefit, and user experience while at the same time minimize the cost and time of the transaction, and preserving synchronization security.

[0024] The embodiments of the present invention may comprise a general-purpose or special-purpose computer system including various computer hardware components, which are discussed in greater detail below. Embodiments within the scope of the present invention also include computer-readable media for carrying or having computer-executable instructions or data structures stored thereon. Such computer-readable media may be any

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

available media, which is accessible by a general-purpose or special-purpose computer system. By way of example, and not limitation, such computer-readable media can comprise physical storage media such as RAM, ROM, EPROM, CD-ROM or other optical disk storage, magnetic disk storage or other magnetic storage devices, or any other media which can be used to carry or store desired program code means in the form of computer-executable instructions or data structures and which may be accessed by a general-purpose or special-purpose computer system.

[0025] When information is transferred or provided over a network or another communications connection (either hardwired, wireless, or a combination of hardwired or wireless) to a computer system or computer device, the connection is properly viewed as a computer-readable medium. Thus, any such connection is properly termed a computer-readable medium. Combinations of the above should also be included within the scope of computer-readable media. Computer-executable instructions comprise, for example, instructions and data which cause a general-purpose computer system or special-purpose computer system to perform a certain function or group of functions.

[0026] In this description and in the following claims, a "computer system" is defined as one or more software modules, one or more hardware modules, or combinations thereof, that work together to perform operations on electronic data. For example, the definition of computer system includes the hardware components of a personal computer, as well as software modules, such as the operating system of the personal computer. The physical layout of the modules is not important. A computer system may include one or more computers coupled via a computer network. Likewise, a computer system may include a single physical device (such as a mobile phone, Personal Digital Assistant "PDA", laptop

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

computer, a tablet PC) where internal modules (such as a memory and processor) work together to perform operations on electronic data.

[0027] Those skilled in the art will appreciate that the invention may be practiced in network computing environments with many types of computer system configurations, including personal computers, laptop computer, hand-held devices, multi-processor systems, microprocessor-based or programmable consumer electronics, network PCs, minicomputers, mainframe computers, mobile telephones, PDAs, pagers, and the like. The invention may also be practiced in distributed computing environments where local and remote computer systems, which are linked (either by hardwired links, wireless links, or by a combination of hardwired or wireless links) through a communication network, both perform tasks. In a distributed computing environment, program modules may be located in both local and remote memory storage devices.

[0028] Figure 1 and the following discussion are intended to provide a brief, general description of a suitable computing environment in which the invention may be implemented. Although not required, the invention will be described in the general context of computer-executable instructions, such as program modules, being executed by computer systems. Generally, program modules include routines, programs, objects, components, data structures, and the like, which perform particular tasks or implement particular abstract data types.

[0029] With reference to Figure 1, a suitable operating environment for the principles of the invention includes a general-purpose computer system in the form of a mobile device 100. The mobile device 100 includes a user interface 101 for allowing a user to input information through an input user interface 103, and to review information presented via an output user interface 102. For example, the output user interface 102 includes a speaker 104

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

for presenting audio information to the user, as well as a display 105 for presenting visual information to the user. The mobile device 100 may also have an antenna 109.

[0030] The input user interface 103 may include a microphone 106 for translating audio information into electronic form. In addition, the input user interface 103 includes dialing controls 107 represented by 12 buttons through which a user may enter information. Input user interface 103 also includes navigation control buttons 108 that assist the user in navigating through various entries and options listed on display 105.

[0031] Although user interface 101 has the appearance of a mobile telephone, the unseen features of user interface 101 may allow for complex and flexible general-purpose processing capabilities. For example, mobile device 100 also includes a processor 111 and a memory 112 that are connected to each other and to the user interface 101 via a bus 110. Memory 112 generally represents a wide variety of volatile and/or non-volatile memories and may include types of memory previously discussed. However, the particular type of memory used in mobile device 100 is not important to the present invention. Mobile device 100 may also include mass storage devices (not shown) similar to those associated with other general-purpose computer systems.

[0032] Program code means comprising one or more program modules may be stored in memory 112 or other storage devices as previously mentioned. The one or more program modules may include an operating system 113, one or more application programs 114, other program modules 115, and program data 116.

[0033] While Figure 1 represents a suitable operating environment for the present invention, the principles of the present invention may be employed in any system that is capable of, with suitable modification if necessary, implementing the principles of the present invention. The environment illustrated in Figure 1 is illustrative only and by no

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

means represents even a small portion of the wide variety of environments in which the principles of the present invention may be implemented.

[0034] Figure 2 illustrates a network environment 200 in accordance with the present invention. The network environment 200 includes a client computer system 210 (also called herein "client 210") and a server computer system 220 (also called herein "server 220") that are "network connectable" to each other over at least a wireless network 230. In this description and in the claims, "network connectable" means being "network connected" or having the ability to establish a permanent and/or temporary network connection with each other. In this description and in the claims, being "network connected" over a network means having the ability to communicate with each other over at least the network among possibly other networks as well.

[0035] The client 210 may be, for example, the mobile device 100 described with respect to Figure 1, although the client 210 may be any general purpose and/or special purpose processing system. The client 210 has a local store 211 that may be memory 112 in the case of the mobile device 100. Local store 211 may hold a variety of different document types including image files, sound files, executable files, word processing document, spreadsheet documents, or the like. For clarity, the local store 211 is illustrated as containing a single data item 212 that is under consideration for synchronization. The data item may be any structured or unstructured data.

[0036] The client 210 also includes a networking module 213 configured to send and receive communications over the wireless network 230 to and from the server 220. Such a networking module may typically be employed within the operating system of the client 210. A processing module 214 of the client 210 is configured to coordinate access to the

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

data item 212 from the local store, and to use of the networking module 214 so as to perform client operations in accordance with the principles of the present invention.

[0037] The server 220 may be, for example, a computer system that runs a synchronization server that synchronizes with a number of wireless devices over the wireless network 230. However, the server 220 may be any general purpose and/or special purpose processing system. The server 220 also has a local store 221 that stores a data item 222. The data item 222 at the server 220 and the data item 212 at the client 210 are versions of the same data item. At synchronization, both of these data items are identical. However, between synchronizations, changes may be made to one version, without them being immediately propagated to the other version.

[0038] The server 220 also includes a networking module 223 configured to send and receive communications over the network 230 to and from the client 210 as well as potentially other clients that are not shown for clarity. A processing module 224 of the server 220 is configured to coordinate access to the local store 221, and to use the networking module 224 so as to perform server operations in accordance with the principles of the present invention.

[0039] In one embodiment, the client 210 is a mobile device while the server 220 is a synchronization server that provides synchronization services to the mobile device. Although the principles of the present invention is not limited to this embodiment, the following will frequently refer to the embodiment in which the client 210 is a mobile device and the server 220 is a synchronization server. The synchronization server may be a service offered within a corporate network or other common sphere of trust protected by a firewall other security mechanisms from the general public. The mobile device may sometimes be within the corporate network, and may other times be far outside of the corporate network.

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

However, there is no requirement that the synchronization server be within a corporate network. The synchronization server may be, for example, implemented as an Internet service.

[0040] Figure 3 illustrates a flowchart of a method 300 for performing synchronization in a flexible manner considering the then-existing circumstances. The method determines whether, how, and when to synchronize a particular data item by consulting a flexible set of rules that may be set by a user of one of the computer systems, and possible overwritten as dictated by a network administrator. It should be noted that the method 300 may be performed by either the client 210 (e.g., a mobile device) or the server 220 (e.g., a synchronization server).

[0041] The flexible set of rules balance the economic value of the data with the economic cost associated with synchronization. The rules also consider the security of the synchronization mechanism as well as the security of the computer system with which synchronization is desired. The rules balance the security risk associated with synchronization with the value in having access to synchronized data. The security rules may also consider the location of the mobile user and/or device in determining whether to synchronize.

[0042] The value of the data may be determined by user preferences and/or by a network administrator. For example, to a user, spam e-mails will typically be less important to synchronize. However, e-mails from particular senders (e.g., clients, bosses, business partners, spouses, or the like) may be of greater value to a user. E-mails that contain the words "coin" or "penny" may be of higher value to a penny collector than e-mails that do not contain such words. To a network administrator, contacts stored in a business folder may be more important than contacts stored in a personal folder. While these are just

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

examples, the examples demonstrate that there is a wide variety of criteria from which a value of a data item may be derived based on user preferences and network administrator dictates.

[0043] Referring back to Figure 3, the method 300 begins by consulting the set of flexible selection rules (act 301). Based on this consultation, it is determined whether or not to synchronize the data item (decision block 302). For example, the network administrator or mobile device user may have determined that data items must have at least a predetermined value in order to be synchronized. Spam, for example, might fall below that threshold. If the data item is not to be synchronized (NO in decision block 302), then the method 300 simply ends without synchronization.

[0044] If the data item is to be synchronized based on the consultation with the flexible set of rules (YES in decision block 302), then the method proceeds to a step for flexibly using an appropriate synchronization mechanism considering the then-existing circumstances (step 303). This may include any corresponding acts for accomplishing this functional result-oriented step. However, in the illustrated embodiment, the step 303 includes corresponding acts 304, 305, 306 and 307.

[0045] Note that in the illustrated embodiment, whether to synchronize is determined by consultation with a set of rules. This determination may also be made by receiving an instruction from the synchronization server, or by receiving a user-issued instruction from the mobile device user. There is no requirement that the flexible set of rules be consulted as to whether the data item is to be synchronized.

[0046] Once it has been determined that a data item is to be synchronized, the method identifies which synchronization mechanisms of a number of synchronization mechanisms are currently available (act 304). For example, a mobile device may be capable of

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

synchronizing with a synchronization server using a number of synchronization mechanisms such as GSM, GPRS, Bluetooth, 802.11a, 802.11b (WiFi), or the like. However, it may be that the mobile device in not within an 802.11a or 802.11b hot spot, or within a Bluetooth network range. Accordingly, the only available synchronization mechanisms would be GSM and GPRS in this example. Note that although the determination of available synchronization mechanisms (act 304) is illustrated as occurring after the determination as to whether to synchronize the data item, the identification of the available synchronization mechanisms may occur before determining that any particular data item is to be synchronized. For example, the mobile device or the synchronization server may constantly or periodically reevaluate the available synchronization mechanisms. Whether synchronization mechanisms are available may even be a consistently updated configuration setting.

[0047] The method also consults the set of flexible selection rules (act 305) to select one of the synchronization mechanisms (act 306). For example, the flexible selection rules may not only be used to identify the value of the data, but may also be used to determine the economic costs associated synchronizing the data item over each synchronization mechanism. For example, analog dialup over a Public Switched Telephone Network (PSTN) network or GSM is a relatively slow way of synchronizing, but is currently typically less expensive than synchronization over a GPRS network. If the data item was relatively small, synchronization may be more appropriate over a GSM network since it might not take long even over a lower bandwidth connection to synchronize the data item.

[0048] Synchronization costs may also depend on the time of day, or the day of the week. Accordingly, the flexible rules may also consider the time of day, and day of the week in selecting an appropriate network. If the costs associated with a particular

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

synchronization mechanism are to change shortly, then the synchronization may be delayed a short while so as to fall into a less expensive cost structure.

[0049] The flexible selection rules also may consider the security of the network associated with the synchronization mechanisms. Some networks are inherently more secure than others. For example, the mobile device may be within the same trusted corporate network as the synchronization server. If remotely connected, the security of the connection (e.g., Virtual Private Network "VPN", Short Message Service "SMS", Secure Sockets Layer "SSL", or direct Remote Access Services "RAS") may be evaluated to determine how difficult it would be for eavesdropping or redirection of the connection.

[0050] The flexible selection rules may also consider the security of the mobile device with which synchronization may occur. The mobile device may have some rigid security attributes inherent in the device and in the associated operating system itself, as well as flexible security attributes that may be changed by a user. For example, a WINDOWS XP® enabled laptop computer is generally considered more secure than most Personal Digital Assistants (PDAs). A network administrator may thus dictate to the flexible selection rules that synchronization of confidential data items may only be made to mobile laptops and not to PDAs.

[0051] The flexible selection rules may also consider where the mobile device or user is in determining a synchronization mechanism. For example, if a user is outside of a corporate network, but heading towards an 802.11b hot spot with a secure high-speed VPN connection to the corporate network, the synchronization may be delayed until the user enters the hot spot, wherein synchronization may occur with great speed and security and with very little cost.

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

[0052] Also, suppose the user is working on their local computer within the corporate network. Now suppose the mobile device is, by chance, not connected to the corporate network but is with the user. The synchronization server may send a notification to the user's local computer that there is important information to synchronize. The user may then connect the device to the low cost / high speed corporate network and then synchronize.

[0053] Once an appropriate synchronization mechanism is selected (act 306), then the selected synchronization mechanism is used to synchronize the data item (act 307). Once synchronized, the synchronization server may constantly or periodically reevaluate whether any security conditions for synchronization have changed such that synchronization is no longer appropriate. For example, suppose that the flexible rules indicate that synchronization to a mobile device is proper since the mobile device has configuration settings in which a screen saver is activated after five minutes of non-use, and that a user password is required to restore the device each time the screen saver is activated. Later, suppose the user deactivates the screen saver. The synchronization server may query the mobile device to determine that the screen saver has been deactivated. Since the original security conditions for synchronization are no longer met, the synchronization server may issue an instruction to erase the data item from the mobile device, or (if change tracking is enabled) may instruct the mobile device to roll back the data item to its pre-synchronization state. Alternatively, the synchronization server may also be setup to change the devices screen saver setting back to the secure mode.

[0054] The synchronization may occur automatically based on the consultation with the set of flexible selection rules. Alternatively or in addition, the synchronization server may notify the mobile device user that there is an important item to synchronize and then prompt the user as to whether to synchronize. The user of the mobile device may also indicate that

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

synchronization is desired, and then the synchronization server might then determine which data items are appropriate to synchronize. The user may also manually synchronize by selecting particular data items to synchronize.

[0055] Some of the advantages of the present invention may be illustrated by the following scenario involving a fictional stock broker named "Michelle". Having access to up-to-date information is very important to Michelle. The information that she is interested is located in her corporate network in various server locations. She has setup her synchronization server to gather the appropriate data from the appropriate corporate servers and to update her device every morning at 5:00 AM when the data rates are lower with important information that she needs to review before she arrives at work. To do this, she may have created a "weekday morning" sync group that contains: Inbox, Tasks, Calendar, Contacts, high priority action items from her Line-Of-Business (LOB) server, and articles from the Wall Street Journal. This allows Michelle to review important information and plan her day while she eats breakfast and rides the train to work.

[0056] When Michelle gets to work, she tethers her mobile phone to her computer and the device does a complete sync. For example, she created a "in-the-office" sync group that contains: Inbox, Tasks, Calendar, Contacts, important information about her customers from the company's LOB server, the latest research information from the company's trading system, and the updates her Wall Street Journal cache. Some of the data items in the "in-the-office" sync group are highly confidential business-related items. The office's network administrator has set a global rule that indicates that such data items should not be synchronized to a mobile phone, but may only be synchronized with laptop or desktop computers with an encrypted file system. Accordingly, although most of the data items in the "in-the-office" sync group are synchronized with Michelle's mobile phone, the highly

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

confidential data items are not. This balances Michelle's need to access information with the office's need to secure confidential information.

[0057] Michelle undocks her phone and proceeds to do various work items during the morning. She is scheduled to meet an important customer named "Tom" for lunch. Her Personal Information Management (PIM) server, her sync server and the LOB server are offering her an integrated solution. When her meeting reminder pops up on her PC it also informs her that Tom has some account activity that morning and that she should dock her phone to get this new activity synced to her phone. Michelle docks her phone and Tom's information is updated. During the cab ride, Michelle reviews Tom's account information and activity. During lunch, Tom is impressed how knowledgeable Michelle is about his account and activity.

[0058] On her way home from work, Michelle decides she would like to go out to dinner and a movie. On her device, she selects the option to sync the group "weekend personal items" and the individual item restaurant reviews. Her device then syncs movie times, her personal calendar, e-mail, and the weekend weather and restaurant reviews. She finds a movie that she would like to see near her office, finds a review of a new restaurant near the movie. She then calls a friend and makes a date.

[0059] Accordingly, the principles of the present invention allow for an intelligence determination of whether, when and how to synchronize by consulting a flexible set of rules that are derived from input from a network administrator as well as the user. The flexible set of rules takes into consideration the value of the data, the economic cost of synchronization, and/or the security of the synchronization mechanisms and device to which synchronization is proposed. Accordingly, synchronization is made in a more intelligent manner.

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

[0060] The present invention may be embodied in other specific forms without departing from its spirit or essential characteristics. The described embodiments are to be considered in all respects only as illustrative and not restrictive. The scope of the invention is, therefore, indicated by the appended claims rather than by the foregoing description. All changes, which come within the meaning and range of equivalency of the claims, are to be embraced within their scope.

What is claimed and desired secured by United States Letters Patent is:

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

1. In a network that includes a first computer system having a first data store and second computer system having a second data store, a method for synchronizing the first and second data stores in a flexible manner considering the circumstances that exist at the time of synchronization, the method comprising the following:

an act of the first computer system determining that a data item is to be synchronized;

an act of the first computer system identifying which of the plurality of synchronization mechanisms are available to use for synchronization;

an act of the first computer system consulting a set of flexible selection rules to select one of the available synchronization mechanisms; and

an act of the first computer system using the selected synchronization mechanism to synchronize the data item with the second computer.

2. A method in accordance with Claim 1, wherein the first computer system is a synchronization server, and the second computer system is a mobile device.

3. A method in accordance with Claim 1, wherein the first computer system is a mobile device, and the second computer system is a synchronization server.

4. A method in accordance with Claim 3, wherein the act of the first computer system determining that a data item is to be synchronized comprises the following:

an act of the mobile device determining on its own that the data item is to be synchronized.

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

5. A method in accordance with Claim 3, wherein the act of the first computer system determining that a data item is to be synchronized comprises the following:

an act of the mobile device receiving a user-issued instruction to synchronize the data item.

6. A method in accordance with Claim 3, wherein the act of the first computer system determining that a data item is to be synchronized comprises the following:

an act of the mobile device receiving a signal from the synchronization server that represents to the mobile device that the data item is to be synchronized.

7. A method in accordance with Claim 3, wherein the second data store is incorporated within a common sphere of trust.

8. A method in accordance with Claim 7, wherein the second data store is incorporated within a corporate network.

9. A method in accordance with Claim 3, wherein the second data store is incorporated within the Internet.

10. A method in accordance with Claim 3, wherein the mobile device comprises a mobile telephone.

11. A method in accordance with Claim 3, wherein the mobile device comprises a personal digital assistant.

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

12. A method in accordance with Claim 3, wherein the mobile device comprises a laptop computer.

13. A method in accordance with Claim 3, wherein the mobile device comprises a tablet personal computer.

14. A method in accordance with Claim 1, wherein the plurality of synchronization mechanisms comprises at least one wireless synchronization mechanism.

15. A method in accordance with Claim 14, wherein the at least one wireless synchronization mechanism uses a GPRS network.

16. A method in accordance with Claim 14, wherein the at least one wireless synchronization mechanism uses an 802.11a network.

17. A method in accordance with Claim 14, wherein the at least one wireless synchronization mechanism uses an 802.11b network.

18. A method in accordance with Claim 14, wherein the at least one wireless synchronization mechanism uses Bluetooth network.

19. A method in accordance with Claim 14, wherein the at least one wireless synchronization mechanism uses a cellular network.

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

20. A method in accordance with Claim 1, wherein the plurality of synchronization mechanisms comprises an analog dialup synchronization mechanism.

21. A method in accordance with Claim 1, wherein the plurality of synchronization mechanisms comprises a Virtual Private Network (VPN).

22. A method in accordance with Claim 1, further comprising the following:

an act of receiving instructions to change the set of flexible selection rules; and

an act of changing the set of selection rules in response to the instruction.

23. A method in accordance with Claim 22, wherein the act of receiving instructions to change the set of flexible selection rules comprises the following:

an act of receiving instructions to change the set of flexible selection rules from a user of the first computer system.

24. A method in accordance with Claim 22, wherein the act of receiving instructions to change the set of flexible selection rules comprises the following:

an act of receiving instructions to change the set of flexible selection rules from an agent of the second computer system.

25. A method in accordance with Claim 24, wherein the act of receiving instructions to change the set of flexible selection rules from an agent of the second computer system comprises the following:

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

an act of receiving instructions to change the set of flexible selection rules from a network administrator of a network that includes the second computer system.

26. A method in accordance with Claim 25, further comprising the following:

an act of receiving instructions to change the set of flexible selection rules from a user.

27. A method in accordance with Claim 26, wherein the act of changing the set of selection rules in response to the instruction, comprises the following:

an act of fulfilling the instructions received from the network administrator of the second computer system to the extent that there is a conflict between the instructions received from the network administrator of the second computer system and the instructions received from the user of the first computer system.

28. A method in accordance with Claim 1, wherein the act of the first computer system consulting a set of flexible selection rules comprises the following:

an act of the first computer system selecting one of the available synchronization mechanisms without synchronous intervention from a user of the first computer system.

29. A method in accordance with Claim 1, wherein the act of determining that a data item is to be synchronized comprises the following:

an act of the first computer system receiving a notification from the second computer system that a data item is available to synchronize;

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

an act of the first computer system notifying the user of the availability of the data item; and

an act of receiving a user-instruction to synchronize the data item.

30. A method in accordance with Claim 1, wherein the act of consulting a set of flexible selection rules to select one of the available synchronization mechanisms comprises the following:

an act of selecting the synchronization mechanism at least based on the time of day.

31. A method in accordance with Claim 1, wherein the act of consulting a set of flexible selection rules to select one of the available synchronization mechanisms comprises the following:

an act of selecting the synchronization mechanism at least based on the day of the week.

32. A method in accordance with Claim 1, wherein the act of consulting a set of flexible selection rules to select one of the available synchronization mechanisms comprises the following:

an act of selecting the synchronization mechanism at least based on the value of the data.

33. A method in accordance with Claim 1, wherein the act of consulting a set of flexible selection rules to select one of the available synchronization mechanisms comprises the following:

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

an act of selecting the synchronization mechanism at least based on the economic cost of using a network associated with the synchronization mechanism.

34. A method in accordance with Claim 1, wherein the act of consulting a set of flexible selection rules to select one of the available synchronization mechanisms comprises the following:

an act of selecting the synchronization mechanism at least based on the security of a network associated with the synchronization mechanism.

35. A method in accordance with Claim 1, wherein the act of consulting a set of flexible selection rules to select one of the available synchronization mechanisms comprises the following:

an act of selecting the synchronization mechanism at least based on the security of the first computer system.

36. A method in accordance with Claim 35, wherein the act of selecting the synchronization mechanism at least based on the security of the first computer system comprises the following:

an act of selecting the selecting the synchronization mechanism at least based on the security features inherent in devices of the same type as the first computer system

37. A method in accordance with Claim 35, wherein the act of selecting the synchronization mechanism at least based on the security of the first computer system comprises the following:

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

an act of selecting the selecting the synchronization mechanism at least based on current security settings of the first computer system

38. A method in accordance with Claim 1, wherein the act of consulting a set of flexible selection rules to select one of the available synchronization mechanisms comprises the following:

an act of selecting the synchronization mechanism at least based on the location of the user of the first computer system.

39. A method in accordance with Claim 1, wherein the act of consulting a set of flexible selection rules to select one of the available synchronization mechanisms comprises the following:

an act of determining that there are no current synchronization mechanisms that are selectable based on the flexible set of rules;

an act of reevaluating the flexible selection rules at a later time; and

an act of repeating the reevaluation until at least one of the available synchronization mechanisms is selectable based on the flexible selection rules.

40. A method in accordance with Claim 1, further comprising the following:

after using the selected synchronization mechanism to synchronize the data item, an act of determining that the conditions for synchronization are no longer met in light of the flexible selection rules; and

an act of automatically reversing the synchronization if it has been determined that the conditions for synchronization are no longer met.

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

41. A method in accordance with Claim 1, wherein the act of the first computer system determining that a data item is to be synchronized comprises the following:

an act of the first computer system determining whether to synchronize a data item by consulting a set of flexible selection rules; and

an act of the first computer system synchronize the data item with the second computer if the first computer system determines that the data item is to be synchronized.

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

42. A computer program product for use in a network that includes a first computer system having a first data store and second computer system having a second data store, the computer program product for implementing a method for synchronizing the first and second data stores in a flexible manner considering the circumstances that exist at the time of synchronization, the computer program product comprising one or more computer-readable media having stored thereon the following:

computer-executable instructions for determining that a data item is to be synchronized;

computer-executable instructions for identifying which of the plurality of synchronization mechanisms are available to use for synchronization;

computer-executable instructions for consulting a set of flexible selection rules to select one of the available synchronization mechanisms; and

computer-executable instructions for using the selected synchronization mechanism to synchronize the data item with the second computer.

43. A computer program product in accordance with Claim 42, wherein the one or more computer-readable media are physical storage media.

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

44. In a network that includes a first computer system having a first data store and second computer system having a second data store, a method for synchronizing the first and second data stores in a flexible manner considering the circumstances that exist at the time of synchronization, the method comprising the following:

an act of the first computer system determining that a data item is to be synchronized; and

a step for flexibly using an appropriate synchronization mechanism considering the then-existing circumstances.

45. A method in accordance with Claim 44, wherein the step for flexibly using an appropriate synchronization considering the then-existing circumstances comprises the following:

an act of the first computer system identifying which of the plurality of synchronization mechanisms are available to use for synchronization;

an act of the first computer system consulting a set of flexible selection rules to select one of the available synchronization mechanisms; and

an act of the first computer system using the selected synchronization mechanism to synchronize the data item with the second computer.

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

46. In a network that includes a first computer system having a first data store and second computer system having a second data store, a method for synchronizing the first and second data stores in a flexible manner considering the circumstances that exist at the time of synchronization, the method comprising the following:

an act of the first computer system determining whether to synchronize a data item by consulting a set of flexible selection rules; and

an act of the first computer system synchronize the data item with the second computer if the first computer system determines that the data item is to be synchronized.

47. A method in accordance with Claim 46, wherein the first computer system is a synchronization server, and the second computer system is a mobile device.

48. A method in accordance with Claim 46, wherein the first computer system is a mobile device, and the second computer system is a synchronization server.

49. A method in accordance with Claim 46, further comprising the following:

an act of receiving instructions to change the set of flexible selection rules; and

an act of changing the set of flexible selection rules in response to the instruction.

50. A method in accordance with Claim 49, wherein the act of receiving instructions to change the set of flexible selection rules comprises the following:

an act of receiving instructions to change the set of flexible selection rules from a user of the first computer system.

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

51. A method in accordance with Claim 49, wherein the act of receiving instructions to change the set of flexible selection rules comprises the following:

an act of receiving instructions to change the set of flexible selection rules from an agent of the second computer system.

52. A method in accordance with Claim 51, wherein the act of receiving instructions to change the set of flexible selection rules from an agent of the second computer system comprises the following:

an act of receiving instructions to change the set of flexible selection rules from a network administrator of trusted network that includes the second computer system.

53. A method in accordance with Claim 52, further comprising the following:

an act of receiving instructions to change the set of flexible selection rules from a user.

54. A method in accordance with Claim 53, wherein the act of changing the set of flexible selection rules in response to the instruction, comprises the following:

an act of fulfilling the instructions received from the network administrator of the second computer system to the extent that there is a conflict between the instructions received from the network administrator of the second computer system and the instructions received from the user of the first computer system.

55. A method in accordance with Claim 46, further comprising the following:

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

after using the selected synchronization mechanism to synchronize the data item, an act of determining that the conditions for synchronization are no longer met in light of the flexible selection rules; and

an act of automatically reversing the synchronization if it has been determined that the conditions for synchronization are no longer met.

56. A method in accordance with Claim 46, wherein the act of the first computer system synchronize the data item with the second computer comprises the following:

an act of the first computer system identifying which of a plurality of synchronization mechanisms are available to use for synchronization;

an act of the first computer system consulting a set of flexible selection rules to select one of the available synchronization mechanisms; and

an act of the first computer system using the selected synchronization mechanism to synchronize the data item with the second computer.

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

57. A computer program product for use in a network that includes a first computer system having a first data store and second computer system having a second data store, the computer program product for implementing a method for synchronizing the first and second data stores in a flexible manner considering the circumstances that exist at the time of synchronization, the computer program product comprising one or more computer-readable media having stored thereon the following:

computer-executable instructions for determining whether to synchronize a data item by consulting a set of flexible selection rules; and

computer-executable instructions for synchronize the data item with the second computer if the first computer system determines that the data item is to be synchronized.

58. A computer program product in accordance with Claim 57, wherein the one or more computer-readable media comprise physical storage media.

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

59. A network system comprising the following:

a synchronization server comprising a data store, a networking module, and a processing module configured to access the data store as well as communicate over a network using the networking module;

a mobile device having a data store, a networking module, and a processing modules configured to access the data store of the mobile device as well as communicate with the synchronization server over the network using the networking module of the mobile device, the processing device of the mobile device configured to perform the following:

determine that a data item is to be synchronized;

identify which of the plurality of synchronization mechanisms are available to use for synchronization;

consult a set of flexible selection rules to select one of the available synchronization mechanisms; and

use the selected synchronization mechanism to synchronize the data item.

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

60. A network system comprising the following:

a synchronization server comprising a data store, a networking module, and a processing module configured to access the data store as well as communicate over a network using the networking module;

a mobile device having a data store, a networking module, and a processing modules configured to access the data store of the mobile device as well as communicate with the synchronization server over the network using the networking module of the mobile device, the processing device of the synchronization server configured to perform the following:

determine that a data item is to be synchronized;

identify which of the plurality of synchronization mechanisms are available to use for synchronization;

consult a set of flexible selection rules to select one of the available synchronization mechanisms; and

use the selected synchronization mechanism to synchronize the data item.

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

ABSTRACT OF THE DISCLOSURE

Two computer systems in a network each have a local store that contains a copy of a data item that is to be synchronized. One of the computer systems may be, for example, a mobile device while the other may be a synchronization server. In order to determine whether to synchronize a data item, and what synchronization mechanism to use, one of the computer systems references a flexible set of rules that may be influenced by instructions from a network administrator or a mobile device user. The flexible set of rules takes into consideration the value of the data, the cost associated with synchronization, the security of the synchronization mechanisms, the security of the mobile device, as well as the location of the mobile user in dictating whether and how to synchronize.

G:\DATA\PAT\WORDPAT\13768.255.doc

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

Title: SYNCHRONIZING OVER A NUMBER OF SYNCHRONIZATION MECHANISMS USING FLEXIBLE RULES
Inventor: Shawn D. Loveland
Docket No.: 13768.255

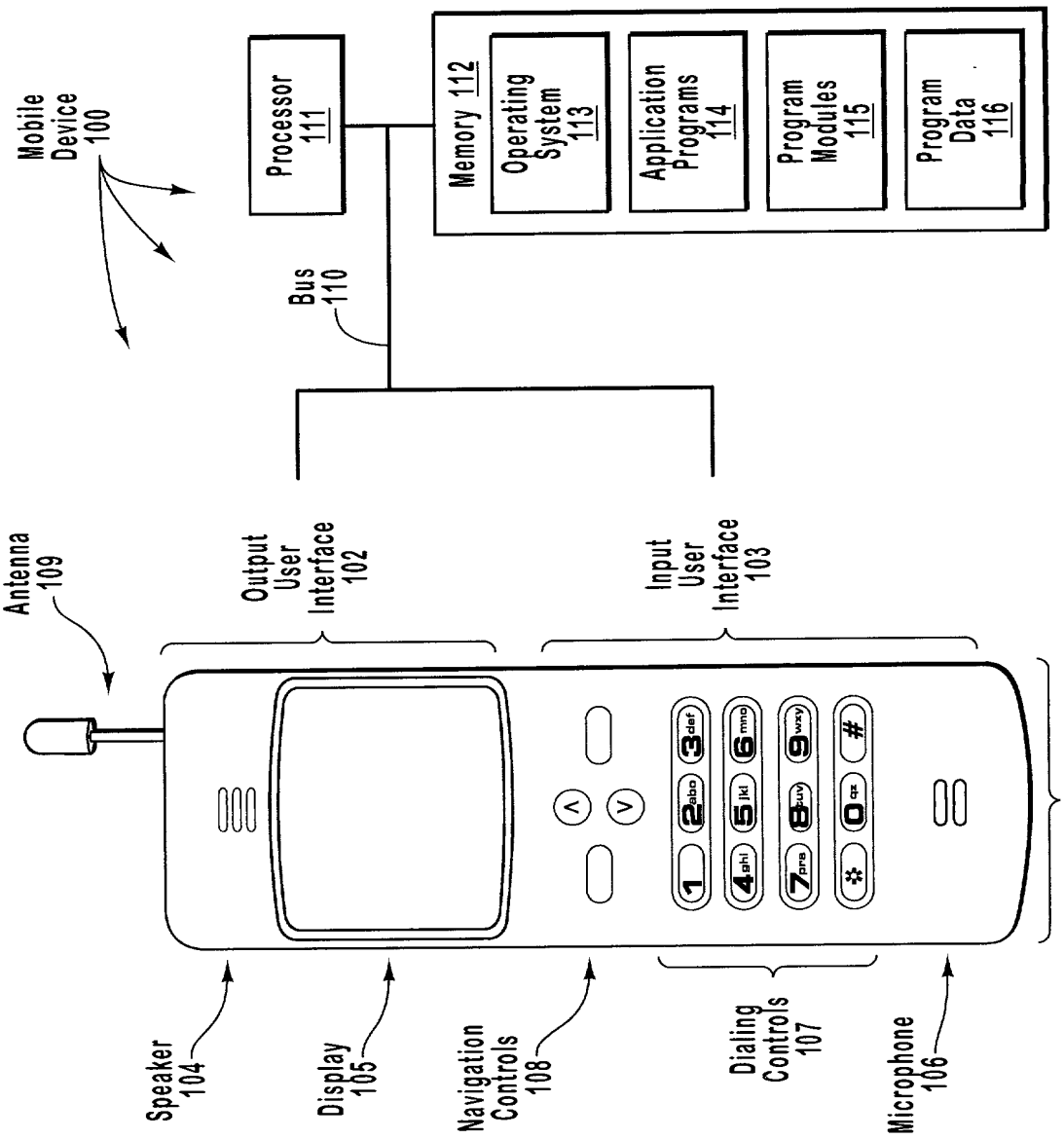


FIG. 1

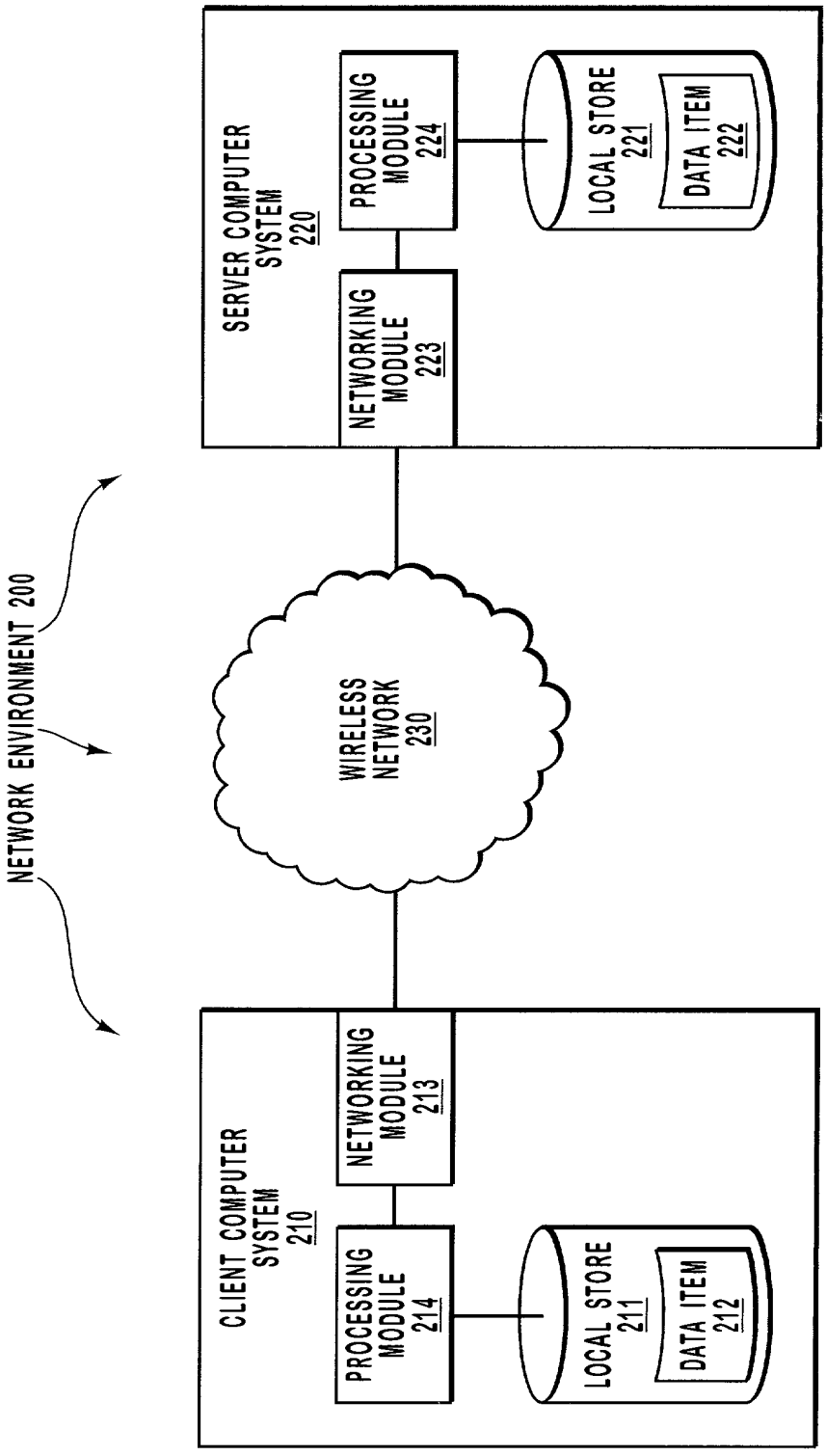

NETWORK ENVIRONMENT 200
SERVER COMPUTER SYSTEM 220
PROCESSING MODULE 224
LOCAL STORE 221
DATA ITEM 222
NETWORKING MODULE 223
WIRELESS NETWORK 230
CLIENT COMPUTER SYSTEM 210
NETWORKING MODULE 213
PROCESSING MODULE 214
LOCAL STORE 211
DATA ITEM 212

FIG. 2

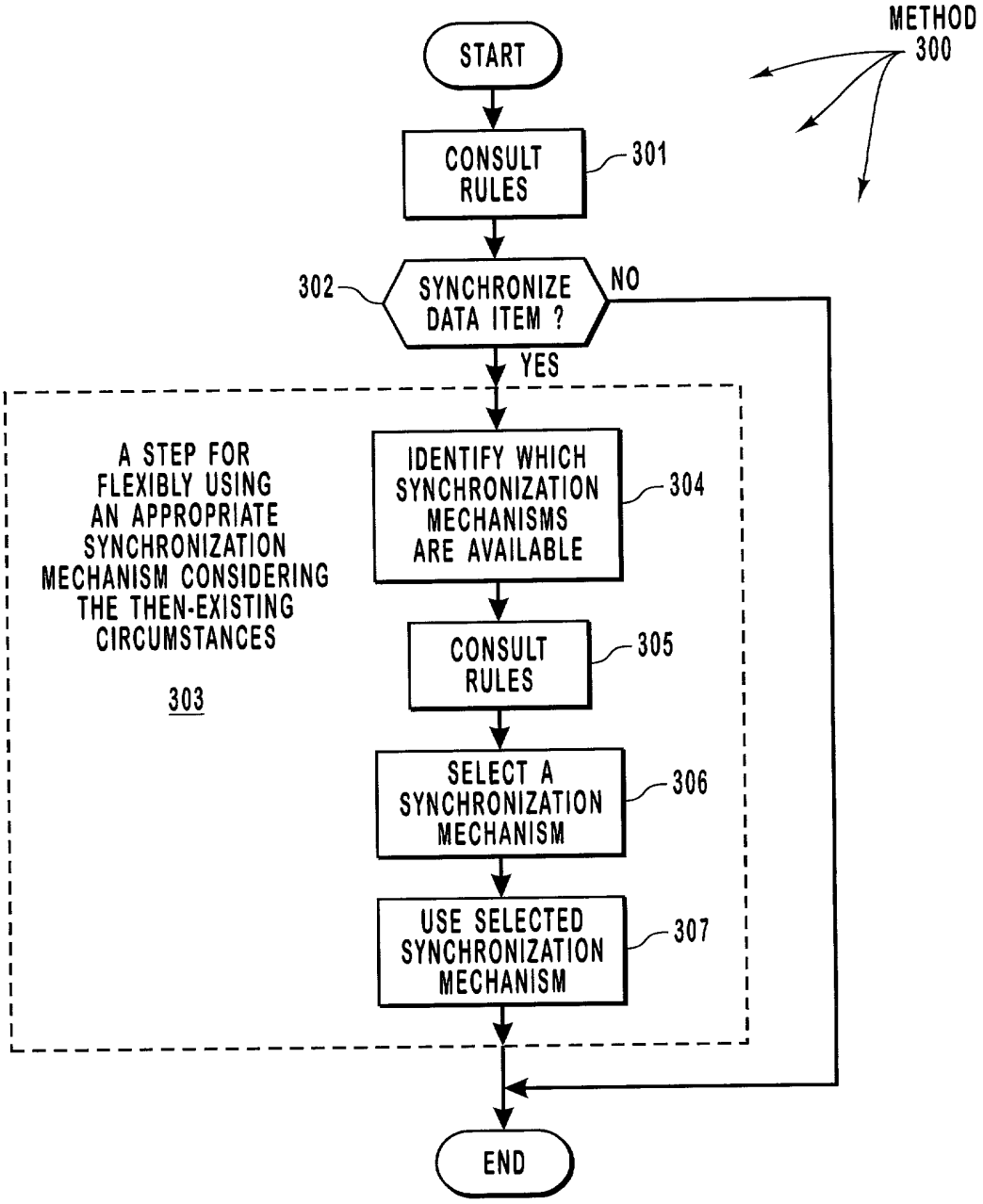

METHOD
300
START
CONSULT RULES
301
302
SYNCHRONIZE DATA ITEM ?
NO
YES
A STEP FOR FLEXIBLY USING AN APPROPRIATE SYNCHRONIZATION MECHANISM CONSIDERING THE THEN-EXISTING CIRCUMSTANCES
303
IDENTIFY WHICH SYNCHRONIZATION MECHANISMS ARE AVAILABLE
304
CONSULT RULES
305
SELECT A SYNCHRONIZATION MECHANISM
306
USE SELECTED SYNCHRONIZATION MECHANISM
307
END

FIG. 3

PATENT APPLICATION

DECLARATION AND POWER OF ATTORNEY FOR PATENT APPLICATION	ATTORNEY DOCKET NO. 13768.255

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: **SYNCHRONIZING OVER A NUMBER OF SYNCHRONIZATION MECHANISMS USING FLEXIBLE RULES**, the specification of which is filed herewith 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) listed below to prosecute this application and transact all business in the Patent and Trademark Office connected therewith.

Katie E. Sako, Reg. No. 32628;
Daniel D. Crouse, Reg. No. 32022; and
all attorneys and/or patent agents listed under the following Customer Number:

022913

PATENT TRADEMARK OFFICE

Send Correspondence to:	Direct Telephone Calls To:
RICK D. NYDEGGER WORKMAN, NYDEGGER & SEELEY 1000 Eagle Gate Tower 60 East South Temple Salt Lake City, UT 84111	RICK D. NYDEGGER (801) 533-9800 (phone) (801) 328-1707 (fax)

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: Shawn Domenic Loveland **Citizenship:** U.S.A.

Residence: 21250 N.E 4th St.
Sammamish, WA 98074

Post Office Address:

Shawn L. Loveland
Inventor's Signature

2/22/02
Date

G:\DATA\WPDOCSRN\MICROSOF\OTHERDOC\255 declaration_022202.doc

BEST AVAILABLE COPY

JC850 U.S. PTO 10/082918 02/26/02

IC 1120

PATENT NUMBER and ISSUE DATE

U.S. UTILITY Patent Application

APPL NUM	FILING DATE	CLASS	SUBCLASS	GAU	EXAMINER
10082918	02/26/2002	455	502	~~2681~~ 2684	NGUYEN, KHAI

**APPLICANTS: Loveland Shawn;

**CONTINUING DATA VERIFIED:

** FOREIGN APPLICATIONS VERIFIED:

PG-PUB | DO NOT PUBLISH ☐ | RESCIND ☐

Foreign priority claimed ☐ yes ☐ no
35 USC 119 conditions met ☐ yes ☐ no
Verified and Acknowledged Examiners's intials

ATTORNEY DOCKET NO
13768.255

TITLE : Synchronizing over a number of synchronization mechanisms using flexible rules

U.S.DEPT. OF COMM./PAT.& TM-PTO-436L(Rev. 12-94)

NOTICE OF ALLOWANCE MAILED	Assistant Examiner	CLAIMS ALLOWED: Total Claims / Print Claim for O.G
ISSUE FEE: Amount Due / Date Paid	Primary Examiner	DRAWING: Sheets Drwg. / Figs.Drwg. / Print Fig.
☐ TERMINAL DISCLAIMER	PREPARED FOR ISSUE	Application Examiner

WARNING: The information disclosed herein may be restricted. Unauthorized disclosure may be prohibited by the United States Code Title 35, Sections 122, 181 and 368, Possession outside the U.S. Patent & Trademark Office is restricted to authorized employees and contractors only.

FILED WITH: ☐ DISK (CRF) ☐ CD-ROM
(Attached in pocket on right inside flap)

BEST AVAILABLE COPY

SEARCH

Class	Sub.	Date	Exmr.
455	502	8/11/2004	KN
	507		
	506		
	456		
	403		
	419		
	445		
	446	8/12/2004	KN
375	355		
	358		
370	350		

INTERFERENCE SEARCHED

Class	Sub.	Date	Exmr.

SEARCH NOTES

(List databases searched. Attach search strategy inside.)

	Date	Exmr.
CORSARO NICK	8/11/04	KN
Duc Nguyen	8/11/04	KN
Binh Tien	8/11/04	KN

ISSUE SLIP STAPLE AREA (for additional cross-references)

ISSUING CLASSIFICATION

ORIGINAL		CROSS REFERENCE(S)	
CLASS	SUBCLASS	CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)
INTERNATIONAL CLASSIFICATION			
/			
/			
/			
/			
/			^ Continued on Issue Slip Inside File Jacket

INDEX OF CLAIMS

✓ ..... Rejected - (Through numeral) ... Canceled N ..... Non-elected A ..... Appeal
= ..... Allowed + ... Restricted I ..... Interference O ..... Objected

Claim Final	Claim Original	Date
	1	8/11/2003
	2	
	3	
	4	
	5	
	6	
	7	
	8	
	9	
	10	
	11	
	12	
	13	
	14	
	15	
	16	
	17	
	18	
	19	
	20	
	21	
	22	
	23	
	24	
	25	
	26	
	27	
	28	
	29	
	30	
	31	
	32	
	33	
	34	
	35	
	36	
	37	
	38	
	39	
	40	
	41	
	42	
	43	
	44	
	45	
	46	
	47	
	48	
	49	
	50	

Claim Final	Claim Original	Date
	51	✓
	52	
	53	
	54	
	55	
	56	
	57	
	58	
	59	
	60	
	61	
	62	
	63	
	64	
	65	
	66	
	67	
	68	
	69	
	70	
	71	
	72	
	73	
	74	
	75	
	76	
	77	
	78	
	79	
	80	
	81	
	82	
	83	
	84	
	85	
	86	
	87	
	88	
	89	
	90	
	91	
	92	
	93	
	94	
	95	
	96	
	97	
	98	
	99	
	100	

Claim Final	Claim Original	Date
	101	
	102	
	103	
	104	
	105	
	106	
	107	
	108	
	109	
	110	
	111	
	112	
	113	
	114	
	115	
	116	
	117	
	118	
	119	
	120	
	121	
	122	
	123	
	124	
	125	
	126	
	127	
	128	
	129	
	130	
	131	
	132	
	133	
	134	
	135	
	136	
	137	
	138	
	139	
	140	
	141	
	142	
	143	
	144	
	145	
	146	
	147	
	148	
	149	
	150	

If more than 150 claims or 9 actions staple additional sheet here

TD 1125 03/29/02

BEST AVAILABLE COPY

Express Mail Label No. EL 813 857 071 US

02.27.02 A

UTILITY PATENT APPLICATION TRANSMITTAL
(Large Entity)

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Docket No. 13768.255
Total Pages in this Submission 4

TO THE ASSISTANT COMMISSIONER FOR PATENTS
Box Patent Application
Washington, D.C. 20231

Transmitted herewith for filing under 35 U.S.C. 111(a) and 37 C.F.R. 1.53(b) is a new utility patent application for an invention entitled:

SYNCHRONIZING OVER A NUMBER OF SYNCHRONIZATION MECHANISMS USING FLEXIBLE RULES

and invented by:

Shawn D. Loveland

If a **CONTINUATION APPLICATION,** *check appropriate box and supply the requisite information:*

☐ **Continuation** ☐ **Divisional** ☐ **Continuation-in-part (CIP)** of prior application No.: _____

Which is a:

☐ **Continuation** ☐ **Divisional** ☐ **Continuation-in-part (CIP)** of prior application No.: _____

Which is a:

☐ **Continuation** ☐ **Divisional** ☐ **Continuation-in-part (CIP)** of prior application No.: _____

Enclosed are:

Application Elements

1. ☒ Filing fee as calculated and transmitted as described below

2. ☒ Specification having 40 pages and including the following:

   a. ☒ Descriptive Title of the Invention

   b. ☐ Cross References to Related Applications *(if applicable)*

   c. ☐ Statement Regarding Federally-sponsored Research/Development *(if applicable)*

   d. ☐ Reference to Microfiche Appendix *(if applicable)*

   e. ☒ Background of the Invention

   f. ☒ Brief Summary of the Invention

   g. ☒ Brief Description of the Drawings *(if drawings filed)*

   h. ☒ Detailed Description

   i. ☒ Claim(s) as Classified Below

   j. ☒ Abstract of the Disclosure

UTILITY PATENT APPLICATION TRANSMITTAL
(Large Entity)

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Docket No. 13768.255
Total Pages in this Submission 4

Application Elements (Continued)

3. ☒ Drawing(s) *(when necessary as prescribed by 35 USC 113)*
   a. ☒ Formal Number of Sheets 3
   b. ☐ Informal Number of Sheets

4. ☒ Oath or Declaration
   a. ☒ Newly executed *(original or copy)* ☐ Unexecuted
   b. ☐ Copy from a prior application (37 CFR 1.63(d)) *(for continuation/divisional application only)*
   c. ☒ With Power of Attorney ☐ Without Power of Attorney
   d. ☐ *DELETION OF INVENTOR(S)*
   Signed statement attached deleting inventor(s) named in the prior application, see 37 C.F.R. 1.63(d)(2) and 1.33(b).

5. ☐ Incorporation By Reference *(usable if Box 4b is checked)*
The entire disclosure of the prior application, from which a copy of the oath or declaration is supplied under Box 4b, is considered as being part of the disclosure of the accompanying application and is hereby incorporated by reference therein.

6. ☐ Computer Program in Microfiche *(Appendix)*

7. ☐ Nucleotide and/or Amino Acid Sequence Submission *(if applicable, all must be included)*
   a. ☐ Paper Copy
   b. ☐ Computer Readable Copy *(identical to computer copy)*
   c. ☐ Statement Verifying Identical Paper and Computer Readable Copy

Accompanying Application Parts

8. ☒ Assignment Papers *(cover sheet & document(s))*

9. ☐ 37 CFR 3.73(B) Statement *(when there is an assignee)*

10. ☐ English Translation Document *(if applicable)*

11. ☒ Information Disclosure Statement/PTO-1449 ☒ Copies of IDS Citations

12. ☐ Preliminary Amendment

13. ☒ Acknowledgment postcard

14. ☒ Certificate of Mailing
   ☐ First Class ☒ Express Mail *(Specify Label No.):* EL 813 857 071 US

UTILITY PATENT APPLICATION TRANSMITTAL
(Large Entity)

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Docket No.
13768.255
Total Pages in this Submission
4

Accompanying Application Parts (Continued)

15. ☐ Certified Copy of Priority Document(s) *(if foreign priority is claimed)*

16. ☒ Additional Enclosures *(please identify below):*

Form PTO 2038 in the amount of $1,836.00

Request That Application Not Be Published Pursuant To 35 U.S.C. 122(b)(2)

17. ☐ Pursuant to 35 U.S.C. 122(b)(2), Applicant hereby requests that this patent application not be published pursuant to 35 U.S.C. 122(b)(1). Applicant hereby certifies that the invention disclosed in this application has not and will not be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication of applications 18 months after filing of the application.

Warning

An applicant who makes a request not to publish, but who subsequently files in a foreign country or under a multilateral international agreement specified in 35 U.S.C. 122(b)(2)(B)(i), must notify the Director of such filing not later than 45 days after the date of the filing of such foreign or international application. A failure of the applicant to provide such notice within the prescribed period shall result in the application being regarded as abandoned, unless it is shown to the satisfaction of the Director that the delay in submitting the notice was unintentional.

UTILITY PATENT APPLICATION TRANSMITTAL
(Large Entity)

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Docket No.
13768.255
Total Pages in this Submission
4

Fee Calculation and Transmittal

CLAIMS AS FILED

For	#Filed	#Allowed	#Extra		Rate	Fee[1]
Total Claims	60	- 20 =	40	x	$18.00	$720.00
Indep. Claims	7	- 3 =	4	x	$84.00	$336.00
Multiple Dependent Claims (check if applicable) ☐						$0.00
					BASIC FEE	$740.00
OTHER FEE *(specify purpose)*	Assignment Recordation Fee					$40.00
					TOTAL FILING FEE	$1,836.00

☒ A check in the amount of to cover the filing fee is enclosed.

☒ The Commissioner is hereby authorized to charge and credit Deposit Account No. **23-3178** as described below. A duplicate copy of this sheet is enclosed.

- ☐ Charge the amount of as filing fee.
- ☒ Credit any overpayment.
- ☒ Charge any additional filing fees required under 37 C.F.R. 1.16 and 1.17.
- ☐ Charge the issue fee set in 37 C.F.R. 1.18 at the mailing of the Notice of Allowance, pursuant to 37 C.F.R. 1.311(b).

Signature

Dated: **February 26, 2002**

Adrian J. Lee
Attorney for Applicant
Registration No. 42,785

cc:

CERTIFICATE OF MAILING BY "EXPRESS MAIL" (37 CFR 1.10) Applicant(s):			Docket No. 13768.255
Serial No. Not yet assigned	Filing Date February 26, 2002	Examiner Not yet assigned	Group Art Unit Not yet assigned

Invention: **SYNCHRONIZING OVER A NUMBER OF SYNCHRONIZATION MECHANISMS USING FLEXIBLE RULES**

I hereby certify that this **(See correspondence listed below)**
(Identify type of correspondence)

is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 CFR 1.10 in an envelope addressed to: The Commissioner of Patents and Trademarks, Washington, D.C. 20231-0001 on **February 26, 2002**
(Date)

Ilona D. Craske
(Typed or Printed Name of Person Mailing Correspondence)

(Signature of Person Mailing Correspondence)

EL 813 857 071 US
("Express Mail" Mailing Label Number)

Submitted:	Pages
Utility Patent Application Transmittal Letter (Large Entity - triplicate)	4
Form PTO-2038 in the amount of **$1,836.00 (in triplicate)**	1
Patent application	40
Drawings	3
Assignment with cover sheet	4
Declaration	2
Certificate of Mailing Express Mail **EL 813 857 071 US**	1
IDS Transmittal w/ PTO-1449 & 1 cited reference	14
Postcard	

Copyright 1995 Legalsoft

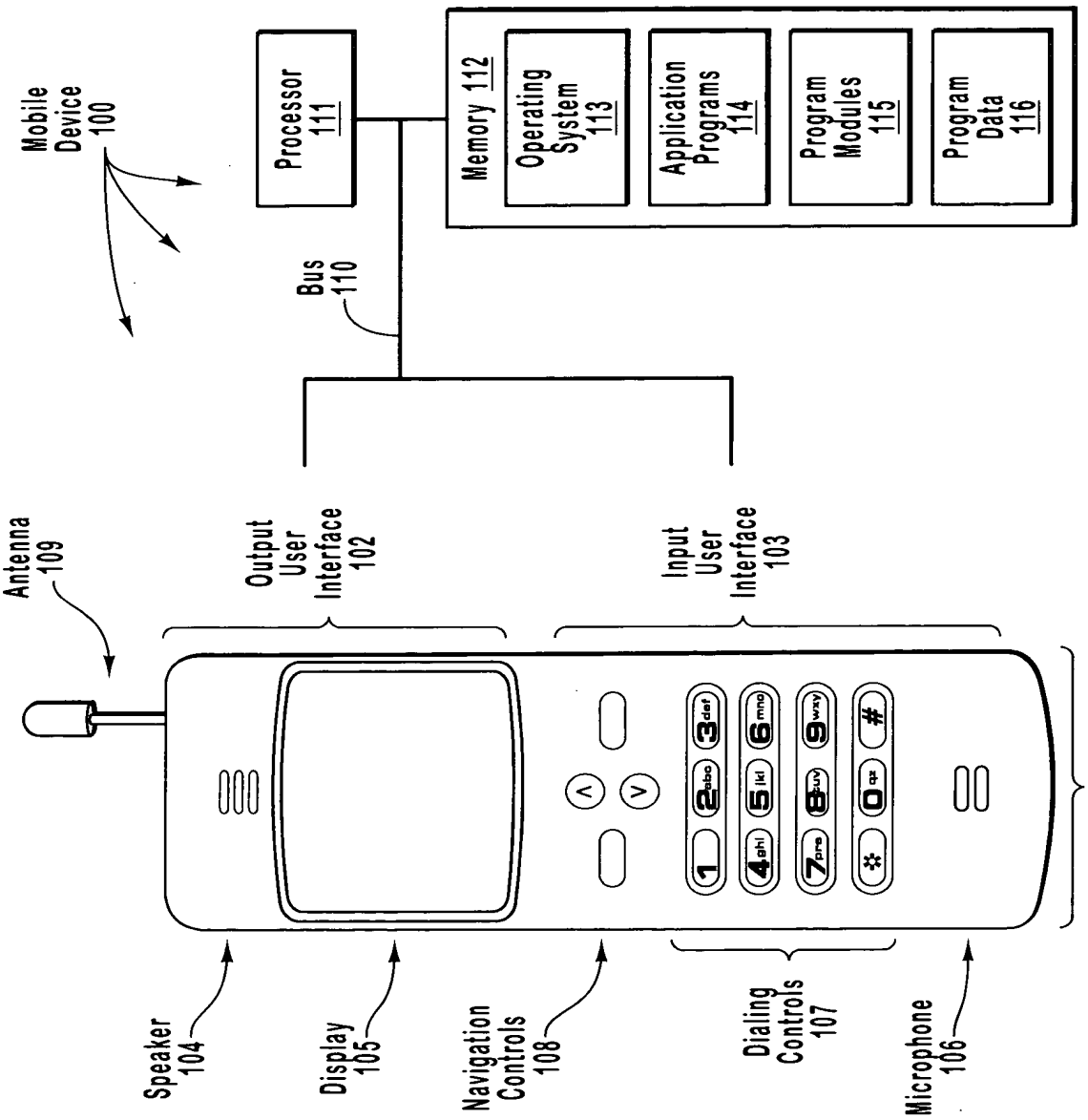

Mobile Device 100
Processor 111
Memory 112
Operating System 113
Application Programs 114
Program Modules 115
Program Data 116
Bus 110
Antenna 109
Output User Interface 102
Input User Interface 103
User Interface 101
Speaker 104
Display 105
Navigation Controls 108
Dialing Controls 107
Microphone 106

FIG. 1

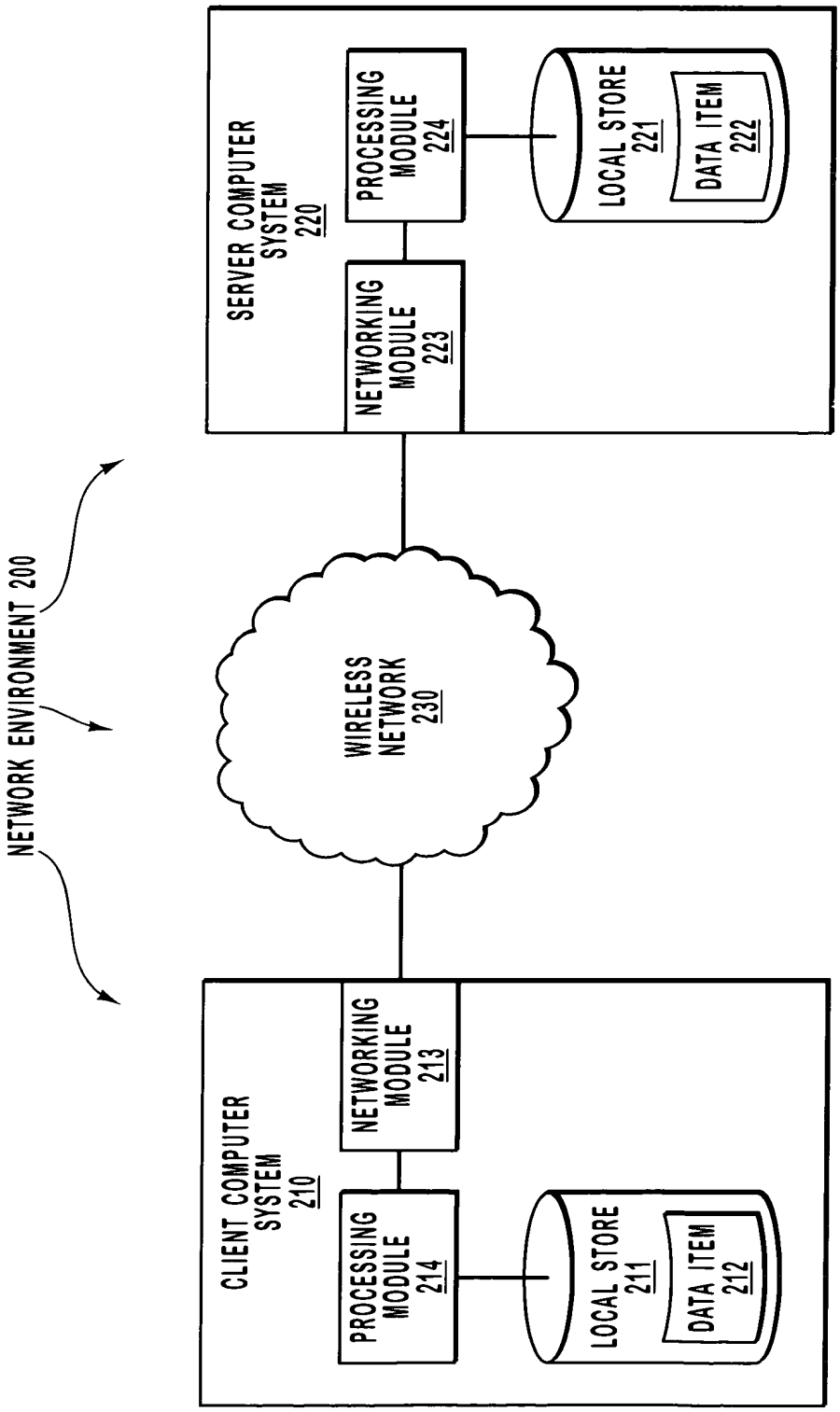

NETWORK ENVIRONMENT 200
SERVER COMPUTER SYSTEM 220
PROCESSING MODULE 224
LOCAL STORE 221
DATA ITEM 222
NETWORKING MODULE 223
WIRELESS NETWORK 230
CLIENT COMPUTER SYSTEM 210
NETWORKING MODULE 213
PROCESSING MODULE 214
LOCAL STORE 211
DATA ITEM 212

FIG. 2

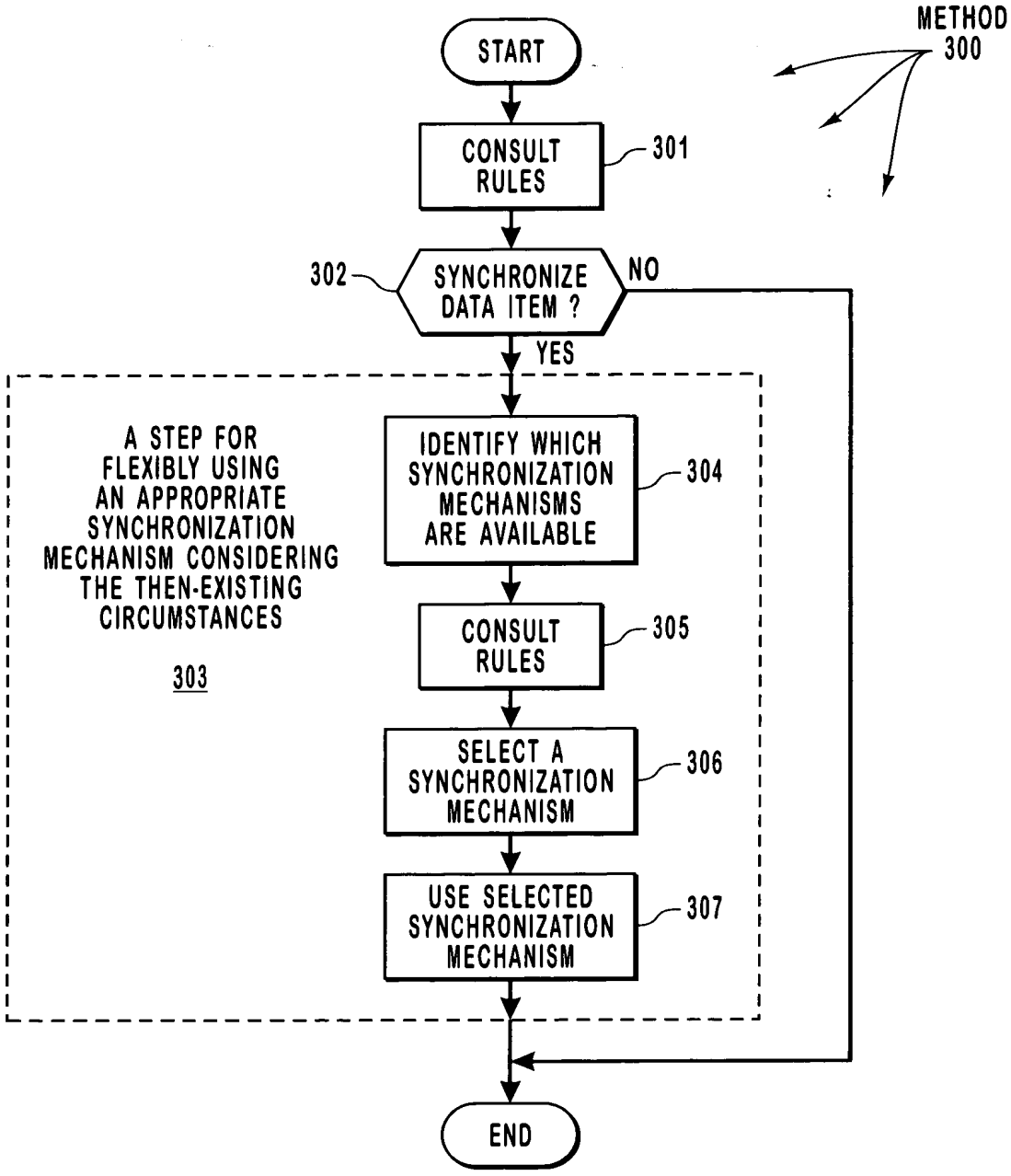

METHOD
300
START
CONSULT RULES
301
302
SYNCHRONIZE DATA ITEM ?
NO
YES
A STEP FOR FLEXIBLY USING AN APPROPRIATE SYNCHRONIZATION MECHANISM CONSIDERING THE THEN-EXISTING CIRCUMSTANCES
303
IDENTIFY WHICH SYNCHRONIZATION MECHANISMS ARE AVAILABLE
304
CONSULT RULES
305
SELECT A SYNCHRONIZATION MECHANISM
306
USE SELECTED SYNCHRONIZATION MECHANISM
307
END

FIG. 3

Express Mailing Lab[redacted]. EL 813 857 071 US

[redacted]TENT APPLICATION
Docket No. 13768.255

UNITED STATES PATENT APPLICATION

of

Shawn D. Loveland

for

SYNCHRONIZING OVER A NUMBER OF SYNCHRONIZATION MECHANISMS USING FLEXIBLE RULES

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

BACKGROUND OF THE INVENTION

1. The Field of the Invention

[0001] The present invention relates to computer network operations. In particular, the present invention relates to methods, systems, and computer program products for synchronizing by flexibly using multiple synchronization mechanisms while considering the then-existing economic and/or security considerations involved with synchronization over a particular mechanism to a particular device.

2. Background and Relevant Art

[0002] Computer networks allow more individuals more ready access to more information than ever before. The Internet is a conglomerate of interconnected computer networks that spreads far and wide throughout the world. An individual need only have an Internet-enabled computer (or device) and an Internet connection to be able to access information from across the globe.

[0003] Mobile devices such as mobile telephones, Personal Digital Assistants (PDAs) and laptop computers also may have the ability to access various objects (e.g., documents) for particular remote network locations. However, accessing documents over a network may be quite time consuming and costly and thus remote access may be unacceptable in many applications. Accordingly, with the memory capabilities of mobile devices increasing, many mobile devices have caching mechanisms that allow them to locally store synchronized copies of more relevant objects that are also stored in another network location.

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

[0004] Synchronization ensures that the copy of a document on the mobile device is an identical replica of a remote copy of the document. After synchronization, however, changes may be made to both of the remote copy or the local copy. Accordingly, the local and remote copies may become quite different after some time. However, the copies are once again made identical during the next synchronization.

[0005] Conventional synchronization mechanisms give the user very little control over synchronization. Basically, the user just selects items to synchronize and selects a single synchronization mechanism to use. This rigid approach ignores some factors that are relevant to whether, when, and how to synchronize.

[0006] For example, some data is more valuable than others. Yet, the conventional technique does not consider the value of the data once the items for synchronization are selected. For example, a user may select to synchronize an in-box. However, the in-box contains high-value e-mails (such as an e-mail offering a highly coveted job) as well as low value e-mails (such as unwanted spam). Yet, all of the e-mails are synchronized in the exact same manner.

[0007] Also current synchronization mechanisms do not consider the costs associated with synchronization. For example, synchronization mechanisms may involve networks with a wide variety of costs and latencies. For example, synchronization over an analog dialup that uses a Global System for Mobile communication (GSM) network has a relatively low bandwidth of approximately 9.6 to 14.4 kilobits per second. A connection over a General Packet Radio Server (GPRS) network allows somewhat faster throughput speeds of up to 115 kilobits per second. However, current GPRS networks are relatively expensive. A connection over an 802.11b (also called "WiFi") wireless network can attain speeds of up to 11 megabits per second, orders of magnitude greater than GSM or GPRS. In addition, use

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

of 802.11b networks is typically free to those who have access to the network. However, 802.11b networks are typically less available as they currently span much less of the globe than do GSM or GPRS networks.

[0008] Current synchronization techniques also typically do not consider security concerns associated with synchronization. For example, the channel used for synchronization may have various levels of inherent security that guard against eavesdropping. For example, physical network connections are very secure, 802.11b networks are somewhat secure, with GSM dialup networks being somewhat less secure, and with GPRS networks being less secure. Also, the devices to which data may be synchronized may have varying levels of security. For example, some devices give access to any locally stored document to anyone who happens to possess the device, even if that person just stole the device from the legitimate user. Other devices are more secure by requiring a password when first logging in. Others are even more secure by having the screen saver turn on after a short period of lack of use, and require a password to restore the device once the screen saver is on. Others are yet even more secure by having an encrypted file system.

[0009] Accordingly, what is desired as mechanisms that use a synchronization mechanism that is appropriate given the economic and security concerns that exist at the time of the synchronization.

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

BRIEF SUMMARY OF THE INVENTION

[0010] The principles of the present invention provide for systems, methods and computer program products for performing synchronization in a flexible manner. Instead of just allowing the user a choice as to what to synchronize and then having the user manually synchronize, one or more of the pair of computer systems involved with the synchronization automatically considers the then-existing circumstances to determine whether, when and how to synchronize. In one described example, the synchronization occurs between a mobile device and a synchronization server. The methods of the present invention may be performed by either synchronizing computer system (e.g., by either the mobile device or the synchronization server).

[0011] It is first determined that a data item is to be synchronized. This may be accomplished in response to a user-issued instruction, or in response to a message from the other device indicating that the data item ought to be synchronized. The determination may also have been made by consulting a flexible set of rules that are dictated by a network administrator of the synchronization server as well as by the mobile device user.

[0012] Once it has been determined that a data item is to be synchronized, the computer system identifies the available synchronization mechanisms, and then once again consults with the flexible rules to determine which of the available synchronization mechanisms to use. The computer system then synchronizes using the selected synchronization mechanism.

[0013] The flexible selection rules may be set and changed by a network administrator and by a user of the mobile device. The flexible selection rules take into consideration the value of the data, the economic cost of synchronization, the security of the synchronization mechanism, and the security of the mobile device. Accordingly, it is much less likely that the flexible rules will allow for highly sensitive data to be shared with an insecure device or

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

over an insecure synchronization channel. Likewise, it is much less likely that a less valuable item of data will be synchronized over an expensive network.

[0014] The synchronization rules also take into consideration the location of the mobile device and user. If none of the available synchronization mechanisms are selectable based on the flexible rules, then the synchronization may be delayed, and then the synchronization mechanism may be repeatedly reevaluated until there is a selectable synchronization mechanism.

[0015] Should synchronization occur, and later a security condition for synchronization changes, then the effects of the synchronization may be reversed. For example, suppose that the flexible rules indicate that synchronization to a mobile device is proper since the mobile device has configuration settings in which a screen saver is activated after five minutes of non-use, and that a user password is required to restore the device each time the screen saver is activated. Later, suppose the user deactivates the screen saver. The synchronization server may query the mobile device to determine that the screen saver has been deactivated. Since the original conditions for synchronization are no longer met, the synchronization server may issue an instruction to erase the data item from the mobile device, or (if change tracking is enabled) then may instruct the mobile device to roll back the data item to its pre-synchronization state.

[0016] Accordingly, the principles of the present invention perform synchronization in a much more appropriate manner considering the surrounding circumstances. In addition, the effects of synchronization may be reversed if security changes so require. Furthermore, the network administrator (and the mobile user) has much more control over when synchronization occurs. This results in a more secure, cost effective, and efficient synchronization design.

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

[0017] Additional features and advantages of the invention will be set forth in the description that follows, and in part will be obvious from the description, or may be learned by the practice of the invention. The features and advantages of the invention may be realized and obtained by means of the instruments and combinations particularly pointed out in the appended claims. These and other features of the present invention will become more fully apparent from the following description and appended claims, or may be learned by the practice of the invention as set forth hereinafter.

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

BRIEF DESCRIPTION OF THE DRAWINGS

[0018] In order to describe the manner in which the above-recited and other advantages and features of the invention can be obtained, a more particular description of the invention briefly described above will be rendered by reference to specific embodiments thereof which are illustrated in the appended drawings. Understanding that these drawings depict only typical embodiments of the invention and are not therefore to be considered to be limiting of its scope, the invention will be described and explained with additional specificity and detail through the use of the accompanying drawings in which:

[0019] Figure 1 illustrates an example of a telephonic device that may implement the principles of the present invention.

[0020] Figure 2 illustrates an example network environment that provides a suitable operating environment for the present invention.

[0021] Figure 3 illustrates a flowchart of a method for flexibly synchronizing in accordance with the present invention.

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0022] The present invention extends to systems, methods and computer program products for performing synchronization in a flexible manner. Two computer systems in a network each have a local store that contains a copy of a data item that is to be synchronized between the two computer systems. One of the computer systems may be, for example, a mobile device while the other may be a synchronization server. In order to determine whether to synchronize a data item, and what synchronization mechanism to use, one of the computer systems references a flexible set of rules that may be influenced by instructions from a network administrator or a mobile device user.

[0023] The flexible set of rules takes into consideration the value of the data, the cost associated with synchronization, the security of the synchronization mechanisms, the security of the mobile device, and/or the location of the mobile device and user in dictating whether and how to synchronize. If synchronization occurs, and the security conditions for synchronization are later not satisfied (e.g., the mobile device's configuration settings have been changed to make the device much less secure), the effects of the synchronization may be reversed. In essence, the principles of the present invention synchronize the appropriate data onto the appropriate device in a manner appropriate to maximize the mobile user's value, benefit, and user experience while at the same time minimize the cost and time of the transaction, and preserving synchronization security.

[0024] The embodiments of the present invention may comprise a general-purpose or special-purpose computer system including various computer hardware components, which are discussed in greater detail below. Embodiments within the scope of the present invention also include computer-readable media for carrying or having computer-executable instructions or data structures stored thereon. Such computer-readable media may be any

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

available media, which is accessible by a general-purpose or special-purpose computer system. By way of example, and not limitation, such computer-readable media can comprise physical storage media such as RAM, ROM, EPROM, CD-ROM or other optical disk storage, magnetic disk storage or other magnetic storage devices, or any other media which can be used to carry or store desired program code means in the form of computer-executable instructions or data structures and which may be accessed by a general-purpose or special-purpose computer system.

[0025] When information is transferred or provided over a network or another communications connection (either hardwired, wireless, or a combination of hardwired or wireless) to a computer system or computer device, the connection is properly viewed as a computer-readable medium. Thus, any such connection is properly termed a computer-readable medium. Combinations of the above should also be included within the scope of computer-readable media. Computer-executable instructions comprise, for example, instructions and data which cause a general-purpose computer system or special-purpose computer system to perform a certain function or group of functions.

[0026] In this description and in the following claims, a "computer system" is defined as one or more software modules, one or more hardware modules, or combinations thereof, that work together to perform operations on electronic data. For example, the definition of computer system includes the hardware components of a personal computer, as well as software modules, such as the operating system of the personal computer. The physical layout of the modules is not important. A computer system may include one or more computers coupled via a computer network. Likewise, a computer system may include a single physical device (such as a mobile phone, Personal Digital Assistant "PDA", laptop

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

computer, a tablet PC) where internal modules (such as a memory and processor) work together to perform operations on electronic data.

[0027] Those skilled in the art will appreciate that the invention may be practiced in network computing environments with many types of computer system configurations, including personal computers, laptop computer, hand-held devices, multi-processor systems, microprocessor-based or programmable consumer electronics, network PCs, minicomputers, mainframe computers, mobile telephones, PDAs, pagers, and the like. The invention may also be practiced in distributed computing environments where local and remote computer systems, which are linked (either by hardwired links, wireless links, or by a combination of hardwired or wireless links) through a communication network, both perform tasks. In a distributed computing environment, program modules may be located in both local and remote memory storage devices.

[0028] Figure 1 and the following discussion are intended to provide a brief, general description of a suitable computing environment in which the invention may be implemented. Although not required, the invention will be described in the general context of computer-executable instructions, such as program modules, being executed by computer systems. Generally, program modules include routines, programs, objects, components, data structures, and the like, which perform particular tasks or implement particular abstract data types.

[0029] With reference to Figure 1, a suitable operating environment for the principles of the invention includes a general-purpose computer system in the form of a mobile device 100. The mobile device 100 includes a user interface 101 for allowing a user to input information through an input user interface 103, and to review information presented via an output user interface 102. For example, the output user interface 102 includes a speaker 104

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

for presenting audio information to the user, as well as a display 105 for presenting visual information to the user. The mobile device 100 may also have an antenna 109.

[0030] The input user interface 103 may include a microphone 106 for translating audio information into electronic form. In addition, the input user interface 103 includes dialing controls 107 represented by 12 buttons through which a user may enter information. Input user interface 103 also includes navigation control buttons 108 that assist the user in navigating through various entries and options listed on display 105.

[0031] Although user interface 101 has the appearance of a mobile telephone, the unseen features of user interface 101 may allow for complex and flexible general-purpose processing capabilities. For example, mobile device 100 also includes a processor 111 and a memory 112 that are connected to each other and to the user interface 101 via a bus 110. Memory 112 generally represents a wide variety of volatile and/or non-volatile memories and may include types of memory previously discussed. However, the particular type of memory used in mobile device 100 is not important to the present invention. Mobile device 100 may also include mass storage devices (not shown) similar to those associated with other general-purpose computer systems.

[0032] Program code means comprising one or more program modules may be stored in memory 112 or other storage devices as previously mentioned. The one or more program modules may include an operating system 113, one or more application programs 114, other program modules 115, and program data 116.

[0033] While Figure 1 represents a suitable operating environment for the present invention, the principles of the present invention may be employed in any system that is capable of, with suitable modification if necessary, implementing the principles of the present invention. The environment illustrated in Figure 1 is illustrative only and by no

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

means represents even a small portion of the wide variety of environments in which the principles of the present invention may be implemented.

[0034] Figure 2 illustrates a network environment 200 in accordance with the present invention. The network environment 200 includes a client computer system 210 (also called herein "client 210") and a server computer system 220 (also called herein "server 220") that are "network connectable" to each other over at least a wireless network 230. In this description and in the claims, "network connectable" means being "network connected" or having the ability to establish a permanent and/or temporary network connection with each other. In this description and in the claims, being "network connected" over a network means having the ability to communicate with each other over at least the network among possibly other networks as well.

[0035] The client 210 may be, for example, the mobile device 100 described with respect to Figure 1, although the client 210 may be any general purpose and/or special purpose processing system. The client 210 has a local store 211 that may be memory 112 in the case of the mobile device 100. Local store 211 may hold a variety of different document types including image files, sound files, executable files, word processing document, spreadsheet documents, or the like. For clarity, the local store 211 is illustrated as containing a single data item 212 that is under consideration for synchronization. The data item may be any structured or unstructured data.

[0036] The client 210 also includes a networking module 213 configured to send and receive communications over the wireless network 230 to and from the server 220. Such a networking module may typically be employed within the operating system of the client 210. A processing module 214 of the client 210 is configured to coordinate access to the

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

data item 212 from the local store, and to use of the networking module 214 so as to perform client operations in accordance with the principles of the present invention.

[0037] The server 220 may be, for example, a computer system that runs a synchronization server that synchronizes with a number of wireless devices over the wireless network 230. However, the server 220 may be any general purpose and/or special purpose processing system. The server 220 also has a local store 221 that stores a data item 222. The data item 222 at the server 220 and the data item 212 at the client 210 are versions of the same data item. At synchronization, both of these data items are identical. However, between synchronizations, changes may be made to one version, without them being immediately propagated to the other version.

[0038] The server 220 also includes a networking module 223 configured to send and receive communications over the network 230 to and from the client 210 as well as potentially other clients that are not shown for clarity. A processing module 224 of the server 220 is configured to coordinate access to the local store 221, and to use the networking module 224 so as to perform server operations in accordance with the principles of the present invention.

[0039] In one embodiment, the client 210 is a mobile device while the server 220 is a synchronization server that provides synchronization services to the mobile device. Although the principles of the present invention is not limited to this embodiment, the following will frequently refer to the embodiment in which the client 210 is a mobile device and the server 220 is a synchronization server. The synchronization server may be a service offered within a corporate network or other common sphere of trust protected by a firewall other security mechanisms from the general public. The mobile device may sometimes be within the corporate network, and may other times be far outside of the corporate network.

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

However, there is no requirement that the synchronization server be within a corporate network. The synchronization server may be, for example, implemented as an Internet service.

[0040] Figure 3 illustrates a flowchart of a method 300 for performing synchronization in a flexible manner considering the then-existing circumstances. The method determines whether, how, and when to synchronize a particular data item by consulting a flexible set of rules that may be set by a user of one of the computer systems, and possible overwritten as dictated by a network administrator. It should be noted that the method 300 may be performed by either the client 210 (e.g., a mobile device) or the server 220 (e.g., a synchronization server).

[0041] The flexible set of rules balance the economic value of the data with the economic cost associated with synchronization. The rules also consider the security of the synchronization mechanism as well as the security of the computer system with which synchronization is desired. The rules balance the security risk associated with synchronization with the value in having access to synchronized data. The security rules may also consider the location of the mobile user and/or device in determining whether to synchronize.

[0042] The value of the data may be determined by user preferences and/or by a network administrator. For example, to a user, spam e-mails will typically be less important to synchronize. However, e-mails from particular senders (e.g., clients, bosses, business partners, spouses, or the like) may be of greater value to a user. E-mails that contain the words "coin" or "penny" may be of higher value to a penny collector than e-mails that do not contain such words. To a network administrator, contacts stored in a business folder may be more important than contacts stored in a personal folder. While these are just

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

examples, the examples demonstrate that there is a wide variety of criteria from which a value of a data item may be derived based on user preferences and network administrator dictates.

[0043] Referring back to Figure 3, the method 300 begins by consulting the set of flexible selection rules (act 301). Based on this consultation, it is determined whether or not to synchronize the data item (decision block 302). For example, the network administrator or mobile device user may have determined that data items must have at least a predetermined value in order to be synchronized. Spam, for example, might fall below that threshold. If the data item is not to be synchronized (NO in decision block 302), then the method 300 simply ends without synchronization.

[0044] If the data item is to be synchronized based on the consultation with the flexible set of rules (YES in decision block 302), then the method proceeds to a step for flexibly using an appropriate synchronization mechanism considering the then-existing circumstances (step 303). This may include any corresponding acts for accomplishing this functional result-oriented step. However, in the illustrated embodiment, the step 303 includes corresponding acts 304, 305, 306 and 307.

[0045] Note that in the illustrated embodiment, whether to synchronize is determined by consultation with a set of rules. This determination may also be made by receiving an instruction from the synchronization server, or by receiving a user-issued instruction from the mobile device user. There is no requirement that the flexible set of rules be consulted as to whether the data item is to be synchronized.

[0046] Once it has been determined that a data item is to be synchronized, the method identifies which synchronization mechanisms of a number of synchronization mechanisms are currently available (act 304). For example, a mobile device may be capable of

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

synchronizing with a synchronization server using a number of synchronization mechanisms such as GSM, GPRS, Bluetooth, 802.11a, 802.11b (WiFi), or the like. However, it may be that the mobile device in not within an 802.11a or 802.11b hot spot, or within a Bluetooth network range. Accordingly, the only available synchronization mechanisms would be GSM and GPRS in this example. Note that although the determination of available synchronization mechanisms (act 304) is illustrated as occurring after the determination as to whether to synchronize the data item, the identification of the available synchronization mechanisms may occur before determining that any particular data item is to be synchronized. For example, the mobile device or the synchronization server may constantly or periodically reevaluate the available synchronization mechanisms. Whether synchronization mechanisms are available may even be a consistently updated configuration setting.

[0047] The method also consults the set of flexible selection rules (act 305) to select one of the synchronization mechanisms (act 306). For example, the flexible selection rules may not only be used to identify the value of the data, but may also be used to determine the economic costs associated synchronizing the data item over each synchronization mechanism. For example, analog dialup over a Public Switched Telephone Network (PSTN) network or GSM is a relatively slow way of synchronizing, but is currently typically less expensive than synchronization over a GPRS network. If the data item was relatively small, synchronization may be more appropriate over a GSM network since it might not take long even over a lower bandwidth connection to synchronize the data item.

[0048] Synchronization costs may also depend on the time of day, or the day of the week. Accordingly, the flexible rules may also consider the time of day, and day of the week in selecting an appropriate network. If the costs associated with a particular

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

synchronization mechanism are to change shortly, then the synchronization may be delayed a short while so as to fall into a less expensive cost structure.

[0049] The flexible selection rules also may consider the security of the network associated with the synchronization mechanisms. Some networks are inherently more secure than others. For example, the mobile device may be within the same trusted corporate network as the synchronization server. If remotely connected, the security of the connection (e.g., Virtual Private Network "VPN", Short Message Service "SMS", Secure Sockets Layer "SSL", or direct Remote Access Services "RAS") may be evaluated to determine how difficult it would be for eavesdropping or redirection of the connection.

[0050] The flexible selection rules may also consider the security of the mobile device with which synchronization may occur. The mobile device may have some rigid security attributes inherent in the device and in the associated operating system itself, as well as flexible security attributes that may be changed by a user. For example, a WINDOWS XP® enabled laptop computer is generally considered more secure than most Personal Digital Assistants (PDAs). A network administrator may thus dictate to the flexible selection rules that synchronization of confidential data items may only be made to mobile laptops and not to PDAs.

[0051] The flexible selection rules may also consider where the mobile device or user is in determining a synchronization mechanism. For example, if a user is outside of a corporate network, but heading towards an 802.11b hot spot with a secure high-speed VPN connection to the corporate network, the synchronization may be delayed until the user enters the hot spot, wherein synchronization may occur with great speed and security and with very little cost.

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

[0052] Also, suppose the user is working on their local computer within the corporate network. Now suppose the mobile device is, by chance, not connected to the corporate network but is with the user. The synchronization server may send a notification to the user's local computer that there is important information to synchronize. The user may then connect the device to the low cost / high speed corporate network and then synchronize.

[0053] Once an appropriate synchronization mechanism is selected (act 306), then the selected synchronization mechanism is used to synchronize the data item (act 307). Once synchronized, the synchronization server may constantly or periodically reevaluate whether any security conditions for synchronization have changed such that synchronization is no longer appropriate. For example, suppose that the flexible rules indicate that synchronization to a mobile device is proper since the mobile device has configuration settings in which a screen saver is activated after five minutes of non-use, and that a user password is required to restore the device each time the screen saver is activated. Later, suppose the user deactivates the screen saver. The synchronization server may query the mobile device to determine that the screen saver has been deactivated. Since the original security conditions for synchronization are no longer met, the synchronization server may issue an instruction to erase the data item from the mobile device, or (if change tracking is enabled) may instruct the mobile device to roll back the data item to its pre-synchronization state. Alternatively, the synchronization server may also be setup to change the devices screen saver setting back to the secure mode.

[0054] The synchronization may occur automatically based on the consultation with the set of flexible selection rules. Alternatively or in addition, the synchronization server may notify the mobile device user that there is an important item to synchronize and then prompt the user as to whether to synchronize. The user of the mobile device may also indicate that

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

synchronization is desired, and then the synchronization server might then determine which data items are appropriate to synchronize. The user may also manually synchronize by selecting particular data items to synchronize.

[0055] Some of the advantages of the present invention may be illustrated by the following scenario involving a fictional stock broker named "Michelle". Having access to up-to-date information is very important to Michelle. The information that she is interested is located in her corporate network in various server locations. She has setup her synchronization server to gather the appropriate data from the appropriate corporate servers and to update her device every morning at 5:00 AM when the data rates are lower with important information that she needs to review before she arrives at work. To do this, she may have created a "weekday morning" sync group that contains: Inbox, Tasks, Calendar, Contacts, high priority action items from her Line-Of-Business (LOB) server, and articles from the Wall Street Journal. This allows Michelle to review important information and plan her day while she eats breakfast and rides the train to work.

[0056] When Michelle gets to work, she tethers her mobile phone to her computer and the device does a complete sync. For example, she created a "in-the-office" sync group that contains: Inbox, Tasks, Calendar, Contacts, important information about her customers from the company's LOB server, the latest research information from the company's trading system, and the updates her Wall Street Journal cache. Some of the data items in the "in-the-office" sync group are highly confidential business-related items. The office's network administrator has set a global rule that indicates that such data items should not be synchronized to a mobile phone, but may only be synchronized with laptop or desktop computers with an encrypted file system. Accordingly, although most of the data items in the "in-the-office" sync group are synchronized with Michelle's mobile phone, the highly

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

confidential data items are not. This balances Michelle's need to access information with the office's need to secure confidential information.

[0057] Michelle undocks her phone and proceeds to do various work items during the morning. She is scheduled to meet an important customer named "Tom" for lunch. Her Personal Information Management (PIM) server, her sync server and the LOB server are offering her an integrated solution. When her meeting reminder pops up on her PC it also informs her that Tom has some account activity that morning and that she should dock her phone to get this new activity synced to her phone. Michelle docks her phone and Tom's information is updated. During the cab ride, Michelle reviews Tom's account information and activity. During lunch, Tom is impressed how knowledgeable Michelle is about his account and activity.

[0058] On her way home from work, Michelle decides she would like to go out to dinner and a movie. On her device, she selects the option to sync the group "weekend personal items" and the individual item restaurant reviews. Her device then syncs movie times, her personal calendar, e-mail, and the weekend weather and restaurant reviews. She finds a movie that she would like to see near her office, finds a review of a new restaurant near the movie. She then calls a friend and makes a date.

[0059] Accordingly, the principles of the present invention allow for an intelligence determination of whether, when and how to synchronize by consulting a flexible set of rules that are derived from input from a network administrator as well as the user. The flexible set of rules takes into consideration the value of the data, the economic cost of synchronization, and/or the security of the synchronization mechanisms and device to which synchronization is proposed. Accordingly, synchronization is made in a more intelligent manner.

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

[0060] The present invention may be embodied in other specific forms without departing from its spirit or essential characteristics. The described embodiments are to be considered in all respects only as illustrative and not restrictive. The scope of the invention is, therefore, indicated by the appended claims rather than by the foregoing description. All changes, which come within the meaning and range of equivalency of the claims, are to be embraced within their scope.

What is claimed and desired secured by United States Letters Patent is:

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

1. In a network that includes a first computer system having a first data store and second computer system having a second data store, a method for synchronizing the first and second data stores in a flexible manner considering the circumstances that exist at the time of synchronization, the method comprising the following:

an act of the first computer system determining that a data item is to be synchronized;

an act of the first computer system identifying which of the plurality of synchronization mechanisms are available to use for synchronization;

an act of the first computer system consulting a set of flexible selection rules to select one of the available synchronization mechanisms; and

an act of the first computer system using the selected synchronization mechanism to synchronize the data item with the second computer.

2. A method in accordance with Claim 1, wherein the first computer system is a synchronization server, and the second computer system is a mobile device.

3. A method in accordance with Claim 1, wherein the first computer system is a mobile device, and the second computer system is a synchronization server.

4. A method in accordance with Claim 3, wherein the act of the first computer system determining that a data item is to be synchronized comprises the following:

an act of the mobile device determining on its own that the data item is to be synchronized.

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

5. A method in accordance with Claim 3, wherein the act of the first computer system determining that a data item is to be synchronized comprises the following:

an act of the mobile device receiving a user-issued instruction to synchronize the data item.

6. A method in accordance with Claim 3, wherein the act of the first computer system determining that a data item is to be synchronized comprises the following:

an act of the mobile device receiving a signal from the synchronization server that represents to the mobile device that the data item is to be synchronized.

7. A method in accordance with Claim 3, wherein the second data store is incorporated within a common sphere of trust.

8. A method in accordance with Claim 7, wherein the second data store is incorporated within a corporate network.

9. A method in accordance with Claim 3, wherein the second data store is incorporated within the Internet.

10. A method in accordance with Claim 3, wherein the mobile device comprises a mobile telephone.

11. A method in accordance with Claim 3, wherein the mobile device comprises a personal digital assistant.

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

12. A method in accordance with Claim 3, wherein the mobile device comprises a laptop computer.

13. A method in accordance with Claim 3, wherein the mobile device comprises a tablet personal computer.

14. A method in accordance with Claim 1, wherein the plurality of synchronization mechanisms comprises at least one wireless synchronization mechanism.

15. A method in accordance with Claim 14, wherein the at least one wireless synchronization mechanism uses a GPRS network.

16. A method in accordance with Claim 14, wherein the at least one wireless synchronization mechanism uses an 802.11a network.

17. A method in accordance with Claim 14, wherein the at least one wireless synchronization mechanism uses an 802.11b network.

18. A method in accordance with Claim 14, wherein the at least one wireless synchronization mechanism uses Bluetooth network.

19. A method in accordance with Claim 14, wherein the at least one wireless synchronization mechanism uses a cellular network.

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

20. A method in accordance with Claim 1, wherein the plurality of synchronization mechanisms comprises an analog dialup synchronization mechanism.

21. A method in accordance with Claim 1, wherein the plurality of synchronization mechanisms comprises a Virtual Private Network (VPN).

22. A method in accordance with Claim 1, further comprising the following:

an act of receiving instructions to change the set of flexible selection rules; and

an act of changing the set of selection rules in response to the instruction.

23. A method in accordance with Claim 22, wherein the act of receiving instructions to change the set of flexible selection rules comprises the following:

an act of receiving instructions to change the set of flexible selection rules from a user of the first computer system.

24. A method in accordance with Claim 22, wherein the act of receiving instructions to change the set of flexible selection rules comprises the following:

an act of receiving instructions to change the set of flexible selection rules from an agent of the second computer system.

25. A method in accordance with Claim 24, wherein the act of receiving instructions to change the set of flexible selection rules from an agent of the second computer system comprises the following:

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

an act of receiving instructions to change the set of flexible selection rules from a network administrator of a network that includes the second computer system.

26. A method in accordance with Claim 25, further comprising the following:

an act of receiving instructions to change the set of flexible selection rules from a user.

27. A method in accordance with Claim 26, wherein the act of changing the set of selection rules in response to the instruction, comprises the following:

an act of fulfilling the instructions received from the network administrator of the second computer system to the extent that there is a conflict between the instructions received from the network administrator of the second computer system and the instructions received from the user of the first computer system.

28. A method in accordance with Claim 1, wherein the act of the first computer system consulting a set of flexible selection rules comprises the following:

an act of the first computer system selecting one of the available synchronization mechanisms without synchronous intervention from a user of the first computer system.

29. A method in accordance with Claim 1, wherein the act of determining that a data item is to be synchronized comprises the following:

an act of the first computer system receiving a notification from the second computer system that a data item is available to synchronize;

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

an act of the first computer system notifying the user of the availability of the data item; and

an act of receiving a user-instruction to synchronize the data item.

30. A method in accordance with Claim 1, wherein the act of consulting a set of flexible selection rules to select one of the available synchronization mechanisms comprises the following:

an act of selecting the synchronization mechanism at least based on the time of day.

31. A method in accordance with Claim 1, wherein the act of consulting a set of flexible selection rules to select one of the available synchronization mechanisms comprises the following:

an act of selecting the synchronization mechanism at least based on the day of the week.

32. A method in accordance with Claim 1, wherein the act of consulting a set of flexible selection rules to select one of the available synchronization mechanisms comprises the following:

an act of selecting the synchronization mechanism at least based on the value of the data.

33. A method in accordance with Claim 1, wherein the act of consulting a set of flexible selection rules to select one of the available synchronization mechanisms comprises the following:

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

an act of selecting the synchronization mechanism at least based on the economic cost of using a network associated with the synchronization mechanism.

34. A method in accordance with Claim 1, wherein the act of consulting a set of flexible selection rules to select one of the available synchronization mechanisms comprises the following:

an act of selecting the synchronization mechanism at least based on the security of a network associated with the synchronization mechanism.

35. A method in accordance with Claim 1, wherein the act of consulting a set of flexible selection rules to select one of the available synchronization mechanisms comprises the following:

an act of selecting the synchronization mechanism at least based on the security of the first computer system.

36. A method in accordance with Claim 35, wherein the act of selecting the synchronization mechanism at least based on the security of the first computer system comprises the following:

an act of selecting the selecting the synchronization mechanism at least based on the security features inherent in devices of the same type as the first computer system

37. A method in accordance with Claim 35, wherein the act of selecting the synchronization mechanism at least based on the security of the first computer system comprises the following:

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

an act of selecting the selecting the synchronization mechanism at least based on current security settings of the first computer system

38. A method in accordance with Claim 1, wherein the act of consulting a set of flexible selection rules to select one of the available synchronization mechanisms comprises the following:

an act of selecting the synchronization mechanism at least based on the location of the user of the first computer system.

39. A method in accordance with Claim 1, wherein the act of consulting a set of flexible selection rules to select one of the available synchronization mechanisms comprises the following:

an act of determining that there are no current synchronization mechanisms that are selectable based on the flexible set of rules;

an act of reevaluating the flexible selection rules at a later time; and

an act of repeating the reevaluation until at least one of the available synchronization mechanisms is selectable based on the flexible selection rules.

40. A method in accordance with Claim 1, further comprising the following:

after using the selected synchronization mechanism to synchronize the data item, an act of determining that the conditions for synchronization are no longer met in light of the flexible selection rules; and

an act of automatically reversing the synchronization if it has been determined that the conditions for synchronization are no longer met.

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

41. A method in accordance with Claim 1, wherein the act of the first computer system determining that a data item is to be synchronized comprises the following:

an act of the first computer system determining whether to synchronize a data item by consulting a set of flexible selection rules; and

an act of the first computer system synchronize the data item with the second computer if the first computer system determines that the data item is to be synchronized.

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

42. A computer program product for use in a network that includes a first computer system having a first data store and second computer system having a second data store, the computer program product for implementing a method for synchronizing the first and second data stores in a flexible manner considering the circumstances that exist at the time of synchronization, the computer program product comprising one or more computer-readable media having stored thereon the following:

computer-executable instructions for determining that a data item is to be synchronized;

computer-executable instructions for identifying which of the plurality of synchronization mechanisms are available to use for synchronization;

computer-executable instructions for consulting a set of flexible selection rules to select one of the available synchronization mechanisms; and

computer-executable instructions for using the selected synchronization mechanism to synchronize the data item with the second computer.

43. A computer program product in accordance with Claim 42, wherein the one or more computer-readable media are physical storage media.

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

44. In a network that includes a first computer system having a first data store and second computer system having a second data store, a method for synchronizing the first and second data stores in a flexible manner considering the circumstances that exist at the time of synchronization, the method comprising the following:

an act of the first computer system determining that a data item is to be synchronized; and

a step for flexibly using an appropriate synchronization mechanism considering the then-existing circumstances.

45. A method in accordance with Claim 44, wherein the step for flexibly using an appropriate synchronization considering the then-existing circumstances comprises the following:

an act of the first computer system identifying which of the plurality of synchronization mechanisms are available to use for synchronization;

an act of the first computer system consulting a set of flexible selection rules to select one of the available synchronization mechanisms; and

an act of the first computer system using the selected synchronization mechanism to synchronize the data item with the second computer.

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

46. In a network that includes a first computer system having a first data store and second computer system having a second data store, a method for synchronizing the first and second data stores in a flexible manner considering the circumstances that exist at the time of synchronization, the method comprising the following:

an act of the first computer system determining whether to synchronize a data item by consulting a set of flexible selection rules; and

an act of the first computer system synchronize the data item with the second computer if the first computer system determines that the data item is to be synchronized.

47. A method in accordance with Claim 46, wherein the first computer system is a synchronization server, and the second computer system is a mobile device.

48. A method in accordance with Claim 46, wherein the first computer system is a mobile device, and the second computer system is a synchronization server.

49. A method in accordance with Claim 46, further comprising the following:

an act of receiving instructions to change the set of flexible selection rules; and

an act of changing the set of flexible selection rules in response to the instruction.

50. A method in accordance with Claim 49, wherein the act of receiving instructions to change the set of flexible selection rules comprises the following:

an act of receiving instructions to change the set of flexible selection rules from a user of the first computer system.

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

51. A method in accordance with Claim 49, wherein the act of receiving instructions to change the set of flexible selection rules comprises the following:

an act of receiving instructions to change the set of flexible selection rules from an agent of the second computer system.

52. A method in accordance with Claim 51, wherein the act of receiving instructions to change the set of flexible selection rules from an agent of the second computer system comprises the following:

an act of receiving instructions to change the set of flexible selection rules from a network administrator of trusted network that includes the second computer system.

53. A method in accordance with Claim 52, further comprising the following:

an act of receiving instructions to change the set of flexible selection rules from a user.

54. A method in accordance with Claim 53, wherein the act of changing the set of flexible selection rules in response to the instruction, comprises the following:

an act of fulfilling the instructions received from the network administrator of the second computer system to the extent that there is a conflict between the instructions received from the network administrator of the second computer system and the instructions received from the user of the first computer system.

55. A method in accordance with Claim 46, further comprising the following:

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

after using the selected synchronization mechanism to synchronize the data item, an act of determining that the conditions for synchronization are no longer met in light of the flexible selection rules; and

an act of automatically reversing the synchronization if it has been determined that the conditions for synchronization are no longer met.

56. A method in accordance with Claim 46, wherein the act of the first computer system synchronize the data item with the second computer comprises the following:

an act of the first computer system identifying which of a plurality of synchronization mechanisms are available to use for synchronization;

an act of the first computer system consulting a set of flexible selection rules to select one of the available synchronization mechanisms; and

an act of the first computer system using the selected synchronization mechanism to synchronize the data item with the second computer.

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

57. A computer program product for use in a network that includes a first computer system having a first data store and second computer system having a second data store, the computer program product for implementing a method for synchronizing the first and second data stores in a flexible manner considering the circumstances that exist at the time of synchronization, the computer program product comprising one or more computer-readable media having stored thereon the following:

computer-executable instructions for determining whether to synchronize a data item by consulting a set of flexible selection rules; and

computer-executable instructions for synchronize the data item with the second computer if the first computer system determines that the data item is to be synchronized.

58. A computer program product in accordance with Claim 57, wherein the one or more computer-readable media comprise physical storage media.

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

59. A network system comprising the following:

a synchronization server comprising a data store, a networking module, and a processing module configured to access the data store as well as communicate over a network using the networking module;

a mobile device having a data store, a networking module, and a processing modules configured to access the data store of the mobile device as well as communicate with the synchronization server over the network using the networking module of the mobile device, the processing device of the mobile device configured to perform the following:

determine that a data item is to be synchronized;

identify which of the plurality of synchronization mechanisms are available to use for synchronization;

consult a set of flexible selection rules to select one of the available synchronization mechanisms; and

use the selected synchronization mechanism to synchronize the data item.

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

60. A network system comprising the following:

a synchronization server comprising a data store, a networking module, and a processing module configured to access the data store as well as communicate over a network using the networking module;

a mobile device having a data store, a networking module, and a processing modules configured to access the data store of the mobile device as well as communicate with the synchronization server over the network using the networking module of the mobile device, the processing device of the synchronization server configured to perform the following:

determine that a data item is to be synchronized;

identify which of the plurality of synchronization mechanisms are available to use for synchronization;

consult a set of flexible selection rules to select one of the available synchronization mechanisms; and

use the selected synchronization mechanism to synchronize the data item.

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

ABSTRACT OF THE DISCLOSURE

Two computer systems in a network each have a local store that contains a copy of a data item that is to be synchronized. One of the computer systems may be, for example, a mobile device while the other may be a synchronization server. In order to determine whether to synchronize a data item, and what synchronization mechanism to use, one of the computer systems references a flexible set of rules that may be influenced by instructions from a network administrator or a mobile device user. The flexible set of rules takes into consideration the value of the data, the cost associated with synchronization, the security of the synchronization mechanisms, the security of the mobile device, as well as the location of the mobile user in dictating whether and how to synchronize.

G:\DATA\PAT\WORDPAT\13768.255.doc

WORKMAN, NYDEGGER & SEELEY
A PROFESSIONAL CORPORATION
ATTORNEYS AT LAW
1000 EAGLE GATE TOWER
60 EAST SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

PATENT APPLICAT

DECLARATION AND POWER OF ATTORNEY FOR PATENT APPLICATION

ATTORNEY DOCKET NO. 13768.255

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: **SYNCHRONIZING OVER A NUMBER OF SYNCHRONIZATION MECHANISMS USING FLEXIBLE RULES**, the specification of which is filed herewith 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) listed below to prosecute this application and transact all business in the Patent and Trademark Office connected therewith.

Katie E. Sako, Reg. No. 32628;
Daniel D. Crouse, Reg. No. 32022; and
all attorneys and/or patent agents listed under the following Customer Number:

022913

PATENT TRADEMARK OFFICE

Send Correspondence to:	Direct Telephone Calls To:
RICK D. NYDEGGER WORKMAN, NYDEGGER & SEELEY 1000 Eagle Gate Tower 60 East South Temple Salt Lake City, UT 84111	RICK D. NYDEGGER (801) 533-9800 (phone) (801) 328-1707 (fax)

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: Shawn Domenic Loveland **Citizenship:** U.S.A.

Residence: 21250 N.E. 4th St.
Sammamish, WA 98074

Post Office Address:

Shawn Loveland
Inventor's Signature

2/22/02
Date

G:\DATA\WPDOCSRN\MICROSOF\OTHERDOC\255 declaration_022202.doc

UNITED STATES PATENT AND TRADEMARK OFFICE

COMMISSIONER FOR PATENTS
UNITED STATES PATENT AND TRADEMARK OFFICE
WASHINGTON, D.C. 20231
www.uspto.gov

Bib Data Sheet

CONFIRMATION NO. 4771

SERIAL NUMBER	FILING DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
10/082,918	02/26/2002 RULE	455	2681	13768.255

APPLICANTS

Shawn Domenic Loveland, Sammamish, WA;

** CONTINUING DATA ********** NONE (KN)

** FOREIGN APPLICATIONS ********** NONE (KN)

IF REQUIRED, FOREIGN FILING LICENSE GRANTED
** 03/27/2002

Foreign Priority claimed	STATE OR COUNTRY	SHEETS DRAWING	TOTAL CLAIMS	INDEPENDENT CLAIMS
☐ yes ☑ no	WA	3	60	7

35 USC 119 (a-d) conditions met: ☐ yes ☑ no ☐ Met after Allowance

Verified and Acknowledged: Examiner's Signature _____ Initials KN

ADDRESS

RICK D. NYDEGGER
WORKMAN, NYDEGGER & SEELEY
1000 Eagle Gate Tower
60 East South Temple
Salt Lake City ,UT 84111

TITLE

Synchronizing over a number of synchronization mechanisms using flexible rules

FILING FEE RECEIVED	FEES: Authority has been given in Paper	
1796	No. _____ to charge/credit DEPOSIT ACCOUNT No. _____ for following:	☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other _____ ☐ Credit

PATENT APPLICATION SERIAL NO. _____

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

03/05/2002 DTESSEM1 00000020 10082918

01 FC:101	740.00	OP
02 FC:103	720.00	OP
03 FC:102	336.00	OP

PTO-1556
(5/87)

*U.S. GPO: 2000-468-987/39595

PATENT APPLICATION FEE DETERMINATION RECORD
Effective October 1, 2001

Application or Docket Number

CLAIMS AS FILED - PART I

	(Column 1)	(Column 2)
TOTAL CLAIMS	60	
FOR	NUMBER FILED	NUMBER EXTRA
TOTAL CHARGEABLE CLAIMS	60 minus 20=	* 40
INDEPENDENT CLAIMS	7 minus 3 =	* 4
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	370.00	OR	BASIC FEE	740.00
X$ 9=		OR	40 X$18=	720
X42=		OR	4 X84=	
+140=		OR	+280=	336
TOTAL		OR	TOTAL	1796

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=	
X42=		OR	X84=	
+140=		OR	+280=	
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=	
X42=		OR	X84=	
+140=		OR	+280=	
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
X$ 9=		OR	X$18=	
X42=		OR	X84=	
+140=		OR	+280=	
TOTAL ADDIT. FEE		OR	TOTAL ADDIT. FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20."
***If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3."
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

CLAIMS ONLY

SERIAL NO.	FILING DATE
10/082,918	
APPLICANT(S)	

CLAIMS

	AS FILED		AFTER 1st AMENDMENT		AFTER 2nd AMENDMENT	
	IND.	DEP.	IND.	DEP.	IND.	DEP.
1	1					
2		1				
3		1				
4		1				
5		1				
6		1				
7		1				
8		1				
9		1				
10		1				
11		1				
12		1				
13		1				
14		1				
15		1				
16		1				
17		1				
18		1				
19		1				
20		1				
21		1				
22		1				
23		1				
24		1				
25		1				
26		1				
27		1				
28		1				
29		1				
30		1				
31		1				
32		1				
33		1				
34		1				
35		1				
36		1				
37		1				
38		1				
39		1				
40		1				
41		1				
42	1					
43		1				
44	1					
45		1				
46	1					
47		1				
48		1				
49		1				
50		1				
TOTAL IND.						
TOTAL DEP.						
TOTAL CLAIMS						

	*		*		*	
	IND.	DEP.	IND.	DEP.	IND.	DEP.
51		1				
52		1				
53		1				
54		1				
55		1				
56		1				
57	1					
58		1				
59	1					
60	1					
61						
62						
63						
64						
65						
66						
67						
68						
69						
70						
71						
72						
73						
74						
75						
76						
77						
78						
79						
80						
81						
82						
83						
84						
85						
86						
87						
88						
89						
90						
91						
92						
93						
94						
95						
96						
97						
98						
99						
100						
TOTAL IND.	7					
TOTAL DEP.	53					
TOTAL CLAIMS	60					

* MAY BE USED FOR ADDITIONAL CLAIMS OR ADMENDMENTS

D. J.
#2 4-1002

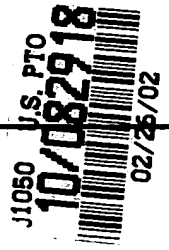
TRANSMITTAL OF INFORMATION DISCLOSURE STATEMENT (Under 37 CFR 1.97(b) or 1.97(c))	Docket No. 13768.255

IDS w/ fees

In Re Application Of: **Shawn D. Loveland**

Serial No.	Filing Date	Examiner	Group Art Unit
Not yet assigned	**February 26, 2002**	**Not yet assigned**	**Not yet assigned**

Title: **SYNCHRONIZING OVER A NUMBER OF SYNCHRONIZATION MECHANISMS USING FLEXIBLE RULES**



Address to:
Assistant Commissioner for Patents
Washington, D.C. 20231

37 CFR 1.97(b)

1. ☒ The Information Disclosure Statement submitted herewith is being filed within three months of the filing of a national application other than a continued prosecution application under 37 CFR 1.53(d); within three months of the date of entry of the national stage as set forth in 37 CFR 1.491 in an international application; before the mailing of a first Office Action on the merits, or before the mailing of a first Office Action after the filing of a request for continued examination under 37 CFR 1.114.

37 CFR 1.97(c)

2. ☐ The Information Disclosure Statement submitted herewith is being filed after the period specified in 37 CFR 1.97(b), provided that the Information Disclosure Statement is filed before the mailing date of a Final Action under 37 CFR 1.113, a Notice of Allowance under 37 CFR 1.311, or an Action that otherwise closes prosecution in the application, and is accompanied by one of:

   ☐ the statement specified in 37 CFR 1.97(e);

   OR

   ☐ the fee set forth in 37 CFR 1.17(p).

TRANSMITTAL OF INFORMATION DISCLOSURE STATEMENT (Under 37 CFR 1.97(b) or 1.97(c))	Docket No. 13768.255

In Re Application: **Shawn D. Loveland**

Serial No.	Filing Date	Examiner	Group Art Unit
Not yet assigned	February 26, 2002	Not yet assigned	Not yet assigned

SYNCHRONIZING OVER A NUMBER OF SYNCHRONIZATION MECHANISMS USING FLEXIBLE RULES

Payment of Fee

(Only complete if Applicant elects to pay the fee set forth in 37 CFR 1.17(p))

☐ A check in the amount of is attached.

☒ The Assistant Commissioner is hereby authorized to charge and credit Deposit Account No. **23-3178** as described below. A duplicate copy of this sheet is enclosed.

- ☐ Charge the amount of
- ☒ Credit any overpayment.
- ☒ Charge any additional fee required.

Certificate of Transmission by Facsimile*

I certify that this document and authorization to charge deposit account is being facsimile transmitted to the United States Patent and Trademark Office (F

_____
(Date)

Signature

Typed or Printed Name of Person Signing Certificate

Certificate of Mailing by First Class Mail

I certify that this document and fee is being deposited with the U.S. Postal Service as first class mail under 37 C.F.R. 1.8 and is addressed to the Assistant Commissioner for Patents, Washington, D.C. 20231.

Signature of Person Mailing Correspondence

Typed or Printed Name of Person Mailing Certificate

***This certificate may only be used if paying by deposit account.**

_____
Signature

Dated: **February 26, 2002**

Adrian J. Lee
Attorney for Applicant
Registration No. 42,785

cc:

QA
76.9
A73
C64
24:5

Computer Architecture News

A Publication of the
Association for Computing Machinery
Special Interest Group on Computer Architecture

Vol. 24, No. 5 - December 1996

Regular Contributions

1 **Constructing Instruction Traces from Cache-Filtered Address Traces (CITCAT)** Charlton D. Rose and J. Kelly Flanagan
9 **Efficient Data Sharing with Conditional Remote Memory Transfers** Susan Flynn Hummel
18 **Eliminating Operand Read Latency** Larry Widigen, Elliot Sowadsky, Kevin McGrath
23 **The Case for SRAM Memory** Philip Machanick

Departments

30 **Bus Traffic**
31 **Calls for Papers & Announcements**
IEEE Computer: Special Issue Processors of the Future: How to use a Billion Transistors

ENGINEERING PERIODICALS

ENGINEERING LIBRARY
DISPLAY PERIODICAL
Non-circulating until:

Chairman:
Jean-Loup Baer
Dept. of Computer Science & Engineering
University of Washington
Seattle, WA 98195
(206)685-1376
baer@cs.washington.edu

Vice-Chairman:
John Hennessy
Stanford University
Dept. of Electrical Engineering
Computer Systems Lab
Stanford, CA 94304
(415)725-3712
hennessy@sierra.stanford.edu

Secy./Treasurer:
Alan Berenbaum
AT&T Bell Labs
Room 2C-325
600 Mountain Avenue
Murray Hill, NJ 07974
(908)582-3655
adb@research.att.com

CAN Editor:
Doug DeGroot
Texas Instruments
4920 Bellerive Dr.
Dallas, TX 75287
(972)995-7957, fax: (972)380-0927
degroot@ti.com

Directors:
Mark D. Hill
Computer Sciences Department
1210 West Dayton Street
University of Wisconsin-Madison
Madison, WI 53706
(608)262-2196
markhill@cs.wisc.edu

Mary Jane Irwin
Department of Computer Science & Engineering
Penn State University
220 Pond Lab
University Park, PA 16802
(814)865-1802
mji@cs.psu.edu

Alan Jay Smith
Computer Science Division
University of California, Berkeley
387 Soda Hall
Berkeley, CA 94720-1776
(510)642-5290
smith@cs.berkeley.edu

Norman P. Jouppi
Digital Equipment Corporation
250 University Ave.
Palo Alto, CA 94301
(415)-617-3305
jouppi@pa.dec.com

ACM SIG
Program Director:
Lisette Burgos
ACM
1515 Broadway
New York, NY 10036
(212)626-0616
burgos@acm.org

COMPUTER ARCHITECTURE NEWS (ISSN 0163 - 5964) is published 5 times a year (March, May, June, September, December) by the Association For Computing Machinery, Inc., 1515 Broadway, New York, NY 10036. Periodicals postage paid at New York, NY 10001, and at additional mailing offices. POSTMASTER: Send address changes to Computer Architecture News, ACM, 1515 Broadway, New York, NY 10036.

Issue closing dates: Articles submitted for publication in the COMPUTER ARCHITECTURE NEWS must be received by the issue closing date to be considered for publication.

Issue date	Closing date
March	January 5
June	April 5
September	July 5
December	October 5

Contributions to COMPUTER ARCHITECTURE NEWS should be sent to the editor in camera-ready format and should not ordinarily exceed eight pages. Submit two copies of the material to be published, single-sided. Type should be single-spaced and confined to a 7 1/2" by 9 1/2" area on each page. Output from low-resolution dot-matrix printers is not acceptable. Items submitted for publication in "Announcements" must also be good-quality, camera-ready copy. Please do not add page numbers, headers, or footers. However, please lightly number the pages on the back of each sheet.

All letters to the editor will be considered "for publication" unless accompanied by a request to the contrary. Except for editorial items, all sources of material appearing in COMPUTER ARCHITECTURE NEWS will be clearly identified. Items attributable to individuals will be interpreted as personal rather than organizational opinions.

Technical Papers appearing in COMPUTER ARCHITECTURE NEWS are unrefereed working papers except where indicated to the contrary. Publication in COMPUTER ARCHITECTURE NEWS does not preclude publication of final papers in other ACM publications.

Subscriptions: Annual subscription cost of $19.95 is included in the member dues of $28.00 (for students, cost is included in $14.00); the non-member annual subscription is $54.00. SIGARCH membership information appears on the inside back cover of this issue.

NOTICE: This material may be protected
by copyright law (Title 17 U.S. Code)
Provided by the University of Washington Libraries

Efficient Data Sharing with Conditional Remote Memory Transfers

Susan Flynn Hummel
IBM T. J. Watson Research Center and Polytechnic University
Currently also with the Cornell Theory Center
email: hummel@mono.poly.edu

Abstract

Remote memory transfers (RMTs) allow processors to access non-local memories without involving the remote processor. As the only interprocessor synchronization required is setting flags on the local and remote processors after the transfer is complete, RMTs do not entail the overhead due to the handshaking and buffering of message passing nor require the complex hardware of cache-coherent shared memory. The minimal synchronization of RMTs, however, necessiates extra remote communications to enforce common data sharing paradigms, such as producer/consumer. We propose a new hardware mechanism: the conditional RMT (CMRT). CRMTs succeed or fail depending on the state of the remote data. We describe potential CRMT hardware definitions, and illustrate their utility by presenting efficient software protocols for producer/consumer and check-in/check-out data sharing.

1 Introduction

Because it is difficult to maintain the consistency of shared data on large-scale parallel machines, some machines restrict interprocessor communication to message passing, e.g., sends and receives, or, more recently, to remote memory transfers, e.g., puts and gets. Ensuring the consistency of shared data is then the responsibility of the programmer. Remote memory transfers use DMA devices to allow processors to access remote memories without involving the remote processor. In general, accessing non-local data is easier with RMTs than with message passing. Moreover, as the only interprocessor synchronization required is setting flags on the local and remote processors after the transfer is complete, RMTs do not incur as much handshaking and buffering overhead as message passing, nor do they require as complex hardware as cache-coherent shared memory. RMT primitives are supported by the Cray T3D, Fujitsu AP1000 and the Meiko CS-2.

Although the synchronization provided by message passing and cache coherency can be overkill, the minimal synchronization of RMTs necessitates extra remote communications to enforce common data sharing paradigms, such as producer/consumer. We propose a new hardware mechanism: the conditional RMT (CRMT). The basic concept behind CRMTs is that two processors synchronize by having one set a local flag when it is ready for the data, and the other processor check this flag before transferring the

data. If the flag is set, then the second processor completes transfer. If the flag is not set, then the second processor sets a flag on the first processor to let it know that it must complete the transfer. A generalization is to queue processors awaiting transfers.

CRMTs can be implemented in software using active messages [1], which execute a procedure on a remote processor upon arrival rather than waiting for the matching receive to be issued. Active messages, however, are executed by the remote processor. To off-load the execution of active messages to a DMA device would require it to have the full functionality of a general purpose processor. The hardware definitions that we propose for CRMTs are only incrementally more complex than those for RMTs.

Conditional puts and gets can be defined in various ways. We first give a simple definition that uses two boolean flags per processor. We then give a more general definition that uses two integers per processor to implement a queue. We illustrate the utility of the first definition in an implementation of producer/consumer data sharing, and of the second in an implemention of check-in, check-out (CICO) data sharing. In producer/consumer sharing, one processor produces data that are needed by another processor. Check-in and check-out are primitives for changing ownership of shared data; a processor has exclusive access to the data that it (transitorily) owns [2].

2 Data Sharing

Processors executing cooperating subtasks need to share data. In parallel SPMD (single program, multiple data) code, a common data paradigm in *producer/consumer* sharing. In producer/consumer shring, one processor generates a stream of data that are needed by another processor. For example, when High Perfomance Fortran is implemented with an owner computes rule, i.e., updates to an element of a matriix is executed by the processor that owns the element, the follwoing statement in a loop nest can lead to producer/consumer sharing:

```
b(J) = ...
...
a(J) = b(J+1)
```

if the elements of a and b have been distributed to processor in blocks.

Heterogeneous and dynamic parallelism may require a sharing pattern that is more general than producer/consumer, for example, where data ownership changes over time. Hill *et al.* have proposed a data sharing model called *check-in, check-out* (CICO) that allows processors to transitorally obtain ownership of shared data [2]. At any given time, a single processor (that has successfully) checked out the data in exclusive mode can update the data, or multiple processors (that have successfully) checked out the data in shared mode can read the data.

3 Conditional Remote Memory Transfers

Remote memory transfers set flags on the local and remote processors after the transfer is complete. Additional flags are needed to enforce data sharing paradigms, such and producer/consumer [3]. Hardware definitions of puts and gets that use two per-processor

flags to enforce producer/consumer sharing have been proposed [3]. The put-based definition is illustrated in Figure 1. Note that three communications take place, one for the actual data transfer and two for handshaking. The acknowledgement is part of the put operation, which sets flags on the local and remote processors when the transfer is complete. As the acknowledgement cannot be piggybacked onto the data transfer, the get-based definition requires an additional communication.

Below we give CRMTs definitions that use 2 flags per-processor. The definitions are very simple, consisting of a test and the setting of the flags.

```
cput(data,f1,f2,result) {
/* The local processor attempts to put data on the remote processor */
  if f1 { /* The remote processor is ready, transfer data */
    f1 = false;
    f2 = false;
    result = true;
    transfer(data);
  } else { /* The remote processor is not ready, signal we were here */
    f2 = true;
    result = false;
  }
}
cget(data,f1,f2,result) {
/* The local processor attempts to get data from the remote processor */
  if f1 { /* The remote processor is ready */
    f1 = false;
    f2 = false;
    result = true;
    transfer(data);
  } else { /* The remote processor is not ready, signal we were here */
    f2 = true;
    result = false;
  }
}
```

In the definitions, `f1` and `f2` are flags on the remote processor, and `result` a flag on the local processor. The remote processor sets `f1` when it is ready, and the local processor sets `f2` to false if it transfers the data. `Result` is used to convey the outcome of the transfer to the local processor.

4 Producer/Consumer

With the hardware definition of CRMTs given in Section 3, software protocols for producer/consumer sharing can be implemented with either 1 or 2 communication operations, depending on whether the producer or consumer is ready first. Protocols can be designed that favor either the producer or the consumer being ready first. In the protocols given below, the producer `p` and consumer `c` each have two flags `pr` (producer ready) and `cr` (consumer ready).

The protocol that favors the producer being ready first is:

```
producer {
cr = false; /* Initial assignments for p */
pr = false;

  /* If cget happens here it will fail, and set cr to true */
  while (pr) { } /* Wait for previous data to be consumed */
  pr = true;
  /* If cget happens here it will succeed, and set cr and pr to false */
  /* If second cget it will fail and set cr but not pr to true */
  if (cr && pr) {
    put(c,data,c.pr); /* Sets c.pr to true */
  }
  /* If getc happens here it will succeed, and set cr and pr to false */
  /* If second getc it will fail and set cr to true */
}

consumer {
  pr = false;
  cget(p,data,pr,cr,pr);
  /* If cget fails, pr is set to false, true o.w.  */
  /* If cget fails, then producer will set pr to true */
  while (!pr) { }
}
```

As cput and cget are symmetrical, the protocol that favors the consumer being ready first is similar. The main difference between the protocols is when processors busy-wait.

```
producer {
cr = true; /* Initial assignments for p */

  while (!cr) { } /* cr is set to true by producer or consumer */
  cr = false;
  cput(c,data,cr,pr,cr);
  /* If cput fails, cr is set to false, true o.w.  */
  /* If cput fails, then consumer will set cr to true */
}

consumer {
cr = false; /* Initial assignments for c */
pr = false;

  /* If cput happens here it will fail, and set pr to true */
  cr = true;
  /* If cput happens here it will succeed, and set cr and pr to false */
  /* If second cput, it will fail and set pr but not cr to true */
  if (pr && cr) {
```

```
    cr = false;
    get(p,data,cr); /* Sets p.cr to true */
  } /* If cput happens here it will succeed, and set cr and pr to false */
  /* If second cput, it will fail and set pr but not cr to true */
  while (cr) { } /* Wait for data to be produced */
}
```

5 Generalized CRMTs

Data sharing paradigms that are more dynamic than producer/consumer require more complex synchronization. For example, a directory-based protocol has been proposed to coordinate CICO data sharing [2]. If the software adheres to a strict CICO policy, where only data are always checked in before a check out is issued, a check-in takes 3 communications, and a check-out 2 communications. When the CICO policy is validated, a trap is generated and the data are located and forwarded by software.

The definition of CRMTs given in Section 3 use two per-processor flags to coordinate data sharing. CMRTs can be generalized to coordinate CICO data sharing by using two per-processor variables to implement a queue instead of flags: if the data are not ready, then the processor attempting the transfer enqueues its id. When the data become ready, they are forwarded to the processor at the head of the queue. The queue data-structure can be implemented in a variety of ways. Below, we give a linked-list based definition of generalized CRMTs. The number of communications is the same as the directory scheme when a CICO policy is adhered to, and only requires an additional 2 communication when the policy is violated, i.e., when a processor attempts to check out data before it has been checked back in.

```
gcput(remote,local,data,f1,f2,result) {
  if f1 != null {
  /* Queue not empty */
    f1 = f1->next;
    if ((f1 == null) or (f1 == remote)) {
    /* Queue now empty or owner is next so return data */
      transfer(data);
      result = local;
    } else result = f1;
  } else {
  /* Queue empty, set f2 as a signal we were here */
    f2 = null;
    result = null;
  }
}

gcget(remote,local,data,f1,f2,result) {
  if f1 == null {
  /* Queue empty so get data */
    result = local;
```

```
consumer {
  result = null;
  gcget(p,c,data,head,tail,result);
  /* If gcget fails, result is set to null, c o.w.  */
  /* If gcget fails, then producer will set result to c */
  while (result != c) { }
}
```

The structure of the protocol that favors the consumer being ready first is similar to the protocol that favors the producer. The differences in the protocols are dué to the different locations of queue (producer or consumer) and the different times that the consumer/producer must busy wait. In the gcput protocol, the queue is used to coordinate data production. As it is local to the consumer, while the consumer is not ready, the queue is empty—there are no pending resuests. If the producer attempts to put the data before the consumer has enqueued itself, i.e., the consumer sets head to c, then the producer fails and sets tail to null. The consumer can check for this later condition.

```
producer {
result = p; /* Initial assignment for p */
  while (result != p) { } /* result is set to p by producer or consumer */
  result = null;
  gcput(p,c,data,head,tail,result);
  /* If gcput fails, result is set to null, p o.w.  */
  /* If gcput fails, then consumer will set result to p */
}
consumer {
head = null; /* Initial assignments for c */
tail = c;
c->next = null;
  /* If gcput happens here it will fail, and set tail to null */
  head = c;
  /* If gcput happens here it will succeed, and set head to null */
  /* If second gcput happens it will fail, and set tail to null */
  if ((tail != head) && (head == c)) {
  /* First gcput failed, so complete transfer */
  /* Producer is busy waiting on result so safe to update */
    head = null; /* Re-initialize variables */
    tail = c;
    c->next = null;
    get(p,c,data,result); /* Sets result to p */
  }
  /* When gcput happens it will succeed, and set head to null */
  /* If second gcput happens it will fail, and set tail to null */
  while (head != null) { } /* Wait for data to be produced */
}
```

```
    f1 = local;
    f1->next = null;
    f2 = local;
    transfer(data);
  } else {
    if (f2 == local) result = null;
    else result = f2;
    f2->next = local;
    f2 = local;
  }
}
```

where f1 and f2 are variables on the remote processor, and result a variable on the local processor.

In the above definitions, f1 and f2 are used as the head and tail pointers of a linked list whose nodes are stored on the remote processor. The queue can be implemented with other data structures, for instance, an array. The definitions for array-based conditional put/get are analogous to the linked-list based ones—f1 and f2 are the first and last indices into an array that are incremented rather than head and tail pointers that follow next pointers. In the next section, we show how to use generalized CRMTs to implement CICO data sharing, and in the appendix, producer/consumer data sharing.

6 Check-in/Check-out

With generalized CRMTs, exclusive check-out can be accomplished with two communication operations, and check-in with two or four communication operations. When checking-out (with a generalized conditional get), if the data are not ready, then the pending owner id is enqueued to let the previous owner know that it must complete the transfer. When checking-in (with a generalized conditional put), the current owner inspects the queue to determine if it must forward the data to a waiting processor. Variations of shared check-outs can be implemented using the proposed CRMTs by having a coordinating processor check-out the data exclusively and forwarding copies to the processors waiting on its queue.

In the code given below, the permanent owner o of the data has two variables head and tail, and each transient owner id has a local variable result.

```
o->head = null; /* Initial assignments */
o->tail = null;

check_out {
  result = null;
  gcget(o,id,data,head,tail,result);
  while (result != id) { } /* Set by gcget or subsequent put */
}

check_in {
  result = null;
```

```
  gcput(o,id,data,head,tail,result);
  while(result == null) {}
  if (result != id) put(result,id,data,result);
  /* gcput sets result->result to result */
}
```

7 Conclusions

We have described a minimal modification to put/get hardware, the conditional put/get, that allows for efficient producer/consumer data sharing. A more significant to the DMA hardware modification allows for efficient check-in, check-out data sharing. The synchronization provided by conditional remote memory transfers also simplifies dynamic load balancing schemes where work is pushed to lightly loaded processors.

Appendix: Generalized Producer/Consumer

Producer/consumer sharing can be implemented using the generalized CRMTs defined in Section 5. We first give a protocol that favors the producer being ready first. In the protocol, the "queue" is used to coordinate data consumption. As it is local to the producer, while the producer is not ready, the queue is not empty, i.e., the data is checked-out. If the consumer attempts to get the data before the producer sets the queue to empty, i.e., the producer sets head to null, then the consumer fails and enqueues itself. The producer can check for this later condition.

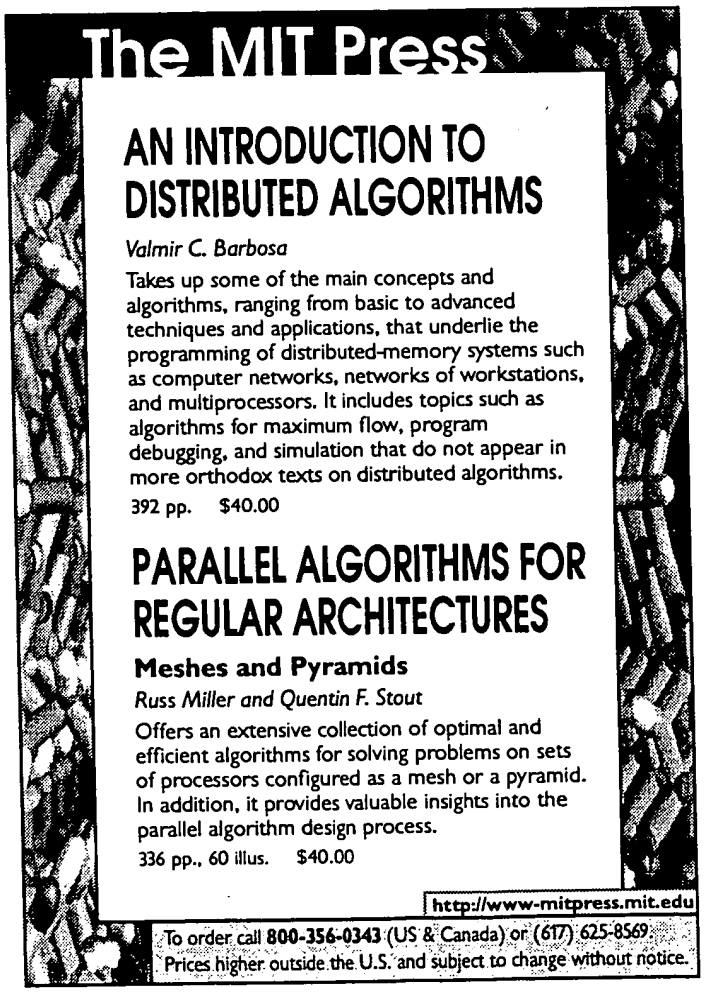
```
producer {
head = c; /* Initial assignments for p */
tail = c;
c->next = null;

  /* If gcget happens here it will fail, and set c->next to c */
  while (head == null) { } /* Wait for previous data to be consumed */
  head = null;
  /* If gcget happens here it will succeed, and set head to c */
  /* If second getc happens it will fail, and set c->next to c */
  if ((c->next != head) && head == null)) {
  /* First gcget failed, so complete transfer */
  /* Consumer is busy waiting on result so safe to update */
    c->next = null; /* Re-initialize variables */
    tail = c; /* Not strictly necessary as we never inspect */
    head = c;
    put(c,p,data,result); /* Sets result to c */
  }
  /* when gcget happens it will succeed, and set head to c */
  /* If second getc happens it will fail, and set c->next to c */
}
```

References

[1] T. von Eickstein, D. Culler, S. Goldstein and K. Shauser, Active Messages: a Mechanism for Integrated Communication and Computation, *Proc. 19th Int. Sym. on Computer Architecture* pp. 256-266, May 1992.

[2] M. D. Hill, J. R. Larus, S. K. Reinhardt, and D. A. Wood, Cooperative Shared Memory: Software and Hardware for Scalable Multiprocessors, *Proc. Fifth Int. Conf. on Architectural Support for Programming Languages and Operating Systems* pp. 262-273, Oct. 1992.

[3] M. Gupta and E. Schonberg, Static Analysis to Reduce Synchronization Costs in Data-Parallel Programs, IBM RC, 1995.



ARTIFACT SHEET

Enter artifact number below. Artifact number is application number + artifact type code (see list below) + sequential letter (A, B, C ...). The first artifact folder for an artifact type receives the letter A, the second B, etc.. Examples: 59123456PA, 59123456PB, 59123456ZA, 59123456ZB

10082918 2A

Indicate quantity of a single type of artifact received but not scanned. Create individual artifact folder/box and artifact number for each Artifact Type.

☐ CD(s) containing:
- computer program listing ☐ — Doc Code: Computer — Artifact Type Code: P
- pages of specification and/or sequence listing and/or table ☐ — Doc Code: Artifact — Artifact Type Code: S
- content unspecified or combined ☐ — Doc Code: Artifact — Artifact Type Code: U

☐ Stapled Set(s) Color Documents or B/W Photographs
Doc Code: Artifact Artifact Type Code: C

☐ Microfilm(s)
Doc Code: Artifact Artifact Type Code: F

☐ Video tape(s)
Doc Code: Artifact Artifact Type Code: V

☐ Model(s)
Doc Code: Artifact Artifact Type Code: M

☐ Bound Document(s)
Doc Code: Artifact Artifact Type Code: B

☐ Confidential Information Disclosure Statement or Other Documents marked Proprietary, Trade Secrets, Subject to Protective Order, Material Submitted under MPEP 724.02, etc.
Doc Code: Artifact Artifact Type Code X

☐ Other, description: Floppy disk
Doc Code: Artifact Artifact Type Code: Z