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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
14/516,867	10/17/2014	Nicholas A.J. Millington	04-0401-CON1014D

CONFIRMATION NO. 9318

107361
McDonnell Boehnen Hulbert & Berghoff LLP
Sonos, Inc.
300 South Wacker Drive
Chicago, IL 60606

POA ACCEPTANCE LETTER

OC000000112243925

Date Mailed: 10/29/2019

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 10/28/2019.

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

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

/rbell/

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14/516,867	10/17/2014	Nicholas A.J. Millington	04-0401-CON1014D

CONFIRMATION NO. 9318

130085
Lee Sullivan Shea & Smith LLP
656 W. Randolph St.
Floor 5W
Chicago, IL 60661

POWER OF ATTORNEY NOTICE

OC000000112243882

Date Mailed: 10/29/2019

NOTICE REGARDING CHANGE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 10/28/2019.

- The Power of Attorney to you in this application has been revoked by the assignee who has intervened as provided by 37 CFR 3.71.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

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

/rbell/

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Bib Data Sheet

CONFIRMATION NO. 9318

SERIAL NUMBER	FILING OR 371(c) DATE / RULE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
14/516,867	10/17/2014	709	2442	04-0401-CON1014D

AIA (First Inventor to File): YES

INVENTORS

Nicholas A.J. Millington, Santa Barbara, CA;

APPLICANTS

Sonos, Inc., Santa Barbara, CA;

**** CONTINUING DATA ***************************

This application is a CON of 13/297,000 11/15/2011 PAT 9182777
which is a CON of 10/816,217 04/01/2004 PAT 8234395
which claims benefit of 60/490,768 07/28/2003

**** FOREIGN APPLICATIONS *********************

IF REQUIRED, FOREIGN FILING LICENSE GRANTED **
10/24/2014

		STATE OR COUNTRY	SHEETS DRAWING	TOTAL CLAIMS	INDEPENDENT CLAIMS
Foreign Priority claimed	☐ yes ☐ no	CA	5	20	3
35 USC 119 (a-d) conditions met	☐ yes ☐ no ☐ Met after Allowance				
Verified and Acknowledged	Examiner's Signature Initials				

ADDRESS
107361

TITLE

Obtaining Content from Remote Source for Playback

FILING FEE RECEIVED		
1740	FEES: Authority has been given in Paper 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

PTO/AIA/80 (07-12)
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POWER OF ATTORNEY TO PROSECUTE APPLICATIONS BEFORE THE USPTO

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

I hereby appoint:

■ Practitioners associated with Customer Number: 107361

OR

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

Name	Registration Number	Name	Registration Number

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

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

■ The address associated with Customer Number: 107361

OR

☐	Firm or Individual Name			
	Address			
	City		State	Zip
	Country			
	Telephone		Email	

Assignee Name and Address: Sonos, Inc, 223 E. De La Guerra St.
Santa Barbara, CA 93101

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

SIGNATURE of Assignee of Record

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

Signature	[signature]	Date	10/2/2012
Name	Mark Triplett	Telephone	(805) 965-3001
Title	Director, IP		

This collection of information is required by 37 CFR 1.31, 1.32 and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

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

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
14/516,867	10/17/2014	Nicholas A.J. Millington	04-0401-CON1014D

CONFIRMATION NO. 9318

130085
Lee Sullivan Shea & Smith LLP
656 W. Randolph St.
Floor 5W
Chicago, IL 60661

POA ACCEPTANCE LETTER

OC000000107620235

Date Mailed: 04/24/2019

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 04/22/2019.

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

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

/rbell/

UNITED STATES PATENT AND TRADEMARK OFFICE

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
14/516,867	10/17/2014	Nicholas A.J. Millington	04-0401-CON1014D

CONFIRMATION NO. 9318

107361
McDonnell Boehnen Hulbert & Berghoff LLP
Sonos, Inc.
300 South Wacker Drive
Chicago, IL 60606

POWER OF ATTORNEY NOTICE

OC000000107620211

Date Mailed: 04/24/2019

NOTICE REGARDING CHANGE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 04/22/2019.

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

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

/rbell/

PTO/AIA/81B (07-13)
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REEXAMINATION OR SUPPLEMENTAL EXAMINATION – PATENT OWNER POWER OF ATTORNEY OR REVOCATION OF POWER OF ATTORNEY WITH A NEW POWER OF ATTORNEY AND CHANGE OF CORRESPONDENCE ADDRESS FOR REEXAMINATION OR SUPPLEMENTAL EXAMINATION AND PATENT

Control Number(s)	90/013,959
Filing Date(s)	June 16, 2017
First Named Inventor	Nicholas A.J. Millington
Title	Obtaining Content from Remote Source for Playback
Patent Number	9,213,357
Examiner Name	David E. England
Attorney Docket No(s)	04-0401-REEXAM

I. Power of Attorney. This form may be used to change the Power of Attorney in a reexamination or supplemental examination proceeding (or multiple proceedings where merged). This form may also be used to change the Power of Attorney in the patent file; in such a case, a copy of this form will be placed in both the patent file and the reexamination or supplemental examination proceeding.

A. Revocation of Previous Power of Attorney. I hereby revoke all previous patent owner powers of attorney, if any, given:

☒ in the above-identified reexamination or supplemental examination proceeding control number(s) (more than one may be changed only if the proceedings are merged).

☐ in the file of the above-identified patent.

(check BOTH boxes if change in BOTH the patent file and the reexamination or supplemental examination proceeding is requested).

B. Designation of Power of Attorney.

☐ A Power of Attorney is submitted herewith.

OR

☒ I hereby appoint Practitioner(s) associated with the Customer Number identified in the box at right as my/our attorney(s) or agent(s) to prosecute the proceeding(s)/patent identified above and selected in section I(A), and to transact all business in the United States Patent and Trademark Office connected therewith:

130085

OR

☐ I hereby appoint Practitioner(s) named below as my/our attorney(s) or agent(s) to prosecute the proceeding(s) identified above, and to transact all business in the United States Patent and Trademark Office connected therewith:

Practitioner(s) Name	Registration Number

Authorization for the Power of Attorney is provided by the signature on page 2 of this form.

This collection of information is required by 37 CFR 1.31, 1.32, and 1.33. The information is required to obtain or retain a benefit by the public, which is to update (and by the USPTO to process) the file of a patent or reexamination proceeding. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 15 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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

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II. Change of Correspondence Address

Please recognize or change the correspondence address for the above-identified reexamination or supplemental examination proceeding control number(s) (more than one may be changed **only** if they are merged proceedings) **and for the file of the above-identified patent** to be:

☒ The address associated with the above-identified Customer Number.
OR
☐ The address associated with the Customer Number identified in the box at right: ☐
OR

☐ Firm or Individual Name					
Address					
City		State		Zip	
Country					
Telephone		Email			

NOTE: THE CORRESPONDENCE ADDRESS FOR THE REEXAMINATION OR SUPPLEMENTAL EXAMINATION PROCEEDING CONTROL NUMBER(S) MUST BE THE SAME AS THAT FOR THE PATENT. SEE 37 CFR 1.33.

III. Authorization for Power of Attorney and (if selected) Change of Correspondence Address

I am the:
☐ Inventor, having ownership of the patent being reexamined.
OR
☒ Patent owner.
Statement under 37 CFR 3.73(c) (Form PTO/AIA/96) submitted herewith or filed on _____.

Signature of Inventor or Patent Owner	/Mark Triplett/	Date	4/22/2019
Name	Mark Triplett	Telephone	
Title and Company	VP Intellectual Property, Sonos, Inc.		

NOTE: Signatures of all the inventors or patent owners of the entire interest or their representative(s) are required. If more than one signature is required, submit multiple forms, check the box below, and identify the total number of forms submitted in the blank below.

☒ A total of 1 forms are submitted. *If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.*

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Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
(Sonos Docket No. 04-0401-REEXAM)
(Attorney Docket No. Sonos-00743)

In the *Ex Parte* Reexamination of:	)	
	)	
USP 9,213,357	)	
	)	**Group Art Unit No.: 3992**
Appeal No.: 2019-003250	)	
	)	
App. No.: 90/013,959	)	**Examiner: David E. England**
	)	
Filed: June 16, 2017	)	
	)	**Confirmation No.: 9548**
For: Obtaining Content from Remote Source for Playback	)	

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

TRANSMITTAL OF POWER OF ATTORNEY

Enclosed is a signed Power of Attorney. The Assignee in the above-referenced patent hereby revokes all previous powers of attorney in the above-identified reexamination proceeding and appoints the practitioners associated with the Customer Number: 130085.

The Commissioner is authorized to charge any fee under 37 CFR 1.16 and 1.17 which may be required during the **entire pendency** of the application to Deposit Account No. 506632.

Respectfully submitted,

Dated: April 22, 2019

By: /Rory P. Shea/
Rory P. Shea
Reg. No. 60,529
Lee Sullivan Shea & Smith LLP
656 W. Randolph St., Floor 5W
Chicago, Illinois 60661
(312) 754-9609
shea@ls3ip.com

Lee Sullivan Shea & Smith LLP
656 W. Randolph St., Floor 5W
Chicago, IL 60661
(312)754-9602

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Electronic Acknowledgement Receipt	
EFS ID:	35793221
Application Number:	90013959
International Application Number:	
Confirmation Number:	9548
Title of Invention:	OBTAINING CONTENT FROM REMOTE SOURCE FOR PLAYBACK
First Named Inventor/Applicant Name:	9213357
Customer Number:	107361
Filer:	Rory Patrick Shea
Filer Authorized By:	
Attorney Docket Number:	04-0401-REEXAM (14-1800-R
Receipt Date:	22-APR-2019
Filing Date:	16-JUN-2017
Time Stamp:	18:38:23
Application Type:	Reexam (Patent Owner)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Assignee showing of ownership per 37 CFR 3.73	04-0401-REEXAM_373c_Statement.pdf	118706 eb37fd9555a19e05fcfcbc4d356312f57e9a8c02	no	3
Warnings:					

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Information:					
2	Reexam Certificate of Service	Certificate_of_Service.pdf	78167 e266f98739eb36d2997a48f0637d4ee31eb04b64	no	1
Warnings:					
Information:					
3	Power of Attorney	04-0401-REEXAM_POA_AIA81B.pdf	501255 8f6c5fb83fc4592dd246fa3faa3c789b5345abbc	no	3
Warnings:					
Information:					
4	Transmittal Letter	04-0401-REEXAM_Transmittal_of_POA.pdf	82254 b35177a4a1eb4c633ab8f531e57a0dd5210a560a	no	1
Warnings:					
Information:					
		Total Files Size (in bytes):	780382		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

<u>New Applications Under 35 U.S.C. 111</u>
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.
<u>National Stage of an International Application under 35 U.S.C. 371</u>
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.
<u>New International Application Filed with the USPTO as a Receiving Office</u>
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

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PTO/AIA/96 (08-12)
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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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STATEMENT UNDER 37 CFR 3.73(c)

Applicant/Patent Owner: Sonos, Inc.

Application No./Patent No.: 9,213,357 Filed/Issue Date: 12/15/2015

Titled: Obtaining Content from Remote Source for Playback

Sonos, Inc., a Corporation

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

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

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

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

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

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

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

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

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

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

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

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

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

1. From: Nicholas A.J. Millington To: Sonos, Inc.

   The document was recorded in the United States Patent and Trademark Office at

   Reel 035518, Frame 0127, or for which a copy thereof is attached.

2. From: _____ To: _____

   The document was recorded in the United States Patent and Trademark Office at

   Reel _____, Frame _____, or for which a copy thereof is attached.

This collection of information is required by 37 CFR 3.73(b). The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 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, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450**.

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

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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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STATEMENT UNDER 37 CFR 3.73(c)

3. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

4. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

5. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

6. From: _____ To: _____

The document was recorded in the United States Patent and Trademark Office at

Reel _____, Frame _____, or for which a copy thereof is attached.

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

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

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

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

/Rory P. Shea/	April 22, 2019
Signature	Date
Rory P. Shea	60,529
Printed or Typed Name	Title or Registration Number

Copied from 90013959 on 04/23/2019

Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Copied from 90013959 on 04/23/2019

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
(Sonos Docket No. 04-0401-REEXAM)
(Attorney Docket No. Sonos-00743)

In the *Ex Parte* Reexamination of:	)	
	)	
USP 9,213,357	)	
	)	**Group Art Unit No.: 3992**
Appeal No.: 2019-003250	)	
	)	
App. No.: 90/013,959	)	**Examiner: David E. England**
	)	
Filed: June 16, 2017	)	
	)	**Confirmation No.: 9548**
For: Obtaining Content from Remote Source for Playback	)	

CERTIFICATE OF SERVICE

The undersigned hereby certifies that copies of the Power of Attorney and associated paperwork filed at the U.S. Patent Office on April 22, 2019 are being served via first class mail upon the following third-party requestor:

Jackson Walker LLP
Attn: Christopher J. Rourk
2323 Ross Avenue, Suite 600
Dallas, TX 75201

Respectfully submitted,

Dated: April 22, 2019

By: /Rory P. Shea/
Rory P. Shea
Reg. No. 60,529
Lee Sullivan Shea & Smith LLP
656 W. Randolph St., Floor 5W
Chicago, Illinois 60661
(312) 754-9609
shea@ls3ip.com

Copied from 90013959 on 04/23/2019

AO 120 (Rev. 08/10)

TO:	Mail Stop 8 Director of the U.S. Patent and Trademark Office P.O. Box 1450 Alexandria, VA 22313-1450	REPORT ON THE FILING OR DETERMINATION OF AN ACTION REGARDING A PATENT OR TRADEMARK

In Compliance with 35 U.S.C. § 290 and/or 15 U.S.C. § 1116 you are hereby advised that a court action has been filed in the U.S. District Court DELAWARE on the following

☐ Trademarks or ☑ Patents. (☐ the patent action involves 35 U.S.C. § 292.):

DOCKET NO.	DATE FILED	U.S. DISTRICT COURT
14-1330 RGA	10/21/2014	DELAWARE
PLAINTIFF SONOS, INC.		DEFENDANT D&M HOLDINGS INC. d/b/a THE D+M GROUP, D&M HOLDINGS U.S. INC., AND DENON ELECTRONICS (USA), LLC

	PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1	US D559,197 S	1/8/2008	SONOS, INC.
2	US 7,571,014 B1	8/4/2009	SONOS, INC.
3	US 8,588,949 B2	11/19/2013	SONOS, INC.
4	US 8,843,224 B2	9/23/2014	SONOS, INC.
5	US 8,938,637 B2	1/20/2015	SONOS, INC.

In the above—entitled case, the following patent(s)/ trademark(s) have been included:

DATE INCLUDED	INCLUDED BY
3/7/2016	☑ Amendment ☐ Answer ☐ Cross Bill ☐ Other Pleading

	PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1	US 8,938,312 B2	1/20/2015	SONOS, INC.
2	US 9,042,556 B2	5/26/2015	SONOS, INC.
3	US 9,130,771 B2	9/8/2015	SONOS, INC.
4	US 9,195,258 B2	11/24/2015	SONOS, INC.
5	US 9,213,357 B2	12/15/2015	SONOS, INC.

SEE ATTACHED

In the above—entitled case, the following decision has been rendered or judgement issued:

DECISION/JUDGEMENT

CLERK	(BY) DEPUTY CLERK	DATE
JOHN A. CERINO		

Copy 1—Upon initiation of action, mail this copy to Director **Copy 3—Upon termination of action, mail this copy to Director**
Copy 2—Upon filing document adding patent(s), mail this copy to Director **Copy 4—Case file copy**

AO 120 (Rev. 08/10)

TO:	REPORT ON THE FILING OR DETERMINATION OF AN ACTION REGARDING A PATENT OR TRADEMARK
Mail Stop 8 Director of the U.S. Patent and Trademark Office P.O. Box 1450 Alexandria, VA 22313-1450	

In Compliance with 35 U.S.C. § 290 and/or 15 U.S.C. § 1116 you are hereby advised that a court action has been filed in the U.S. District Court DELAWARE on the following

☐ Trademarks or ☑ Patents. (☐ the patent action involves 35 U.S.C. § 292.):

DOCKET NO.	DATE FILED	U.S. DISTRICT COURT
14-1330 RGA	10/21/2014	DELAWARE

PLAINTIFF	DEFENDANT
SONOS, INC. PAGE TWO	D&M HOLDINGS INC. d/b/a THE D+M GROUP, D&M HOLDINGS U.S. INC., AND DENON ELECTRONICS (USA), LLC

	PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1	US 9,202,509 B2	12/1/2015	SONOS, INC.
2	US 9,219,959 B2	12/22/2015	SONOS, INC.
3			
4			
5			

In the above—entitled case, the following patent(s)/ trademark(s) have been included:

DATE INCLUDED	INCLUDED BY ☐ Amendment ☐ Answer ☐ Cross Bill ☐ Other Pleading	
PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1		
2		
3		
4		
5		

In the above—entitled case, the following decision has been rendered or judgement issued:

DECISION/JUDGEMENT

CLERK	(BY) DEPUTY CLERK	DATE
JOHN A. CERINO		

Copy 1—Upon initiation of action, mail this copy to Director **Copy 3—Upon termination of action, mail this copy to Director**
Copy 2—Upon filing document adding patent(s), mail this copy to Director **Copy 4—Case file copy**

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.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/516,867	12/15/2015	9213357	04-0401-CON1014D	9318

107361 7590 11/24/2015

McDonnell Boehnen Hulbert & Berghoff LLP
Sonos, Inc.
300 South Wacker Drive
Chicago, IL 60606

ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(application filed on or after May 29, 2000)

The Patent Term Adjustment is 0 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

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 Application Assistance Unit (AAU) of the Office of Data Management (ODM) at (571)-272-4200.

APPLICANT(s) (Please see PAIR WEB site http://pair.uspto.gov for additional applicants):

Nicholas A.J. Millington, Santa Barbara, CA;
Sonos, Inc., Santa Barbara, CA;

The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The USA offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to encourage and facilitate business investment. To learn more about why the USA is the best country in the world to develop technology, manufacture products, and grow your business, visit SelectUSA.gov.

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)

107361 7590 08/04/2015
McDonnell Boehnen Hulbert & Berghoff LLP
Sonos, Inc.
300 South Wacker Drive
Chicago, IL 60606

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.
14/516,867	10/17/2014	Nicholas A.J. Millington	04-0401-CON1014D	9318

TITLE OF INVENTION: Obtaining Content from Remote Source for Playback

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$960	$0	$0	$960	11/04/2015

EXAMINER	ART UNIT	CLASS-SUBCLASS
SURVILLO, OLEG	2442	709-219000

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 McDonnell Boehnen
2 Hulbert & Berghoff LLP
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: Sonos, Inc.
(B) RESIDENCE: (CITY and STATE OR COUNTRY): Santa Barbara, CA

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 submitted:
- ☒ Issue Fee
- ☐ Publication Fee (No small entity discount permitted)
- ☐ Advance Order - # of Copies _____

4b. Payment of Fee(s): **(Please first reapply any previously paid issue fee shown above)**
- ☐ A check is enclosed.
- ☐ Payment by credit card. Form PTO-2038 is attached.
- ☒ The director is hereby authorized to charge the required fee(s), any deficiency, or credits any overpayment, to Deposit Account Number 13-2490 (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)
- ☐ Applicant certifying micro entity status. See 37 CFR 1.29
  NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.
- ☐ Applicant asserting small entity status. See 37 CFR 1.27
  NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.
- ☐ Applicant changing to regular undiscounted fee status.
  NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature /Jeffrey P. Armstrong/ Date November 2, 2015
Typed or printed name Jeffrey P. Armstrong Registration No. 54,967

PTOL-85 Part B (10-13) Approved for use through 10/31/2013. OMB 0651-0033 U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
(Case No.: 04-0401-CON1014D)
(MBHB Docket No. 14-1800-CON2)

In the Application of:	)	
	)	
Millington	)	Art Unit: 2442
	)	
Serial No.: 14/516,867	)	Examiner: Survillo
	)	
Filed: October 17, 2014	)	Confirmation No. 9318
	)	
For: Obtaining Content from Remote Source For Playback	)	

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

RESPONSE TO NOTICE REQUIRING INVENTOR'S OATH OR DECLARATION

The Notice of Allowance mailed on August 4, 2015 included a Notice Requiring an Inventor Oath or Declaration (the "Notice"). However, this Notice was sent in error because Applicant submitted an Inventor Declaration on April 28, 2015. Applicant called the Office's attention to the April 28, 2015 Declaration via telephone to the U.S. PTO Inventors Assistance Center, and on October 15, 2015, the Office withdrew the Notice. If further dialog would advance consideration of the attached Declaration, the Office is invited to telephone the undersigned at 312-913-0001.

Respectfully submitted,
McDonnell Boehnen Hulbert & Berghoff LLP

Date: November 2, 2015 By: /Jeffrey P. Armstrong/
Jeffrey P. Armstrong
Reg. No. 54,967

LINKPLAY EXHIBIT 1002
Page 21 of 1434

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
(Case No.: 04-0401-CON1014D)
(MBHB Docket No. 14-1800-CON2)

In the Application of:	)	
	)	
Millington	)	Art Unit: 2442
	)	
Serial No.: 14/516,867	)	Examiner: Survillo
	)	
Filed: October 17, 2014	)	Confirmation No. 9318
	)	
For: Obtaining Content from Remote Source For Playback	)	
	)	

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

APPLICANT'S COMMENT ON EXAMINER'S STATEMENT OF REASONS FOR ALLOWANCE

Applicant acknowledges the Examiner's Statement of Reasons for Allowance appearing in the Notice of Allowance mailed on August 4, 2015 in the above-referenced patent application. Applicant agrees that the claimed subject matter is patentable. However, Applicant takes no position regarding the Reasons for Allowance presented by the Examiner other than the positions Applicant may have previously taken during prosecution. Therefore, the Examiner's Reasons for Allowance should not be attributed to Applicant as an indication of the basis for Applicant's belief that the claims are patentable, or as an indication of Applicant's understanding of the cited references or the relevance of the cited references to the claims. In addition, Applicant notes that the Examiner's description of the claims should not be interpreted as altering the scope of the

claims, which is defined by the language of the claims themselves. Furthermore, Applicant respectfully asserts that there may also be additional reasons for patentability of the claimed subject matter not explicitly stated in this record and Applicant does not waive its rights to such arguments by not further addressing such reasons herein.

Respectfully submitted,
McDonnell Boehnen Hulbert & Berghoff LLP

Date: November 2, 2015 By: /Jeffrey P. Armstrong/
Jeffrey P. Armstrong
Reg. No. 54,967

Electronic Patent Application Fee Transmittal

Application Number:	14516867
Filing Date:	17-Oct-2014
Title of Invention:	Obtaining Content from Remote Source for Playback
First Named Inventor/Applicant Name:	Nicholas A.J. Millington
Filer:	Jeffrey Armstrong
Attorney Docket Number:	04-0401-CON1014D

Filed as Large Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Utility Appl Issue Fee	1501	1	960	960

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
		Total in USD ($)		**960**

Electronic Acknowledgement Receipt	
EFS ID:	23961592
Application Number:	14516867
International Application Number:	
Confirmation Number:	9318
Title of Invention:	Obtaining Content from Remote Source for Playback
First Named Inventor/Applicant Name:	Nicholas A.J. Millington
Customer Number:	107361
Filer:	Jeffrey Armstrong
Filer Authorized By:	
Attorney Docket Number:	04-0401-CON1014D
Receipt Date:	02-NOV-2015
Filing Date:	17-OCT-2014
Time Stamp:	15:51:29
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$960
RAM confirmation Number	2445
Deposit Account	132490
Authorized User	ARMSTRONG, JEFFREY P.
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: Charge any Additional Fees required under 37 C.F.R. Section 1.16 (National application filing, search, and examination fees) Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)	

Charge any Additional Fees required under 37 C.F.R. Section 1.19 (Document supply fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.20 (Post Issuance fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Issue Fee Payment (PTO-85B)	04-0401CON1014D_Issue_Fee_Transmittal.pdf	1592379 69dbb8967238553d17977a057facc4749d7f5ac2	no	1
Warnings:					
Information:					
2	Miscellaneous Incoming Letter	04-0401CON1014D_Response_to_Notice.pdf	66408 4846ade2c7504846e0136a433219a2a49d9daccc	no	1
Warnings:					
Information:					
3	Miscellaneous Incoming Letter	04-0401CON1014D_Comment.pdf	67784 755297b232503257bc55abf5d09af03837d224a1	no	2
Warnings:					
Information:					
4	Fee Worksheet (SB06)	fee-info.pdf	30529 f37b7ce4b9e300933b2387c74716e6dccbcdbf0e	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	1757100		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

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.
14/516,867	10/17/2014	Nicholas A.J. Millington	04-0401-CON1014D	9318

7590. 10/19/2015

McDonnell Boehnen Hulbert & Berghoff LLP
Sonos, Inc.
300 South Wacker Drive
Chicago, IL 60606

EXAMINER	
SURVILLO, OLEG	
ART UNIT	PAPER NUMBER
2442	
MAIL DATE	DELIVERY MODE
10/19/2015	PAPER

Letter Withdrawing a Notice Requiring Inventor's Oath or Declaration

The Notice Requiring Inventor's Oath or Declaration mailed on 8/4/15 was sent in error, and is hereby withdrawn. The time period set forth in the Notice of Allowance and Fee(s) Due to file a reply and pay the required fees continues to run from the mailing date of the Notice of Allowance and Fee(s) Due. Any time period set forth in the Notice of Allowability continues to run from the mailing date of the Notice of Allowability.

Questions relating to this Notice should be directed to the Application Assistance Unit at 571-272-4200.

(571)-272-4200 or 1(888)-786-0101
Patent Publication Branch
Office of Data Management

dated 08/17/2015

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**		
	Application Number	14516867
	Filing Date	2014-10-17
	First Named Inventor	MILLINGTON; Nicholas A.J.
	Art Unit	2442
	Examiner Name	SURVILLO, OLEG
	Attorney Docket Number	04-0401-CON1014D

U.S.PATENTS						
Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
/OS/	1	RE41608		2010-08-31	BLAIR; Christopher Douglas et al.	
	2	6122668		2000-09-19	TENG; Peter Y. et al.	
	3	6449653		2002-09-10	KLEMETS; Anders Edgar et al.	
	4	6823225		2004-11-23	SASS; Jonathan	
	5	7068596		2006-06-27	MOU; Hensen	
	6	7313593		2007-12-25	PULITO; Brian et al.	
/OS/	7	7702403		2010-04-20	GLADWIN; Stephen Christopher et al.	
If you wish to add additional U.S. Patent citation information please click the Add button.						
U.S.PATENT APPLICATION PUBLICATIONS						

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99**)		
	Application Number	14516867
	Filing Date	2014-10-17
	First Named Inventor	MILLINGTON; Nicholas A.J.
	Art Unit	2442
	Examiner Name	SURVILLO, OLEG
	Attorney Docket Number	04-0401-CON1014D

Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
/OS/	1	20010047377		2001-11-29	SINCAGLIA; Nicholas William et al.	
	2	20020159596		2002-10-31	DURAND; Julian et al.	
	3	20020165721		2002-11-07	CHANG; Kenneth H.P. et al.	
	4	20030219007		2003-11-27	BARRACK; Craig et al.	
	5	20040012620		2004-01-22	BUHLER; Rene et al.	
	6	20040048569		2004-03-11	KAWAMURA; Harumi	
	7	20040080671		2004-04-29	SIEMENS; Duane et al.	
	8	20040224638		2004-11-11	FADELL; Anthony M. et al.	
	9	20050015551		2005-01-20	EAMES; Russell Mark et al.	
/OS/	10	20050131558		2005-06-16	BRAITHWAITE; Michael et al.	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**		
	Application Number	14516867
	Filing Date	2014-10-17
	First Named Inventor	MILLINGTON; Nicholas A.J.
	Art Unit	2442
	Examiner Name	SURVILLO, OLEG
	Attorney Docket Number	04-0401-CON1014D

/OS/	11	20060193454		2006-08-31	ABOU-CHAKRA RABIH . et al.		

If you wish to add additional U.S. Published Application citation information please click the Add button.

FOREIGN PATENT DOCUMENTS

Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] ¡	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1							☐

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NON-PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
/OS/	1	"Advisory Action mailed on 28 July 2015, issued in connection with U.S. Patent Application No. 14/184522, filed on 19 February 2014, 7 pages".	☐
	2	"BAUDISCH et al., "Flat Volume Control: Improving Usability by Hiding the Volume Control Hierarchy in the User Interface", 2004, 8 pages.".	☐
	3	"CHAKRABARTI et al., "A Remotely Controlled Bluetooth Enabled Environment", IEEE, 2004, pp. 77-81.".	☐
	4	"SCHMANDT et al., "Impromptu: Managing Networked Audio Applications for Mobile Users", 2004, 11 pages.".	☐
/OS/	5	"Final Office Action mailed on 10 August 2015, issued in connection with U.S. Patent Application No. 14/290493, filed on 29 May 2014, 26 pages.".	☐

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99**)		
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	First Named Inventor	MILLINGTON; Nicholas A.J.
	Art Unit	2442
	Examiner Name	SURVILLO, OLEG
	Attorney Docket Number	04-0401-CON1014D

/OS/	6	"Final Office Action mailed on 11 August 2015, issued in connection with U.S. Patent Application No. 13/864247, filed on 17 April 2013, 15 pages".	☐
	7	"Final Office Action mailed on 15 July, 2015, issued in connection with U.S. Patent Application No. 14/504812, filed on 2 October 2014, 18 pages".	☐
	8	"Final Office Action mailed on 3 August 2015, issued in connection with U.S. Patent Application No. 13/848921, filed on 22 March 2013, 13 pages".	☐
	9	"FULTON et al., "The Network Audio System: Make Your Application Sing (As Well As Dance)!", The X Resource, 1994, 14 pages.".	☐
	10	"HANS et al., "Interacting with Audio Streams for Entertainment and Communication", 2003, 7 pages.".	☐
	11	"LEVERGOOD et al., "AudioFile: A Network-Transparent System for Distributed Audio Applications", Digital Equipment Corporation, 1993, 109 pages.".	☐
	12	"Notice of Allowance mailed on 10 August 2015, issued in connection with U.S. Patent Application No. 13/848904, filed on 22 March 2013, 9 pages".	☐
	13	"Notice of Allowance mailed on 12 August 2015, issued in connection with U.S. Patent Application No. 13/435739, filed on 30 March 2012, 27 pages".	☐
	14	"Notice of Allowance mailed on 13 July 2015, issued in connection with U.S. Patent Application No. 14/184526, filed on 19 February 2014, 22 pages".	☐
	15	"Notice of Allowance mailed on 15 July 2015, issued in connection with U.S. Patent Application No. 13/705174, filed on 5 December 2012, 18 pages".	☐
/OS/	16	"Notice of Allowance mailed on 17 July 2015, issued in connection with U.S. Patent Application No. 13/864251, filed on 17 April 2013, 20 pages".	☐

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	First Named Inventor	MILLINGTON; Nicholas A.J.
	Art Unit	2442
	Examiner Name	SURVILLO, OLEG
	Attorney Docket Number	04-0401-CON1014D

/OS/	17	"Notice of Allowance mailed on 29 July 2015, issued in connection with U.S. Patent Application No. 13/359976, filed on 27 January 2012, 28 pages".	☐
	18	"Notice of Allowance mailed on 29 July 2015, issued in connection with U.S. Patent Application No. 14/186850, filed on 21 February 2014, 9 pages".	☐
	19	"Notice of Allowance mailed on 30 July 2015, issued in connection with U.S. Patent Application No. 13/705178, filed 5 December 2012, 18 pages".	☐
	20	"Notice of Allowance mailed on 5 August 2015, issued in connection with U.S. Patent Application No. 13/435776, filed on 30 March 2012, 26 pages".	☐
	21	"NUTZEL et al., "Sharing Systems for Future HiFi Systems", IEEE, 2004, 9 pages.".	☐
/OS/	22	"Re-Exam Final Office Action mailed on 5 August 2015, issued in connection with U.S. Patent Application No. 90/013423, filed on 5 January 2015, 25 pages.".	☐

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EXAMINER SIGNATURE

Examiner Signature	/OLEG SURVILLO/	Date Considered	09/09/2015

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

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

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	Attorney Docket Number	04-0401-CON1014D

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☒ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☒ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☐ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Jeffrey P. Armstrong/	Date (YYYY-MM-DD)	2015-08-17
Name/Print	Jeffrey P. Armstrong	Registration Number	54,967

This collection of information is required by 37 CFR 1.97 and 1.98. 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 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/516,867	10/17/2014	Nicholas A.J. Millington	04-0401-CON1014D	9318

107361 7590 09/15/2015

McDonnell Boehnen Hulbert & Berghoff LLP
Sonos, Inc.
300 South Wacker Drive
Chicago, IL 60606

EXAMINER	
SURVILLO, OLEG	

ART UNIT	PAPER NUMBER
2442	

MAIL DATE	DELIVERY MODE
09/15/2015	PAPER

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

The time period for reply, if any, is set in the attached communication.

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APPLICATION NO./ CONTROL NO.	FILING DATE	FIRST NAMED INVENTOR / PATENT IN REEXAMINATION	ATTORNEY DOCKET NO.
14/516,867	17 October, 2014	MILLINGTON, NICHOLAS A.J.	04-0401-CON1014D

		EXAMINER	
McDonnell Boehnen Hulbert & Berghoff LLP Sonos, Inc. 300 South Wacker Drive Chicago, IL 60606		OLEG SURVILLO	
		ART UNIT	PAPER
		2442	20150909

DATE MAILED:

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

Commissioner for Patents

Information Disclosure Statement dated August 17, 2015 has been considered by the Examiner. Copy of the IDS is attached with this correspondence.

37 CFR 1.312 amendment dated August 20, 2015 has been fully considered and is entered.

NO SEPARATE RESPONSE TO THIS COMMUNICATION IS REQUIRED.

/OLEG SURVILLO/
Primary Examiner, Art Unit 2442

PTO-90C (Rev.04-03)

Response to Rule 312 Communication	Application No.	Applicant(s)
	14/516,867	MILLINGTON, NICHOLAS A.J.
	Examiner	Art Unit
	OLEG SURVILLO	2442

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

1. ☒ The amendment filed on *20 August 2015* under 37 CFR 1.312 has been considered, and has been:

a) ☒ entered.

b) ☐ entered as directed to matters of form not affecting the scope of the invention.

c) ☐ disapproved because the amendment was filed after the payment of the issue fee.
Any amendment filed after the date the issue fee is paid must be accompanied by a petition under 37 CFR 1.313(c)(1) and the required fee to withdraw the application from issue.

d) ☐ disapproved. See explanation below.

e) ☐ entered in part. See explanation below.

/OLEG SURVILLO/
Primary Examiner, Art Unit 2442

OK TO ENTER: /O.S./

09/09/2015

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
(Case No.: 04-0401-CON1014D)
(MBHB Docket No. 14-1800-CON2)

In the Application of:	)	
	)	
Millington	)	Art Unit: 2442
	)	
Serial No.: 14/516,867	)	Examiner: Survillo
	)	
Filed: October 17, 2014	)	Confirmation No. 9318
	)	
For: Obtaining Content from Remote Source For Playback	)	
	)	

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

37 CFR § 1.312 AMENDMENT

Please enter the present amendment pursuant to 37 CFR § 1.312.

AMENDMENTS TO THE CLAIMS begin on page 2.

REMARKS begin on page 8.

The Office is hereby authorized to charge any underpayment of fees or credit any overpayment of fees in connection with the prosecution of the above-captioned application to Deposit Account 13-2490.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
(Case No.: 04-0401-CON1014D)
(MBHB Docket No. 14-1800-CON2)

In the Application of:	)	
	)	
Millington	)	Art Unit: 2442
	)	
Serial No.: 14/516,867	)	Examiner: Survillo
	)	
Filed: October 17, 2014	)	Confirmation No. 9318
	)	
For: Obtaining Content from Remote Source For Playback	)	
	)	

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

37 CFR § 1.312 AMENDMENT

Please enter the present amendment pursuant to 37 CFR § 1.312.

AMENDMENTS TO THE CLAIMS begin on page 2.

REMARKS begin on page 8.

The Office is hereby authorized to charge any underpayment of fees or credit any overpayment of fees in connection with the prosecution of the above-captioned application to Deposit Account 13-2490.

AMENDMENTS TO THE CLAIMS

1-20. (Canceled)

21. (Currently Amended) A first playback device comprising:

one or more processors;

a network interface; and

tangible, non-transitory computer-readable memory comprising program instructions that, when executed by the one or more processors, cause the first playback device to:

receive, via the network interface from a network device configured to control the first playback device and communicatively coupled to the first playback device over a local area network (LAN), control information comprising an address identifying a network location of [[the]] audio information available at an audio information source, wherein the audio information source is outside of the LAN; and

after receiving the control information, (i) obtain, via the network interface from the audio information source outside of the LAN, the audio information; (ii) transmit, via the network interface of the first playback device to a second playback device, the audio information, playback timing information associated with the audio information, and device clock information of the first playback device; and (iii) play back the audio information in synchrony with the second playback device by using the playback timing information associated with the audio information and the device clock information of the first playback device to play back the audio information, wherein the first and second playback devices remain independently clocked during synchronous playback of the audio information.

22. (Currently Amended) The first playback device of claim 21, wherein the program instructions, when executed by the one or more processors, further cause the first playback device to:

generate the playback timing information associated with the audio information; and

generate the device clock ~~time~~ information of the first playback device.

23. (Previously Presented) The first playback device of claim 21, wherein the control information further comprises one or more instructions for the first playback device and the second playback device to playback audio information.

24. (Currently Amended) The first playback device of claim 23, wherein the first and second playback devices are members of a synchrony group, and wherein the program instructions, when executed by the one or more processors, further cause the first playback device to:

transmit, to the network device, status information that comprises a status of the synchrony group.

25. (Previously Presented) The first playback device of claim 24, wherein the status information further comprises an identification of each playback device in the synchrony group.

26. (Previously Presented) The first playback device of claim 24, wherein the status information further comprises an identification of a master playback device of the synchrony group.

27. (Previously Presented) The first playback device of claim 26, wherein the first playback device is the master playback device of the synchrony group.

28. (Previously Presented) The first playback device of claim 24, wherein the status information further comprises an identification of one or more slave playback devices in the synchrony group, and wherein the second playback device is one of the one or more slave playback devices in the synchrony group.

29. (Previously Presented) The first playback device of claim 28, wherein the instructions, when executed by the one or more processors, further cause the first playback device to:

generate a plurality of frames, wherein an individual frame comprises at least a portion of the audio information and the playback timing information associated with the audio information, and wherein the first playback device transmitting to the second playback device the audio information, playback timing information, and device clock information of the first playback device comprises transmitting the plurality of frames to the second playback device.

30. (Currently Amended) The first playback device of claim 21, wherein the audio information comprises one of audio files or packetized streaming audio information.

31. (Currently Amended) The first playback device of claim 21, wherein the audio information source outside of the LAN is an Internet-accessible audio information source, and wherein obtaining, from the audio information source outside of the LAN, the audio information, comprises obtaining~~, from the audio information source via the Internet,~~ the audio information from the Internet-accessible audio information source.

32. (Currently Amended) The first playback device of claim 21, wherein obtaining, from the audio information source outside of the LAN, the audio information, comprises sending, to the audio information source, a request for the audio information.

33. (Currently Amended) A method comprising:

receiving, by a first playback device from a network device configured to control the first playback device and communicatively coupled to the first playback device over a local area network (LAN), control information comprising an address identifying a location of [[the]] audio information available at an audio information source, wherein the audio information source is outside of the LAN; and

after receiving the control information (i) obtaining, by the first playback device from the audio information source outside of the LAN, the audio information; (ii) transmitting, by the first playback device to a second playback device, the audio information, playback timing information associated with the audio information, and device clock ~~time~~ information of the first playback device; and (iii) playing back, by the first playback device, the audio information in synchrony with the second playback device by using the playback timing information associated with the audio information and the device clock ~~time~~ information of the first playback device to play back the audio information, wherein the first and second playback devices remain independently clocked during synchronous playback of the audio information.

34. (Currently Amended) The method of claim 33, further comprising:

after receiving the control information, additionally (i) generating, by the first playback device, the playback timing information associated with the audio information; and (ii)

generating, by the first playback device, the device clock ~~time~~ information of the first playback device.

35. (Previously Presented) The method of claim 33, wherein the control information further comprises one or more instructions for the first playback device and the second playback device to playback audio information.

36. (Currently Amended) The method of claim 35, wherein the first and second playback devices are members of a synchrony group, and wherein the method further ~~comprising~~ comprises:

transmitting, by the first playback device to the network device, status information that comprises a status of the synchrony group.

37. (Currently Amended) The method of claim [[35]] 36, wherein the status information further comprises an identification of each playback device in the synchrony group.

38. (Previously Presented) The method of claim 37, wherein the status information further comprises an identification of a master playback device of the synchrony group.

39. (Previously Presented) The method of claim 38, wherein the first playback device is the master playback device of the synchrony group.

40. (Currently Amended) A tangible non-transitory computer-readable medium having instructions stored thereon that, when executed, cause a first playback device to:

receive, from a network device configured to control the first playback device and communicatively coupled to the first playback device over a local area network (LAN), control

information comprising an address identifying a location of audio information available at an audio information source, wherein the audio information source is outside of the LAN; and

after receiving the control information, (i) obtain, from the audio information source outside of the LAN, the audio information; (ii) transmit, to a second playback device, the audio information, playback timing information associated with the audio information, and clock time information for the first playback device; and (iii) play back the audio information in synchrony with the second playback device by using the playback timing information associated with the audio information and the clock time information of the first playback device to play back the audio information, wherein the first and second playback devices remain independently clocked during synchronous playback of the audio information.

REMARKS

Claims 21-40 are pending. Claims 21, 33, and 40 are independent. Applicant has amended claims 21, 22, 24, 30-34, 36, 37, and 40 to correct typographical errors and to generally put the claims in better condition for issuance. No new subject matter has been added. Because the amendments are ministerial in nature and/or do not change the scope of the allowed claims, Applicant requests that the Office enter the amendments pursuant to 37 C.F.R. § 1.312. If further dialog would advance consideration and entry of the present amendments, the Office is invited to telephone the undersigned at 312-913-0001.

Respectfully submitted,
McDonnell Boehnen Hulbert & Berghoff LLP

Date: August 20, 2015

By: /Jeffrey P. Armstrong/
Jeffrey P. Armstrong
Reg. No. 54,967

Electronic Acknowledgement Receipt	
EFS ID:	23260474
Application Number:	14516867
International Application Number:	
Confirmation Number:	9318
Title of Invention:	Obtaining Content from Remote Source for Playback
First Named Inventor/Applicant Name:	Nicholas A.J. Millington
Customer Number:	107361
Filer:	Jeffrey Armstrong
Filer Authorized By:	
Attorney Docket Number:	04-0401-CON1014D
Receipt Date:	20-AUG-2015
Filing Date:	17-OCT-2014
Time Stamp:	11:08:11
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		04-0401-CON1014D__14-1800-CON2_312_Amendment.pdf	85248 2c962823f01b37aa155510171df8d90e1457b53b	yes	8

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Amendment after Notice of Allowance (Rule 312)	1	1
	Claims	2	7
	Applicant Arguments/Remarks Made in an Amendment	8	8
Warnings:			
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<u>New Applications Under 35 U.S.C. 111</u>
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

<u>National Stage of an International Application under 35 U.S.C. 371</u>
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

<u>New International Application Filed with the USPTO as a Receiving Office</u>
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
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	Attorney Docket Number	04-0401-CON1014D

U.S.PATENTS						
Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	RE41608		2010-08-31	BLAIR; Christopher Douglas et al.	
	2	6122668		2000-09-19	TENG; Peter Y. et al.	
	3	6449653		2002-09-10	KLEMETS; Anders Edgar et al.	
	4	6823225		2004-11-23	SASS; Jonathan	
	5	7068596		2006-06-27	MOU; Hensen	
	6	7313593		2007-12-25	PULITO; Brian et al.	
	7	7702403		2010-04-20	GLADWIN; Stephen Christopher et al.	
If you wish to add additional U.S. Patent citation information please click the Add button.						
U.S.PATENT APPLICATION PUBLICATIONS						

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	1	20010047377		2001-11-29	SINCAGLIA; Nicholas William et al.	
	2	20020159596		2002-10-31	DURAND; Julian et al.	
	3	20020165721		2002-11-07	CHANG; Kenneth H.P. et al.	
	4	20030219007		2003-11-27	BARRACK; Craig et al.	
	5	20040012620		2004-01-22	BUHLER; Rene et al.	
	6	20040048569		2004-03-11	KAWAMURA; Harumi	
	7	20040080671		2004-04-29	SIEMENS; Duane et al.	
	8	20040224638		2004-11-11	FADELL; Anthony M. et al.	
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	Attorney Docket Number	04-0401-CON1014D

	11	20060193454		2006-08-31	ABOU-CHAKRA RABIH . et al.		

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	1							☐

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Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
	1	"Advisory Action mailed on 28 July 2015, issued in connection with U.S. Patent Application No. 14/184522, filed on 19 February 2014, 7 pages".	☐
	2	"BAUDISCH et al., "Flat Volume Control: Improving Usability by Hiding the Volume Control Hierarchy in the User Interface", 2004, 8 pages.".	☐
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	4	"SCHMANDT et al., "Impromptu: Managing Networked Audio Applications for Mobile Users", 2004, 11 pages.".	☐
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	Examiner Name	SURVILLO, OLEG
	Attorney Docket Number	04-0401-CON1014D

	6	"Final Office Action mailed on 11 August 2015, issued in connection with U.S. Patent Application No. 13/864247, filed on 17 April 2013, 15 pages".	☐
	7	"Final Office Action mailed on 15 July, 2015, issued in connection with U.S. Patent Application No. 14/504812, filed on 2 October 2014, 18 pages".	☐
	8	"Final Office Action mailed on 3 August 2015, issued in connection with U.S. Patent Application No. 13/848921, filed on 22 March 2013, 13 pages".	☐
	9	"FULTON et al., "The Network Audio System: Make Your Application Sing (As Well As Dance)!", The X Resource, 1994, 14 pages.".	☐
	10	"HANS et al., "Interacting with Audio Streams for Entertainment and Communication", 2003, 7 pages.".	☐
	11	"LEVERGOOD et al., "AudioFile: A Network-Transparent System for Distributed Audio Applications", Digital Equipment Corporation, 1993, 109 pages.".	☐
	12	"Notice of Allowance mailed on 10 August 2015, issued in connection with U.S. Patent Application No. 13/848904, filed on 22 March 2013, 9 pages".	☐
	13	"Notice of Allowance mailed on 12 August 2015, issued in connection with U.S. Patent Application No. 13/435739, filed on 30 March 2012, 27 pages".	☐
	14	"Notice of Allowance mailed on 13 July 2015, issued in connection with U.S. Patent Application No. 14/184526, filed on 19 February 2014, 22 pages".	☐
	15	"Notice of Allowance mailed on 15 July 2015, issued in connection with U.S. Patent Application No. 13/705174, filed on 5 December 2012, 18 pages".	☐
	16	"Notice of Allowance mailed on 17 July 2015, issued in connection with U.S. Patent Application No. 13/864251, filed on 17 April 2013, 20 pages".	☐

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99**)		
	Application Number	14516867
	Filing Date	2014-10-17
	First Named Inventor	MILLINGTON; Nicholas A.J.
	Art Unit	2442
	Examiner Name	SURVILLO, OLEG
	Attorney Docket Number	04-0401-CON1014D

	17	"Notice of Allowance mailed on 29 July 2015, issued in connection with U.S. Patent Application No. 13/359976, filed on 27 January 2012, 28 pages".	☐
	18	"Notice of Allowance mailed on 29 July 2015, issued in connection with U.S. Patent Application No. 14/186850, filed on 21 February 2014, 9 pages".	☐
	19	"Notice of Allowance mailed on 30 July 2015, issued in connection with U.S. Patent Application No. 13/705178, filed 5 December 2012, 18 pages".	☐
	20	"Notice of Allowance mailed on 5 August 2015, issued in connection with U.S. Patent Application No. 13/435776, filed on 30 March 2012, 26 pages".	☐
	21	"NUTZEL et al., "Sharing Systems for Future HiFi Systems", IEEE, 2004, 9 pages.".	☐
	22	"Re-Exam Final Office Action mailed on 5 August 2015, issued in connection with U.S. Patent Application No. 90/013423, filed on 5 January 2015, 25 pages.".	☐

If you wish to add additional non-patent literature document citation information please click the Add button

EXAMINER SIGNATURE

Examiner Signature		Date Considered	

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

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	14516867
	Filing Date	2014-10-17
	First Named Inventor	MILLINGTON; Nicholas A.J.
	Art Unit	2442
	Examiner Name	SURVILLO, OLEG
	Attorney Docket Number	04-0401-CON1014D

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☒ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☒ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☐ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Jeffrey P. Armstrong/	Date (YYYY-MM-DD)	2015-08-17
Name/Print	Jeffrey P. Armstrong	Registration Number	54,967

This collection of information is required by 37 CFR 1.97 and 1.98. 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 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

Electronic Patent Application Fee Transmittal				
Application Number:	14516867			
Filing Date:	17-Oct-2014			
Title of Invention:	Obtaining Content from Remote Source for Playback			
First Named Inventor/Applicant Name:	Nicholas A.J. Millington			
Filer:	Jeffrey Armstrong			
Attorney Docket Number:	04-0401-CON1014D			
Filed as Large Entity				
Filing Fees for Utility under 35 USC 111(a)				
Description	**Fee Code**	**Quantity**	**Amount**	**Sub-Total in USD($)**
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
Submission- Information Disclosure Stmt	1806	1	180	180
		Total in USD ($)		**180**

Electronic Acknowledgement Receipt	
EFS ID:	23231942
Application Number:	14516867
International Application Number:	
Confirmation Number:	9318
Title of Invention:	Obtaining Content from Remote Source for Playback
First Named Inventor/Applicant Name:	Nicholas A.J. Millington
Customer Number:	107361
Filer:	Jeffrey Armstrong
Filer Authorized By:	
Attorney Docket Number:	04-0401-CON1014D
Receipt Date:	17-AUG-2015
Filing Date:	17-OCT-2014
Time Stamp:	21:27:48
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$180
RAM confirmation Number	7827
Deposit Account	132490
Authorized User	ARMSTRONG, JEFFREY P.
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: Charge any Additional Fees required under 37 C.F.R. Section 1.16 (National application filing, search, and examination fees) Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)	

Charge any Additional Fees required under 37 C.F.R. Section 1.19 (Document supply fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.20 (Post Issuance fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Form (SB08)	14_1800_CON2_IDS.pdf	70448 d0865baa429494c7ff6359a2e94aed4c0fe852fd	no	6
Warnings:					
Information:					
This is not an USPTO supplied IDS fillable form					
2	Non Patent Literature	14184522_Advisory_Action_7-28-15.pdf	277143 7fcfad075310e7f2fab8bc55319e64dcd2de8433	no	7
Warnings:					
Information:					
3	Non Patent Literature	Baudisch_2004.pdf	1634267 e33e5c32295c07d293432e83b636f62b07d9b6dc	no	8
Warnings:					
Information:					
4	Non Patent Literature	Chakrabarti_2004_upload.pdf	282098 dee7ac8b5b885330742867 05c9ca18fa29f791da	no	6
Warnings:					
Information:					
5	Non Patent Literature	Schmandt_2004.pdf	177678 0c351c26010c2e08393709de7495eb6d3deeb6b5	no	11
Warnings:					
Information:					
6	Non Patent Literature	14290493_Final_OA_8-10-15.pdf	899235 584096268dced3272a404601423a84b914a7ca8b	no	26
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Information:					
7	Non Patent Literature	13864247_Final_OA_8-11-15.pdf	469907 4287ec1a4c3eeb2f9865d7ec19a5edf6447a4d18	no	15
Warnings:					
Information:					

8	Non Patent Literature	14504812_Final_OA_7-15-15.pdf	623848 26f4452f5fffa47ff1b4029748cd138f187ca73e	no	18
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Information:					
9	Non Patent Literature	13848921_Final_OA_8-3-15.pdf	403417 ecce87efe9efe52759a6f5d572ca3eae1fba5151	no	13
Warnings:					
Information:					
10	Non Patent Literature	Fulton_1994.pdf	852241 ee1233830925f934696f48725c7288f4a2bb0a40	no	14
Warnings:					
The page size in the PDF is too large. The pages should be 8.5 x 11 or A4. If this PDF is submitted, the pages will be resized upon entry into the Image File Wrapper and may affect subsequent processing					
Information:					
11	Non Patent Literature	Hans_2003_upload.pdf	331319 14b2738422e0364e751174a5941a3e6376e254f3	no	7
Warnings:					
Information:					
12	Non Patent Literature	Levergood_1993_image.pdf	13115189 e526ac44e2b9509afaf164ade55bd86b8a26055c	no	109
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Information:					
13	Non Patent Literature	13848904_NOA_8-10-15.pdf	448808 39cd3e39cc7e851edb57e0390374117eb097d65a	no	9
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Information:					
14	Non Patent Literature	13435739_NOA_8-12-15.pdf	1047019 089231d7b44d8a1c3b1b67b5784e5be545433cf9	no	27
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Information:					
15	Non Patent Literature	14184526_NOA_7-13-15.pdf	874911 3701c92f5e9ea1b9ccb704aada994cd407a93c21	no	22
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16	Non Patent Literature	13705174_NOA_7-15-15.pdf	695893 922afe75fbb095e4e2544484ad9452ecaf5ac383	no	18

Warnings:					
Information:					
17	Non Patent Literature	13864251_NOA_7-17-15.pdf	770292 b6609e4de2322a7b708c5a1c0798bd151ac30c0b	no	20
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18	Non Patent Literature	13359976_NOA_7_29_15.pdf	1036691 a93ee8b86d61549b26aa19a5caeeebccb4f19da9	no	28
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19	Non Patent Literature	14186850_NOA_7-29-15.pdf	481118 de2be8668a3a55ab0fccc46021ce065d7eca191f	no	9
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20	Non Patent Literature	13705178_NOA_7-30-15.pdf	747679 1ef96578df40312f991a9032eacc950cfcd739e8	no	18
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Information:					
21	Non Patent Literature	Nutzel_2004.pdf	465214 7093a5ae395c3a038c86654390a9edba80de6cba	no	9
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Information:					
22	Non Patent Literature	90013423_Final_OA_8-5-15.pdf	923527 6869aab4e1bd9cfe5de86f629af93185a98338b4	no	25
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Information:					
23	Non Patent Literature	13435776_NOA_8-5-15.pdf	961714 9386a087f679f37eb34c5df4f8f82adf0547528e	no	26
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Information:					
24	Fee Worksheet (SB06)	fee-info.pdf	30156 6c1d644bf74e5a9c157f126e2ce0dfc655e32380	no	2
Warnings:					
Information:					
			Total Files Size (in bytes):	27619812	

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

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

107361 7590 08/04/2015

McDonnell Boehnen Hulbert & Berghoff LLP
Sonos, Inc.
300 South Wacker Drive
Chicago, IL 60606

EXAMINER
SURVILLO, OLEG

ART UNIT	PAPER NUMBER
2442	

DATE MAILED: 08/04/2015

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/516,867	10/17/2014	Nicholas A.J. Millington	04-0401-CON1014D	9318

TITLE OF INVENTION: Obtaining Content from Remote Source for Playback

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$960	$0	$0	$960	11/04/2015

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 DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 1/2 the amount of undiscounted fees, and micro entity fees are 1/2 the amount of small entity fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). 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. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

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. 02/11)

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)

107361 7590 08/04/2015
McDonnell Boehnen Hulbert & Berghoff LLP
Sonos, Inc.
300 South Wacker Drive
Chicago, IL 60606

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.
14/516,867	10/17/2014	Nicholas A.J. Millington	04-0401-CON1014D	9318

TITLE OF INVENTION: Obtaining Content from Remote Source for Playback

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$960	$0	$0	$960	11/04/2015

EXAMINER	ART UNIT	CLASS-SUBCLASS
SURVILLO, OLEG	2442	709-219000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).
- ❑ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
- ❑ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list
(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,
(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.
1 _____
2 _____
3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE (B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ❑ Individual ❑ Corporation or other private group entity ❑ Government

4a. The following fee(s) are submitted:
- ❑ Issue Fee
- ❑ Publication Fee (No small entity discount permitted)
- ❑ Advance Order - # of Copies _____

4b. Payment of Fee(s): **(Please first reapply any previously paid issue fee shown above)**
- ❑ A check is enclosed.
- ❑ Payment by credit card. Form PTO-2038 is attached.
- ❑ The director is hereby authorized to charge the required fee(s), any deficiency, or credits any overpayment, to Deposit Account Number _____ (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)
- ❑ Applicant certifying micro entity status. See 37 CFR 1.29 — NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.
- ❑ Applicant asserting small entity status. See 37 CFR 1.27 — NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.
- ❑ Applicant changing to regular undiscounted fee status. — NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature _____ Date _____

Typed or printed name _____ Registration No. _____

PTOL-85 Part B (10-13) Approved for use through 10/31/2013. OMB 0651-0033 U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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.
14/516,867	10/17/2014	Nicholas A.J. Millington	04-0401-CON1014D	9318

107361 7590 08/04/2015

McDonnell Boehnen Hulbert & Berghoff LLP
Sonos, Inc.
300 South Wacker Drive
Chicago, IL 60606

EXAMINER	
SURVILLO, OLEG	
ART UNIT	PAPER NUMBER
2442	

DATE MAILED: 08/04/2015

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(Applications filed on or after May 29, 2000)

The Office has discontinued providing a Patent Term Adjustment (PTA) calculation with the Notice of Allowance.

Section 1(h)(2) of the AIA Technical Corrections Act amended 35 U.S.C. 154(b)(3)(B)(i) to eliminate the requirement that the Office provide a patent term adjustment determination with the notice of allowance. See Revisions to Patent Term Adjustment, 78 Fed. Reg. 19416, 19417 (Apr. 1, 2013). Therefore, the Office is no longer providing an initial patent term adjustment determination with the notice of allowance. The Office will continue to provide a patent term adjustment determination with the Issue Notification Letter that is mailed to applicant approximately three weeks prior to the issue date of the patent, and will include the patent term adjustment on the patent. Any request for reconsideration of the patent term adjustment determination (or reinstatement of patent term adjustment) should follow the process outlined in 37 CFR 1.705.

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 1-(888)-786-0101 or (571)-272-4200.

Notice Requiring Inventor's Oath or Declaration	Application No. 14/516,867	Applicant(s) Nicholas A.J. Millington	
	Examiner SURVILLO, OLEG	Art Unit 2442	

This notice is an attachment to the Notice of Allowability (PTOL-37), or the Notice of Allowability For A Design Application (PTOL-37D).

An inventor's oath or declaration in compliance with 37 CFR 1.63 or 1.64 executed by or with respect to each inventor has not yet been submitted.

An oath or declaration in compliance with 37 CFR 1.63, or a substitute statement in compliance with 37 CFR 1.64, executed by or with respect to each inventor (for any inventor for which a compliant oath, declaration, or substitute statement has not yet been submitted) MUST be filed no later than the date on which the issue fee is paid. See 35 U.S.C. 115(f). Failure to timely comply will result in ABANDONMENT of this application.

A properly executed inventor's oath to declaration has not been received for the following inventor(s):

If applicant previously filed one or more oaths, declarations, or substitute statements, applicant may have received an informational notice regarding deficiencies therein.

The following deficiencies are noted:

INFORMAL ACTION PROBLEMS

- A properly executed inventor's oath or declaration has not been received for the following inventor(s): **Nicholas A.J. Millington**.
  Applicant may submit the inventor's oath or declaration at any time before the Notice of Allowance and Fee(s) Due, PTOL-85, is mailed.

Questions relating to this Notice should be directed to the Application Assistance Unit at 571-272-4200.

OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B 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.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Notice of Allowability	Application No. 14/516,867	Applicant(s) MILLINGTON, NICHOLAS A.J.	
	Examiner OLEG SURVILLO	Art Unit 2442	AIA (First Inventor to File) Status No

-- 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 *Request for continued examination dated 07/07/2015*.
   ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on_____.
2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.
3. ☒ The allowed claim(s) is/are *21-40*. As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov .
4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

   Certified copies:

   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.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
   ☐ 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. ☒ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date 06/02/15; 07/13/15
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
4. ☒ Interview Summary (PTO-413), Paper No./Mail Date *20150731* .
5. ☒ Examiner's Amendment/Comment
6. ☒ Examiner's Statement of Reasons for Allowance
7. ☐ Other _____.

/OLEG SURVILLO/
Primary Examiner, Art Unit 2442

EXAMINER'S COMMENT

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicants' submission dated July 7, 2015 has been entered.

Response to Amendment

Claims 21-40 are pending in the application. Claims 21-24, 28, 29, 33-35, and 40 are currently amended. Claims 1-20 have been canceled. No new claims are currently added.

Response to Arguments

With regard to the Applicant's remarks dated July 7, 2015:

Regarding the rejection of claims 21-40 under 35 U.S.C. 103(a), Applicant's amendment and arguments have been fully considered. Applicants argue at page 10 of Remarks as filed that none of Goldberg, Meade, and Sinha teaches the newly added subject matter. Examiner generally agrees. Therefore, the rejection has been withdrawn. Upon further search, no better art exists to teach all of the claimed limitations as in independent claims 21, 33, and 40. Therefore, no new grounds of

rejection are made. No other previously-made grounds of rejection remain. Claims 21-40 are allowable, while claims 1-20 are canceled.

Examiner's Amendment

Examiner's amendment to the record appears below. Should the changes be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it MUST be filed no later than the payment of the issue fee.

Authorization for this examiner's amendment was given in a communication with Jeffrey P. Armstrong, Reg. No.: 54,967, on July 31, 2015.

Please make the following changes in this application:

in claim 21 at line 5 add "first" to read "...the first playback device..."

in claim 21 at line 15 amend the claim to read "…[[the]] a second playback..."

in claim 23 at line 2 amend the claim to read "…[[a]] the second..."

in claim 29 at line 3 add "first" to read "...the first playback device..."

in claim 33 at line 10 amend the claim to read "…[[the]] a second playback..."

in claim 35 at line 2 amend the claim to read "…[[a]] the second..."

in claim 40 at line 10 amend the claim to read "…[[the]] a second..."

Allowed Claims

Claims 21-40 are allowed.

Reasons for Allowance

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

none of the qualifying prior art references of record, taken alone or in combination, disclose or reasonably suggest: a combination of elements as claimed in independent claim 33, wherein after receiving the control information (i) obtaining, by the first playback device from the audio information source outside of the LAN, the audio information; (ii) transmitting, by the first playback device to a second playback device, the audio information, playback timing information associated with the audio information, and device clock time information of the first playback device; and (iii) playing back, by the first playback device, the audio information in synchrony with the second playback device by using the timing information associated with the audio information and the device clock time information of the first playback device to play back the audio information, wherein the first and second playback devices remain independently clocked during synchronous playback of the audio information. Independent claims 21 and 40 contain similar limitations.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to OLEG SURVILLO whose telephone number is (571)272-9691. The examiner can normally be reached on Mon-Thu 10:00am - 7:30pm; Fri 10:00am - 6:30pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Glenton B. Burgess can be reached on 571-272-3949. 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). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/OLEG SURVILLO/
Primary Examiner, Art Unit 2442

Examiner-Initiated Interview Summary	Application No.	Applicant(s)	
	14/516,867	MILLINGTON, NICHOLAS A.J.	
	Examiner	Art Unit	
	OLEG SURVILLO	2442	

All participants (applicant, applicant's representative, PTO personnel):

(1) *Oleg Survillo, Examiner AU 2442*. (3)_____.

(2) *Jeffrey Armstrong, Reg. No.: 54,967*. (4)_____.

Date of Interview: *31 July 2015*.

Type: ☒ Telephonic ☐ Video Conference
☐ Personal [copy given to: ☐ applicant ☐ applicant's representative]

Exhibit shown or demonstration conducted: ☐ Yes ☒ No.
If Yes, brief description: _____.

Issues Discussed ☐101 ☒112 ☐102 ☐103 ☐Others
(For each of the checked box(es) above, please describe below the issue and detailed description of the discussion)

Claim(s) discussed: *21,23,29,33,35 and 40*.

Identification of prior art discussed: *none*.

Substance of Interview
(For each issue discussed, provide a detailed description and indicate if agreement was reached. Some topics may include: identification or clarification of a reference or a portion thereof, claim interpretation, proposed amendments, arguments of any applied references etc...)

discussed 35 U.S.C. 112, second paragraph issues noted. Agreed to make changes to fix the issues via Examiner's Amendment. Obtained authorization from Applicant's Attorney to make changes as attached with the Notice of Allowance.

Applicant recordation instructions: It is not necessary for applicant to provide a separate record of the substance of interview.

Examiner recordation instructions: Examiners must summarize the substance of any interview of record. A complete and proper recordation of the substance of an interview should include the items listed in MPEP 713.04 for complete and proper recordation including the identification of the general thrust of each argument or issue discussed, a general indication of any other pertinent matters discussed regarding patentability and the general results or outcome of the interview, to include an indication as to whether or not agreement was reached on the issues raised.

☒ Attachment

/OLEG SURVILLO/ Primary Examiner, Art Unit 2442	

Notice of References Cited	Application/Control No. 14/516,867	Applicant(s)/Patent Under Reexamination MILLINGTON, NICHOLAS A.J	
	Examiner OLEG SURVILLO	Art Unit 2442	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-2005/0166135	07-2005	Burke et al.	715/500.1
*	B	US-7,206,367	04-2007	Moore, Daniel L	375/354
	C	US-			
	D	US-			
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
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	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.

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT
(Not for submission under 37 CFR 1.99)

Application Number	14516867
Filing Date	10-17-2014
First Named Inventor	MILLINGTON; Nicholas A.J.
Art Unit	2442
Examiner Name	SURVILLO, OLEG
Attorney Docket Number	04-0401-CON1014D

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
/O.S./	1	5761320		1998-06-02	FARINELLI; Robert et al.	
/O.S./	2	6535121		2003-03-18	MATHNEY; Richard K. et al.	
/O.S./	3	6816818		2004-11-09	WOLF; Michael Jaochim et al.	

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Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
/O.S./	1	20020080783		2002-06-27	FUJIMORI; Junichi	
/O.S./	2	20020114354		2002-08-22	SINHA; Pranesh et al.	
/O.S./	3	20030018797		2003-01-23	DUNNING; Ted E. et al.	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	14516867
	Filing Date	10-17-2014
	First Named Inventor	MILLINGTON; Nicholas A.J.
	Art Unit	2442
	Examiner Name	SURVILLO, OLEG
	Attorney Docket Number	04-0401-CON1014D

/O.S./	4	20030067437		2003-04-10	MCCLINTOCK; Dale Thomas et al.	
	5	20040208158		2004-10-21	FELLMAN; Ronald D. et al.	
	6	20040228367		2004-11-18	MOSIG; Rudiger et al.	
	7	20130018960		2013-01-17	KNYSZ; Matthew S. et al.	
/O.S./	8	20140181569		2014-06-26	MILLINGTON; Nicholas A.J. et al.	

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Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
/O.S./	1	"Advisory Action mailed on 15 April 2015, issued in connection with U.S. Patent Application No. 14/184526, filed on 19 February 2014, 9 pages".	☐

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	Art Unit	2442
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	Attorney Docket Number	04-0401-CON1014D

/O.S./	2	"Advisory Action mailed on 15 April 2015, issued in connection with U.S. Patent Application No. 14/184935, filed on 20 February 2014, 9 pages".	☐
	3	"Advisory Action mailed on 25 March 2015, issued in connection with U.S. Patent Application No. 13/533105, filed 26 June 2012, 5 pages.".	☐
	4	"European Extended Search Report for Application No. 14181454.1 mailed on 31 March 2015, 9 pages.".	☐
	5	"Final Office Action mailed on 28 April 2015, issued in connection with U.S. Patent Application No. 14/186850, filed on 21 February 2014, 20 pages".	☐
	6	"Non-Final Office Action mailed on 12 March 2015, issued in connection with U.S. Patent Application No. 13/705174, filed 5 December 2012, 13 pages.".	☐
	7	"Non-Final Office Action mailed on 13 March 2015, issued in connection with U.S. Patent Application No. 13/705177, filed 5 December 2012, 15 pages.".	☐
	8	"Non-Final Office Action mailed on 26 March 2015, issued in connection with U.S. Patent Application No. 14/184528, filed on 19 February 2014, 18 pages".	☐
	9	"Non-Final Office Action mailed on 27 March 2015, issued in connection with U.S. Patent Application No. 13/705178, filed 5 December 2012, 14 pages.".	☐
	10	"Notice of Allowance mailed on 19 May 2015, issued in connection with U.S. Patent Application No. 13/907666, filed on 31 May 2013, 7 pages".	☐
/O.S./	11	"Re-Exam Non-Final Office Action mailed on 22 April 2015, issued in connection with U.S. Patent Application No. 90/013423, filed on 5 January 2015, 16 pages.".	☐

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	Examiner Name	SURVILLO, OLEG
	Attorney Docket Number	04-0401-CON1014D

EXAMINER SIGNATURE			
Examiner Signature	/Oleg Survillo/	Date Considered	07/31/2015

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

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

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BIB DATA SHEET

CONFIRMATION NO. 9318

SERIAL NUMBER	FILING or 371(c) DATE RULE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
14/516,867	10/17/2014	709	2442	04-0401-CON1014D

APPLICANTS
Sonos, Inc., Santa Barbara, CA;

INVENTORS
Nicholas A.J. Millington, Santa Barbara, CA;

**** CONTINUING DATA **************************
This application is a CON of 13/297,000 11/15/2011
which is a CON of 10/816,217 04/01/2004 PAT 8234395
which claims benefit of 60/490,768 07/28/2003

**** FOREIGN APPLICATIONS **************************

**** IF REQUIRED, FOREIGN FILING LICENSE GRANTED ****
10/24/2014

Foreign Priority claimed ☐ Yes ☑ No 35 USC 119(a-d) conditions met ☐ Yes ☑ No Verified and Acknowledged /OLEG SURVILLO/ Examiner's Signature	☐ Met after Allowance Initials	STATE OR COUNTRY	SHEETS DRAWINGS	TOTAL CLAIMS	INDEPENDENT CLAIMS
		CA	5	20	3

ADDRESS

McDonnell Boehnen Hulbert & Berghoff LLP
Sonos, Inc.
300 South Wacker Drive
Chicago, IL 60606
UNITED STATES

TITLE

Obtaining Content from Remote Source for Playback

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1740	FEES: Authority has been given in Paper 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

dated 07/13/2015

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
/O.S./	1	6108485		2000-08-22	KIM; Jeong-Kyu	
	2	6343028		2002-01-29	KUWAOKA; Toshiharu	
	3	6778493		2004-08-17	ISHII; Atsushi	
	4	6970482		2005-11-29	KIM; Sung-Tae	
/O.S./	5	7130368		2006-10-31	AWEYA; James et al.	

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Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
/O.S./	1	20020114359		2002-08-22	IBARAKI; Susumu et al.	

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	Art Unit	2442
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	Attorney Docket Number	04-0401-CON1014D

/O.S./	2	20030035072		2003-02-20	HAGG; Wilhelm	
	3	20030198254		2003-10-23	SULLIVAN; Gary E. et al.	
	4	20030198255		2003-10-23	SULLIVAN; Gary E. et al.	
	5	20040248601		2004-12-09	CHANG; Chin-Chi	
	6	20070043847		2007-02-22	CARTER; Harry N. et al.	
	7	20100284389		2010-11-11	RAMSAY; Max et al.	
/O.S./	8	20100299639		2010-11-25	RAMSAY; Max Gordon et al.	

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Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
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	Attorney Docket Number	04-0401-CON1014D

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
/O.S./	1	"Baldwin, Roberto. "How-To: Setup iTunes DJ on Your Max and iPhone", available at http://www.maclife.com/article/howtos/howto_setup_itunes_dj_your_mac_and_iphone, archived on 3/17/ 2009, 4 pages.".	☐
	2	"Final Office Action mailed on 15 June 2015, issued in connection with U.S. Patent Application No. 14/184522, filed on 19 February 2014, 25 pages".	☐
	3	"Non-Final Office Action mailed on 12 June 2015, issued in connection with U.S. Patent Application No. 13/848932, filed on 22 March 2013, 16 pages".	☐
	4	"Non-Final Office Action mailed on 19 June 2015, issued in connection with U.S. Patent Application No. 13/533105 filed on 26 June 2012, 38 pages.".	☐
	5	"Non-Final Office Action mailed on 23 June 2015, issued in connection with U.S. Patent Application No. 13/705176, filed on 5 December 2012, 30 pages".	☐
	6	"Non-Final Office Action mailed on 3 June 2015, issued in connection with U.S. Patent Application No. 14/564544, filed on 9 December 2014, 7 pages.".	☐
	7	"Non-Final Office Action mailed on 4 June 2015, issued in connection with U.S. Patent Application No. 13/871795 filed on 26 April 2013, 16 pages.".	☐
	8	"Notice of Allowance mailed on 2 July 2015, issued in connection with U.S. Patent Application No. 13/848904, filed on 22 March 2013, 17 pages".	☐
	9	"Notice of Allowance mailed on 2 July 2015, issued in connection with U.S. Patent Application No. 13/888203, filed on 6 May 2013, 19 pages".	☐
/O.S./	10	"Notice of Allowance mailed on 2 July 2015, issued in connection with U.S. Patent Application No. 14/184935, filed on 20 February 2014, 23 pages".	☐

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	14516867
	Filing Date	10-17-2014
	First Named Inventor	MILLINGTON; Nicholas A.J.
	Art Unit	2442
	Examiner Name	SURVILLO, OLEG
	Attorney Docket Number	04-0401-CON1014D

/O.S./	11	"Notice of Allowance mailed on 6 July 2015, issued in connection with U.S. Patent Application No. 13/297000, filed on 15 November 2011, 24 pages.".	☐

If you wish to add additional non-patent literature document citation information please click the Add button **Add**

EXAMINER SIGNATURE

Examiner Signature	/Oleg Survillo/	Date Considered	07/31/2015

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

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	14516867	MILLINGTON, NICHOLAS A.J.
	Examiner	**Art Unit**
	OLEG SURVILLO	2442

CPC						
Symbol					**Type**	**Version**
G06F		1	/	00	F	2013-01-01
H04J		3	/	0664	I	2013-01-01
H04R		27	/	00	I	2013-01-01
H04R		2227	/	005	A	2013-01-01
G06F		17	/	00	I	2013-01-01
H03G		3	/	20	I	2013-01-01
H04L		65	/	60	I	2013-01-01
G06F		3	/	048	I	2013-01-01
G06F		3	/	165	I	2013-01-01
G06F		3	/	167	I	2013-01-01
G06F		3	/	16	I	2013-01-01
H04L		67	/	1095	I	2013-01-01
G06F		3	/	0484	I	2013-01-01
H04R		3	/	12	I	2013-01-01
H04L		65	/	4076	A	2013-01-01
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H04L		69	/	28	I	2013-01-01
G06F		17	/	3074	I	2013-01-01
G06F		3	/	0482	I	2013-01-01
H03G		3	/	00	I	2013-01-01
H04L		67	/	26	I	2013-01-01
H04H		20	/	103	I	2013-01-01
H04H		20	/	26	I	2013-01-01
H04H		2201	/	20	A	2013-01-01
H04R		2227	/	003	A	2013-01-01
G05B		15	/	02	I	2013-01-01
G11B		20	/	10527	I	2013-01-01
G11B		2020	/	10592	A	2013-01-01
H04N		5	/	04	I	2013-01-01
H04N		9	/	7904	I	2013-01-01
H04N		21	/	4307	I	2013-01-01

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	20	
/OLEG SURVILLO/ Primary Examiner.Art Unit 2442	07/30/2015	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	33	1

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	14516867	MILLINGTON, NICHOLAS A.J.
	Examiner	**Art Unit**
	OLEG SURVILLO	2442

H04N	▒	21	/	43615	I	2013-01-01

CPC Combination Sets								
Symbol					**Type**	**Set**	**Ranking**	**Version**
	▒		/					
	▒		/					

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	20	
/OLEG SURVILLO/ Primary Examiner.Art Unit 2442	07/30/2015	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	33	1

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	14516867	MILLINGTON, NICHOLAS A.J.
	Examiner	**Art Unit**
	OLEG SURVILLO	2442

US ORIGINAL CLASSIFICATION		INTERNATIONAL CLASSIFICATION										
CLASS	SUBCLASS	CLAIMED					NON-CLAIMED					
709	231	G	0	6	F	15 / 16 (2006.01.01)						

CROSS REFERENCE(S)					
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)				
709	219	220			

NONE		Total Claims Allowed:	
(Assistant Examiner)	(Date)	20	
/OLEG SURVILLO/ Primary Examiner.Art Unit 2442	07/30/2015	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	33	1

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
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	Examiner	**Art Unit**
	OLEG SURVILLO	2442

☐ 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	Final	Original
	1		17	1	33										
	2		18	2	34										
	3		19	3	35										
	4		20	4	36										
	5	9	21	5	37										
	6	10	22	6	38										
	7	11	23	7	39										
	8	12	24	8	40										
	9	13	25												
	10	14	26												
	11	15	27												
	12	16	28												
	13	17	29												
	14	18	30												
	15	19	31												
	16	20	32												

NONE		**Total Claims Allowed:**	
(Assistant Examiner)	(Date)	20	
/OLEG SURVILLO/ Primary Examiner.Art Unit 2442	07/30/2015	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner)	(Date)	33	1

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	14516867	MILLINGTON, NICHOLAS A.J.
	Examiner	Art Unit
	OLEG SURVILLO	2442

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

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

CLAIM		DATE								
Final	Original	03/04/2015	07/30/2015							
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	2	-	-							
	3	-	-							
	4	-	-							
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20	32	✓	=							
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2	34	✓	=							
3	35	✓	=							
4	36	✓	=							

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	14516867	MILLINGTON, NICHOLAS A.J.
	Examiner	Art Unit
	OLEG SURVILLO	2442

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
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☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	03/04/2015	07/30/2015							
5	37	✓	=							
6	38	✓	=							
7	39	✓	=							
8	40	✓	=							

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S197	5331135	@ad<"20040401" or @rlad<"20040401"	US-PGPUB; USPAT	OR	ON	2015/06/11 10:42
S198	0	S197 and (playback or play or playing or played) with while near5 (transmit or transmitting or transmitted or send or sending or sent) near4 (second or different or next or previous)	US-PGPUB; USPAT	OR	ON	2015/06/11 10:47
S199	0	S197 and (playback or play or playing or played) with while with (transmit or transmitting or transmitted or send or sending or sent) near4 (second or different or next or previous)	US-PGPUB; USPAT	OR	ON	2015/06/11 10:47
S200	0	S197 and (playback or play or playing or played or display$3 or output$3) with while with (transmit or transmitting or transmitted or send or sending or sent) near4 (second or different or next or previous)	US-PGPUB; USPAT	OR	ON	2015/06/11 10:48
S201	45898	S197 and (playback or play or playing or played or display$3 or output$3) with (transmit or transmitting or transmitted or send or sending or sent) near4 (second or different or next or previous)	US-PGPUB; USPAT	OR	ON	2015/06/11 10:48
S202	2033	S197 and (playback or play or playing or played) with (transmit or transmitting or transmitted or send or sending or sent) near4 (second or different or next or previous)	US-PGPUB; USPAT	OR	ON	2015/06/11 11:08
S203	1670	S197 and (playback or play or playing or played or display$3 or output$3) with during with (transmit or transmitting or transmitted or send or sending or sent) near4 (second or different or next or previous)	US-PGPUB; USPAT	OR	ON	2015/06/11 11:09
S204	111	S197 and (playback or play or playing or played) with during with (transmit or transmitting or transmitted or send or sending or sent) near4 (second or different or next or previous)	US-PGPUB; USPAT	OR	ON	2015/06/11 11:10
S205	58	S197 and (playback or play or playing or played) with during with (transmit or transmitting or transmitted or send or sending or sent) near4 (second or different or next or previous) near3 (content or file or song or video or information or	US-PGPUB; USPAT	OR	ON	2015/06/11 11:15

		signal or data)				
S206	57	S197 and (playback or play or playing or played) with during with (transmit or transmitting or transmitted or send or sending or sent) near4 (second or different or next or previous) near3 (content or file or song or video or information or signal or data) not millington.in.	US-PGPUB; USPAT	OR	ON	2015/06/11 11:15
S207	600	S197 and (output$3) with during with (transmit or transmitting or transmitted or send or sending or sent) near4 (second or different or next or previous) near3 (content or file or song or video or information or signal or data) not millington.in.	US-PGPUB; USPAT	OR	ON	2015/06/11 11:23
S208	623	S197 and (output$4) with during with (transmit or transmitting or transmitted or send or sending or sent) near4 (second or different or next or previous) near3 (content or file or song or video or information or signal or data) not millington.in.	US-PGPUB; USPAT	OR	ON	2015/06/11 11:23
S209	241	S197 and (output$4) near5 during with (transmit or transmitting or transmitted or send or sending or sent) near4 (second or different or next or previous) near3 (content or file or song or video or information or signal or data) not millington.in.	US-PGPUB; USPAT	OR	ON	2015/06/11 11:24
S210	51	S197 and (output$4) near5 during with (transmit or transmitting or transmitted or send or sending or sent) near4 (different or next or previous) near3 (content or file or song or video or information or signal or data) not millington.in.	US-PGPUB; USPAT	OR	ON	2015/06/11 11:25
S211	17	S197 and during adj3 (output$4) with (transmit or transmitting or transmitted or send or sending or sent) near4 (different or next or previous) near3 (content or file or song or video or information or signal or data) not millington.in.	US-PGPUB; USPAT	OR	ON	2015/06/11 11:27
S212	3	S197 and during adj3 (display$3) with (transmit or transmitting or transmitted or send or sending or sent) near4 (different or next or previous) near3 (content or file or song or video or information or signal or data) not millington.in.	US-PGPUB; USPAT	OR	ON	2015/06/11 11:28
S213	20	S197 and during adj3 (display$3 or playback or play adj back) with (transmit or transmitting or transmitted or send or sending or sent or broadcast$3 or multicast$3) near4 (different or next or previous or second) adj3 (content or file or song or video or information or signal or data) not millington.in.	US-PGPUB; USPAT	OR	ON	2015/06/11 11:30
S214	339	S197 and (display$3 or playback or	US-PGPUB;	OR	ON	2015/06/11

		play adj back) near2 (current or first) near3 (content or file or song or video or information or signal or data) with (transmit or transmitting or transmitted or send or sending or sent or broadcast$3 or multicast$3) near4 (different or next or previous or second) adj3 (content or file or song or video or information or signal or data) not millington.in.	USPAT			11:33
S215	1	S197 and (while or during) adj3 (displaying or playback or play adj back or playing adj back or outputting) near2 (current or first) near3 (content or file or song or video or information or signal or data) with (transmit or transmitting or transmitted or send or sending or sent or broadcast$3 or multicast$3) near4 (different or next or previous or second) adj3 (content or file or song or video or information or signal or data) not millington.in.	US-PGPUB; USPAT	OR	ON	2015/06/11 11:35
S216	21	S197 and (while or during) adj3 (displaying or playback or play adj back or playing adj back or outputting) with (transmit or transmitting or transmitted or send or sending or sent or broadcast$3) near4 (different or next or previous or second) adj3 (content or file or song or video or information or signal or data) not millington.in.	US-PGPUB; USPAT	OR	ON	2015/06/11 11:37
S217	21	S197 and (while or during) adj3 (displaying or playback or play adj back or playing adj back or outputting) with (transmit or transmitting or transmitted or send or sending or sent or broadcast$3) near4 (different or next or previous or second) adj3 (content or file or song or video or information or signal or data or stream$3) not millington.in.	US-PGPUB; USPAT	OR	ON	2015/06/11 12:34
S218	76	S197 and (displaying or playback or play adj back or playing adj back or outputting) with (transmit or transmitting or transmitted or send or sending or sent or broadcast$3) near4 (different or next or previous or second) adj3 (content or file or song or video or information or signal or data or stream$3) with (concurrent$3 or simultaneous$3) not millington.in.	US-PGPUB; USPAT	OR	ON	2015/06/11 12:37
S219	1	"6970482".pn.	US-PGPUB; USPAT	OR	ON	2015/06/11 14:50
S220	5331709	@ad<"20040401" or @rlad<"20040401"	US-PGPUB; USPAT	OR	ON	2015/06/25 09:09
S221	350	S220 and (playback or playing or play adj back) with clock with time with (audio) not millington.in.	US-PGPUB; USPAT	OR	ON	2015/06/25 09:09

S222	1214	S220 and (playback or playing or play adj back) with clock with (synchronize or synchrony or sync or synch or synchronization or synchronized) not millington.in.	US-PGPUB; USPAT	OR	ON	2015/06/25 09:10
S223	381	S220 and (playback or playing or play adj back) with clock with (synchronize or synchrony or sync or synch or synchronization or synchronized) and clock near4 (transmit$4 or send or sending or sent or receiv$3) not millington.in.	US-PGPUB; USPAT	OR	ON	2015/06/25 09:12
S224	114	S220 and (playback or playing or play adj back) near3 (synchronize or synchrony or sync or synch or synchronization or synchronized) with clock and clock near4 (transmit$4 or send or sending or sent or receiv$3) not millington.in.	US-PGPUB; USPAT	OR	ON	2015/06/25 09:16
S225	18	S220 and (playback or playing or play adj back) near3 (synchronize or synchrony or sync or synch or synchronization or synchronized) with clock with (audio or sound) and clock near4 (transmit$4 or send or sending or sent or receiv$3) not millington.in.	US-PGPUB; USPAT	OR	ON	2015/06/25 09:16
S226	10	S220 and (playback or playing or play adj back) near3 (synchronize or synchrony or sync or synch or synchronization or synchronized) with clock with (audio or sound) and clock near4 (transmit$4 or send or sending or sent or receiv$3) not millington.in. and offset	US-PGPUB; USPAT	OR	ON	2015/06/25 09:18
S227	10	S220 and (playback or playing or play adj back) near3 (synchronize or synchrony or sync or synch or synchronization or synchronized) with clock with (audio or sound) and clock near4 (transmit$4 or send or sending or sent or receiv$3) not millington.in. and offset	US-PGPUB; USPAT; FPRS; EPO; JPO	OR	ON	2015/06/25 09:22
S228	55698251	@ad<"20040401" or @rlad<"20040401"	US-PGPUB; USPAT; FPRS; EPO; JPO	OR	ON	2015/06/25 09:22
S229	10	S228 and (playback or playing or play adj back) near3 (synchronize or synchrony or sync or synch or synchronization or synchronized) with clock with (audio or sound) and clock near4 (transmit$4 or send or sending or sent or receiv$3) not millington.in. and offset	US-PGPUB; USPAT; FPRS; EPO; JPO	OR	ON	2015/06/25 09:23
S230	8	S225 not S226	US-PGPUB; USPAT; FPRS; EPO; JPO	OR	ON	2015/06/25 10:04
S231	8	millington.in. and clock.clm.	USPAT	OR	ON	2015/06/25

						16:16
S236	1	"20020124097"	US-PGPUB; USPAT	OR	ON	2015/06/26 19:11
S237	1	"6598172".pn.	US-PGPUB; USPAT	OR	ON	2015/06/29 14:34
S238	7	("20030035072" | "20040248601" | "20070043847" | "20100284389" | "20100299639" | "6778493" | "6970482").PN.	US-PGPUB; USPAT	OR	ON	2015/07/12 23:31
S239	3	S238 and clock	US-PGPUB; USPAT	OR	ON	2015/07/12 23:31
S240	1	"20120191232" and synchrony adj group with form$3	US-PGPUB; USPAT	OR	ON	2015/07/16 13:48
S241	0	"20120191232" and command with form$3	US-PGPUB; USPAT	OR	ON	2015/07/16 13:49
S242	1	"20120191232" and command with group	US-PGPUB; USPAT	OR	ON	2015/07/16 13:49
S243	18	("20020114359" | "20030035072" | "20030198254" | "20030198255" | "20030200001" | "20040248601" | "20060098936" | "20070043847" | "20100284389" | "20100299639" | "5726989" | "5923869" | "6108485" | "6343028" | "6687664" | "6778493" | "6970482" | "7130368").PN.	US-PGPUB; USPAT	OR	ON	2015/07/24 14:25
S244	14	S243 and clock	US-PGPUB; USPAT	OR	ON	2015/07/24 14:25
S245	18	millington-nicholas$.in. and volume.clm.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2015/07/29 13:56
S246	4	millington-nicholas$.in. and volume.clm.	USPAT	OR	ON	2015/07/29 14:59
S247	0	"20130232355"	USPAT	OR	ON	2015/07/29 15:24
S248	1	"20130232355"	US-PGPUB; USPAT	OR	ON	2015/07/29 15:24
S249	1	"20040131192"	US-PGPUB; USPAT	OR	ON	2015/07/29 19:13
S250	55735275	@ad<"20040401" or @rlad<"20040401"	US-PGPUB; USPAT; FPRS; EPO; JPO	OR	ON	2015/07/29 19:14
S251	2152	S250 and volume near2 (control$4 or adjust$3) with (zone or player)	US-PGPUB; USPAT; FPRS; EPO; JPO	OR	ON	2015/07/29 19:28
S252	28	S250 and volume near2 (control$4 or adjust$3) with (zone or player) with (master or slave)	US-PGPUB; USPAT; FPRS; EPO; JPO	OR	ON	2015/07/29 19:29
S253	27	S250 and volume near2 (control$4 or adjust$3) with (zone or player) with	US-PGPUB; USPAT;	OR	ON	2015/07/29 19:29

		(master or slave) not millington-nicholas$.in.	FPRS; EPO; JPO			
S254	2	S250 and volume near2 (control$4 or adjust$3 or set$4) with (zone or player) with (propagat$3) not millington-nicholas$.in.	US-PGPUB; USPAT; FPRS; EPO; JPO	OR	ON	2015/07/29 19:33
S255	62	S250 and volume near2 (control$4 or adjust$3 or set$4) with (player) with (second or other or additional or another or slave) not millington-nicholas$.in.	US-PGPUB; USPAT; FPRS; EPO; JPO	OR	ON	2015/07/29 19:35
S256	1	S250 and volume near2 (control$4 or adjust$3 or set$4) with (player) same (master and slave) not millington-nicholas$.in.	US-PGPUB; USPAT; FPRS; EPO; JPO	OR	ON	2015/07/29 19:47
S257	96	S250 and volume near2 (control$4 or adjust$3 or set$4) with (player) with (second or plurality) not millington-nicholas$.in.	US-PGPUB; USPAT; FPRS; EPO; JPO	OR	ON	2015/07/29 19:52
S258	1	S250 and volume near2 (control$4 or adjust$3 or set$4) with (player) with (second or plurality) same slave not millington-nicholas$.in.	US-PGPUB; USPAT; FPRS; EPO; JPO	OR	ON	2015/07/29 19:54
S259	1	S250 and volume near2 (control$4 or adjust$3 or set$4) with (player) with slave not millington-nicholas$.in.	US-PGPUB; USPAT; FPRS; EPO; JPO	OR	ON	2015/07/29 19:56
S260	1224	S250 and volume near2 (control$4 or adjust$3 or set$4) with (player)	US-PGPUB; USPAT; FPRS; EPO; JPO	OR	ON	2015/07/29 19:56
S261	6	S250 and volume near2 (control$4 or adjust$3 or set$4) with (player) near2 plurality	US-PGPUB; USPAT; FPRS; EPO; JPO	OR	ON	2015/07/29 19:56
S262	32	S250 and volume near2 (control$4 or adjust$3 or set$4) with (player) near2 (group or zone)	US-PGPUB; USPAT; FPRS; EPO; JPO	OR	ON	2015/07/29 19:58
S263	3816	S250 and volume near2 (control$4 or adjust$3 or set$4) with (group or zone)	US-PGPUB; USPAT; FPRS; EPO; JPO	OR	ON	2015/07/29 20:01
S264	3784	S250 and volume near2 (control$4 or adjust$3 or set$4) with (group or zone) not S262	US-PGPUB; USPAT; FPRS; EPO; JPO	OR	ON	2015/07/29 20:01
S265	0	S250 and volume near2 (control$4 or adjust$3 or set$4) with (group or zone) with (master and slave) not S262	US-PGPUB; USPAT; FPRS; EPO; JPO	OR	ON	2015/07/29 20:02
S266	6	S250 and volume near2 (control$4 or adjust$3 or set$4) with (group or zone) same (master and slave) not S262	US-PGPUB; USPAT; FPRS; EPO; JPO	OR	ON	2015/07/29 20:10
S267	63	S250 and volume near2 (control$4 or adjust$3 or set$4) with (group or zone) not S262 and (music or media) near2 player	US-PGPUB; USPAT; FPRS; EPO; JPO	OR	ON	2015/07/29 20:16

S268	197	S250 and volume near2 (control$4 or adjust$3 or set$4) with (multiple or plurality or second) not S262 and (music or media) near2 player	US-PGPUB; USPAT; FPRS; EPO; JPO	OR	ON	2015/07/29 20:19
S269	4	"20030023741"	US-PGPUB; USPAT; FPRS; EPO; JPO	OR	ON	2015/07/29 20:22
S270	15	profile and survillo.xa.	US-PGPUB; USPAT; FPRS; EPO; JPO	OR	ON	2015/07/29 20:27
S271	7	S250 and volume near2 (control$4 or adjust$3 or set$4) with (group) with (music or media or multimedia) near2 (player or device)	US-PGPUB; USPAT; FPRS; EPO; JPO	OR	ON	2015/07/29 20:29
S272	52	S250 and volume near2 (control$4 or adjust$3 or set$4) with (group or set) with (music or media or multimedia) near2 (player or device)	US-PGPUB; USPAT; FPRS; EPO; JPO	OR	ON	2015/07/29 20:30
S273	52	S250 and volume near2 (control$4 or adjust$3 or set$4) with (group or set or zone) with (music or media or multimedia) near2 (player or device)	US-PGPUB; USPAT; FPRS; EPO; JPO	OR	ON	2015/07/29 20:30
S274	2276	S250 and volume near2 (control$4 or adjust$3) with (transmit$4)	US-PGPUB; USPAT; FPRS; EPO; JPO	OR	ON	2015/07/29 20:39
S275	382	S250 and volume near2 (control$4 or adjust$3) with (music or media or multimedia or zone) near2 (player or device)	US-PGPUB; USPAT; FPRS; EPO; JPO	OR	ON	2015/07/29 20:40
S276	11	S250 and volume near2 (control$4 or adjust$3) with (music or media or multimedia or zone) near2 (player or device) with (command or instruction)	US-PGPUB; USPAT; FPRS; EPO; JPO	OR	ON	2015/07/29 20:41
S277	49	S250 and volume near2 (control$4 or adjust$3) with (music or media or multimedia or zone) near2 (player or device) with (remote or remotely)	US-PGPUB; USPAT; FPRS; EPO; JPO	OR	ON	2015/07/29 20:55
S278	6	"20050021530"	US-PGPUB; USPAT; FPRS; EPO; JPO	OR	ON	2015/07/30 11:29
S279	1	"20020178259"	US-PGPUB; USPAT; FPRS; EPO; JPO	OR	ON	2015/07/30 11:42

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S232	2	((playback or playing or play adj back) near3 (synchronize or synchrony or sync or synch or synchronization or synchronized) with clock	US-PGPUB; UPAD	OR	ON	2015/06/26 12:28

		with (audio or sound) and clock near4 (transmit$4 or send or sending or sent or receiv$3)).clm.				
S233	7	((playback or playing or play adj back) near3 (synchronize or synchrony or sync or synch or synchronization or synchronized) with clock with (audio or sound)).clm.	US-PGPUB; UPAD	OR	ON	2015/06/26 12:55
S234	5	S233 not S232	US-PGPUB; UPAD	OR	ON	2015/06/26 12:55
S235	17	((playback or playing or play adj back) near3 (synchronize or synchrony or sync or synch or synchronization or synchronized) with timing with (audio or sound)).clm.	US-PGPUB; UPAD	OR	ON	2015/06/26 12:57

7/31/2015 12:05:30 PM
C:\Users\osurvillo\Documents\EAST\Workspaces\14186850.wsp

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	14516867	MILLINGTON, NICHOLAS A.J.
	Examiner	Art Unit
	OLEG SURVILLO	2442

CPC- SEARCHED		
Symbol	Date	Examiner
G06F 3/167, 17/00, 17/3074, 3/048, 3/0482, 3/0484, 3/126, 3/16	7/31/2015	OS
H04L 65/60, 12/2812	7/31/2015	OS

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner
709	219, 220, 231	7/31/2015	OS

SEARCH NOTES		
Search Notes	Date	Examiner
Updated Inventor search	7/31/2015	OS
Updated Assignee search	7/31/2015	OS
Updated EAST search in USPAT, US-PGPUB, EPO, JPO, and FPRS databases	7/31/2015	OS
Updated NPL search using Google search engine	7/31/2015	OS

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner
	Text search in US-PGPUB and UPAD databases - See interference search history printout	7/31/2015	OS

	/OLEG SURVILLO/ Primary Examiner.Art Unit 2442

PTO/SB/08a (01-10)
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT
(Not for submission under 37 CFR 1.99)

Application Number	14516867
Filing Date	10-17-2014
First Named Inventor	MILLINGTON; Nicholas A.J.
Art Unit	2442
Examiner Name	SURVILLO, OLEG
Attorney Docket Number	04-0401-CON1014D

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	6108485		2000-08-22	KIM; Jeong-Kyu	
	2	6343028		2002-01-29	KUWAOKA; Toshiharu	
	3	6778493		2004-08-17	ISHII; Atsushi	
	4	6970482		2005-11-29	KIM; Sung-Tae	
	5	7130368		2006-10-31	AWEYA; James et al.	

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Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20020114359		2002-08-22	IBARAKI; Susumu et al.	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	14516867
	Filing Date	10-17-2014
	First Named Inventor	MILLINGTON; Nicholas A.J.
	Art Unit	2442
	Examiner Name	SURVILLO, OLEG
	Attorney Docket Number	04-0401-CON1014D

	2	20030035072		2003-02-20	HAGG; Wilhelm	
	3	20030198254		2003-10-23	SULLIVAN; Gary E. et al.	
	4	20030198255		2003-10-23	SULLIVAN; Gary E. et al.	
	5	20040248601		2004-12-09	CHANG; Chin-Chi	
	6	20070043847		2007-02-22	CARTER; Harry N. et al.	
	7	20100284389		2010-11-11	RAMSAY; Max et al.	
	8	20100299639		2010-11-25	RAMSAY; Max Gordon et al.	

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**		
	Application Number	14516867
	Filing Date	10-17-2014
	First Named Inventor	MILLINGTON; Nicholas A.J.
	Art Unit	2442
	Examiner Name	SURVILLO, OLEG
	Attorney Docket Number	04-0401-CON1014D

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T5
	1	"Baldwin, Roberto. "How-To: Setup iTunes DJ on Your Max and iPhone", available at http://www.maclife.com/article/howtos/howto_setup_itunes_dj_your_mac_and_iphone, archived on 3/17/ 2009, 4 pages.".	☐
	2	"Final Office Action mailed on 15 June 2015, issued in connection with U.S. Patent Application No. 14/184522, filed on 19 February 2014, 25 pages".	☐
	3	"Non-Final Office Action mailed on 12 June 2015, issued in connection with U.S. Patent Application No. 13/848932, filed on 22 March 2013, 16 pages".	☐
	4	"Non-Final Office Action mailed on 19 June 2015, issued in connection with U.S. Patent Application No. 13/533105 filed on 26 June 2012, 38 pages.".	☐
	5	"Non-Final Office Action mailed on 23 June 2015, issued in connection with U.S. Patent Application No. 13/705176, filed on 5 December 2012, 30 pages".	☐
	6	"Non-Final Office Action mailed on 3 June 2015, issued in connection with U.S. Patent Application No. 14/564544, filed on 9 December 2014, 7 pages.".	☐
	7	"Non-Final Office Action mailed on 4 June 2015, issued in connection with U.S. Patent Application No. 13/871795 filed on 26 April 2013, 16 pages.".	☐
	8	"Notice of Allowance mailed on 2 July 2015, issued in connection with U.S. Patent Application No. 13/848904, filed on 22 March 2013, 17 pages".	☐
	9	"Notice of Allowance mailed on 2 July 2015, issued in connection with U.S. Patent Application No. 13/888203, filed on 6 May 2013, 19 pages".	☐
	10	"Notice of Allowance mailed on 2 July 2015, issued in connection with U.S. Patent Application No. 14/184935, filed on 20 February 2014, 23 pages".	☐

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	14516867
	Filing Date	10-17-2014
	First Named Inventor	MILLINGTON; Nicholas A.J.
	Art Unit	2442
	Examiner Name	SURVILLO, OLEG
	Attorney Docket Number	04-0401-CON1014D

	11	"Notice of Allowance mailed on 6 July 2015, issued in connection with U.S. Patent Application No. 13/297000, filed on 15 November 2011, 24 pages.".	☐

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EXAMINER SIGNATURE

Examiner Signature		Date Considered	

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

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	14516867
	Filing Date	10-17-2014
	First Named Inventor	MILLINGTON; Nicholas A.J.
	Art Unit	2442
	Examiner Name	SURVILLO, OLEG
	Attorney Docket Number	04-0401-CON1014D

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☐ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Benjamin M. Urban/	Date (YYYY-MM-DD)	2015-07-13
Name/Print	Benjamin M. Urban	Registration Number	71,591

This collection of information is required by 37 CFR 1.97 and 1.98. 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 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Electronic Acknowledgement Receipt	
EFS ID:	22899771
Application Number:	14516867
International Application Number:	
Confirmation Number:	9318
Title of Invention:	Obtaining Content from Remote Source for Playback
First Named Inventor/Applicant Name:	Nicholas A.J. Millington
Customer Number:	107361
Filer:	Benjamin Michael Urban
Filer Authorized By:	
Attorney Docket Number:	04-0401-CON1014D
Receipt Date:	13-JUL-2015
Filing Date:	17-OCT-2014
Time Stamp:	19:00:16
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Form (SB08)	04-0401-CON1014D_MBHB14-1800-CON2_IDS.pdf	707731 28381fcd69d2dc43b703cfc1cc5c121d563997f8	no	6
Warnings:					
Information:					

2	Non Patent Literature	Baldwin_2009_Reference.pdf	903362 8422d4841e69a7c92fd17aabe0be48a687b08db3	no	4
Warnings:					
Information:					
3	Non Patent Literature	14184522_Final_OA_6-15-15.pdf	1039401 500960021d5c52b1643c0d46ae9b5bbbdbc1c826	no	25
Warnings:					
Information:					
4	Non Patent Literature	13848932_Non-Final_OA_6-12-15.pdf	513062 96ccb5337b8cafed96c91c39264e5f0b3513cd9e	no	16
Warnings:					
Information:					
5	Non Patent Literature	13533105_Non-Final_OA_6-19-15.pdf	1289356 8300207d63e690baa8e42f54863f97e4466e1d30	no	38
Warnings:					
Information:					
6	Non Patent Literature	13705176_Non-Final_OA_6-23-15.pdf	1076722 bd20eb51ad8026f7b519b42758da06c87ba8ed3f	no	30
Warnings:					
Information:					
7	Non Patent Literature	14564544_Non-Final_OA_6-3-15.pdf	275013 02d3b0eb2d284579abf30b84dd36b9ef841cf439	no	7
Warnings:					
Information:					
8	Non Patent Literature	13871795_Non-Final_OA_6-4-15.pdf	513966 d0e52ff11adeef9811795be56fba251f3b0d49d9	no	16
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Information:					
9	Non Patent Literature	13848904_NOA_7-2-15.pdf	715510 671c946de78fe21f82cd17aca6daeffae723af7c	no	17
Warnings:					
Information:					
10	Non Patent Literature	13888203_NOA_7-2-15.pdf	788278 720041564c35623e97d0aa0250e19c5706d9580c	no	19
Warnings:					
Information:					

11	Non Patent Literature	14184935_NOA_7-2-15.pdf	903361 d3e7e726fc1250edd4c48065dc353fc04a6dc292	no	23
Warnings:					
Information:					
12	Non Patent Literature	13297000_NOA_7-6-15.pdf	913287 ae1344298983a152e8108d05ce6a8da86526ce30	no	24
Warnings:					
Information:					
			Total Files Size (in bytes):	9639049	

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National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

Doc code: RCEX
Doc description: Request for Continued Examination (RCE)

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REQUEST FOR CONTINUED EXAMINATION(RCE)TRANSMITTAL
(Submitted Only via EFS-Web)

Application Number	14516867	Filing Date	2014-10-17	Docket Number (if applicable)	04-0401-CON1014D (14-1800	Art Unit	2442
First Named Inventor	Millington			Examiner Name	Survillo		

This is a Request for Continued Examination (RCE) under 37 CFR 1.114 of the above-identified application.
Request for Continued Examination (RCE) practice under 37 CFR 1.114 does not apply to any utility or plant application filed prior to June 8, 1995, to any international application that does not comply with the requirements of 35 U.S.C. 371, or to any design application. The Instruction Sheet for this form is located at WWW.USPTO.GOV.

SUBMISSION REQUIRED UNDER 37 CFR 1.114

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☐ Previously submitted. If a final Office action is outstanding, any amendments filed after the final Office action may be considered as a submission even if this box is not checked.

- ☐ Consider the arguments in the Appeal Brief or Reply Brief previously filed on _____
- ☐ Other _____

☒ Enclosed

- ☒ Amendment/Reply
- ☐ Information Disclosure Statement (IDS)
- ☐ Affidavit(s)/ Declaration(s)
- ☒ Other Petition for Extension of Time

MISCELLANEOUS

☐ Suspension of action on the above-identified application is requested under 37 CFR 1.103(c) for a period of months _____ (Period of suspension shall not exceed 3 months; Fee under 37 CFR 1.17(i) required)

☐ Other _____

FEES

☒ **The RCE fee under 37 CFR 1.17(e) is required by 37 CFR 1.114 when the RCE is filed.**
The Director is hereby authorized to charge any underpayment of fees, or credit any overpayments, to Deposit Account No 132490

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED

☒ Patent Practitioner Signature
☐ Applicant Signature

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Signature of Registered U.S. Patent Practitioner			
Signature	/Jeffrey P. Armstrong/	Date (YYYY-MM-DD)	2015-07-07
Name	Jeffrey P. Armstrong	Registration Number	54967

This collection of information is required by 37 CFR 1.114. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 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, VA 22313-1450.

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
(Case No.: 04-0401-CON1014D)
(MBHB Docket No. 14-1800-CON2)

In the Application of:	)	
	)	
Millington	)	Art Unit: 2442
	)	
Serial No.: 14/516,867	)	Examiner: Survillo
	)	
Filed: October 17, 2014	)	Confirmation No. 9318
	)	
For: Obtaining Content from Remote Source For Playback	)	
	)	

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

RESPONSE TO THE FINAL OFFICE ACTION MAILED MARCH 9, 2015 AND THE ADVISORY ACTION MAILED JUNE 1, 2015

Please consider the following **AMENDMENTS** and **REMARKS** in response to the Final Office Action mailed on March 9, 2015 (the "Final Office Action") and the Advisory Action mailed on June 1, 2015 (the "Advisory Action") in the above-captioned application.

AMENDMENTS TO THE CLAIMS begin on page 2.

REMARKS begin on page 9.

The Office is hereby authorized to charge any underpayment of fees or credit any overpayment of fees in connection with the prosecution of the above-captioned application to Deposit Account 13-2490.

AMENDMENTS TO THE CLAIMS

1-20. (Canceled)

21. (Currently Amended) A first playback device comprising:

one or more processors;

a network interface; and

tangible, non-transitory computer-readable memory comprising program instructions that, when executed by [[a]] the one or more processors, cause the playback device to:

receive, via the network interface from a network device configured to control the first playback device and communicatively coupled to the first playback device over a local area network (LAN), control information comprising ~~(i) one or more instructions that cause the first playback device and a second playback device to playback audio information and (ii)~~ an address identifying a network location of the audio information available at an audio information source, wherein the audio information source is outside of the LAN; and

~~in response to~~ after receiving the control information, (i) obtain, via the network interface from the audio information source outside of the LAN, the audio information; (ii) transmit, via the network interface of the first playback device to the second playback device, the audio information, playback timing information associated with the audio information, and device clock information of the first playback device; and (iii) play back the audio information in synchrony with the second playback device by using the playback timing information associated with the audio information and the clock information of the first playback device to play back the audio information, wherein the

first and second playback devices remain independently clocked during synchronous playback of the audio information.

22. (Currently Amended) The first playback device of claim 21, wherein the program instructions, when executed by the one or more processors, further cause the first playback device to:

generate the playback timing information ~~based on~~ associated with the audio information; and

generate the device clock time information of the first playback device.

~~transmit, to the second playback device, the timing information, and~~

~~wherein causing the first playback device to play back the audio information comprises causing the first playback device to play back the audio information according to the timing information.~~

23. (Currently Amended) The first playback device of claim 21, wherein the control information further comprises one or more instructions for the first playback device and a second playback device to playback audio information. ~~the program instructions, when executed by the processor, further cause the first playback device to:~~

~~before transmitting the audio information to the second playback device, receive, from the network device, an instruction to join a synchrony group that includes the second playback device~~.

24. (Currently Amended) The first playback device of claim 23, wherein the program instructions, when executed by the one or more processors, further cause the first playback device to:

transmit, to the network device, status information that comprises a status of the synchrony group.

25. (Previously Presented) The first playback device of claim 24, wherein the status information further comprises an identification of each playback device in the synchrony group.

26. (Previously Presented) The first playback device of claim 24, wherein the status information further comprises an identification of a master playback device of the synchrony group.

27. (Previously Presented) The first playback device of claim 26, wherein the first playback device is the master playback device of the synchrony group.

28. (Currently Amended) The first playback device of claim 24, wherein the status information further comprises an identification of one or more slave playback devices in the synchrony group, and wherein the second playback device is one of the one or more slave playback devices in the synchrony group.

29. (Currently Amended) The first playback device of claim 28, wherein ~~the second playback device is one of the one or more slave playback devices in the synchrony group~~ the instructions, when executed by the one or more processors, further cause the playback device to:

generate a plurality of frames, wherein an individual frame comprises at least a portion of the audio information and the playback timing information associated with the audio information, and wherein the first playback device transmitting to the second playback device the audio information, playback timing information, and device clock information of the first playback device comprises transmitting the plurality of frames to the second playback device.

30. (Previously Presented) The playback device of claim 21, wherein the audio information comprises one of audio files or packetized streaming audio information.

31. (Previously Presented) The playback device of claim 21, wherein obtaining, from the audio information source outside of the LAN, the audio information, comprises obtaining, from the audio information source via the Internet, the audio information.

32. (Previously Presented) The playback device of claim 21, wherein obtaining, from the audio information source outside of the LAN, the audio information, comprises sending, to the audio information source, a request for the audio information.

33. (Currently Amended) A method comprising:

receiving, by a first playback device from a network device configured to control the first playback device and communicatively coupled to the first playback device over a local area network (LAN), control information comprising ~~(i) one or more instructions that cause the first playback device and a second playback device to playback audio information and (ii)~~ an address identifying a location of the audio information available at an audio information source, wherein the audio information source is outside of the LAN; and

~~in response to~~ after receiving the control information (i) obtaining, by the first playback device from the audio information source outside of the LAN, the audio information; (ii) transmitting, by the first playback device to the second playback device, the audio information, playback timing information associated with the audio information, and device clock time information of the first playback device; and (iii) playing back, by the first playback device, the audio information in synchrony with the second playback device by using the timing information associated with the audio information and the device clock time information of the first playback device to play back the audio information, wherein the first and second playback devices remain independently clocked during synchronous playback of the audio information.

34. (Currently Amended) The method of claim 33, further comprising:

~~in response to~~ after receiving the control information, additionally (i) generating, by the first playback device, the playback timing information ~~based on~~ associated with the audio information; and (ii) ~~transmitting, by the first playback device to the second playback device, the timing information, and wherein playing back the audio information comprises playing back the audio information according to the timing information~~ generating, by the first playback device, the clock time information of the first playback device.

35. (Currently Amended) The method of claim 33, wherein the control information further comprises one or more instructions for the first playback device and a second playback device to playback audio information.

~~further comprising:~~

~~before transmitting the audio information to the second playback device, receiving, by the first playback device from the network device, an instruction to join a synchrony group that includes the second playback device.~~

36. (Previously Presented) The method of claim 35, further comprising:

transmitting, by the first playback device to the network device, status information that comprises a status of the synchrony group.

37. (Previously Presented) The method of claim 35, wherein the status information further comprises an identification of each playback device in the synchrony group.

38. (Previously Presented) The method of claim 37, wherein the status information further comprises an identification of a master playback device of the synchrony group.

39. (Previously Presented) The method of claim 38, wherein the first playback device is the master playback device of the synchrony group.

40. (Currently Amended) A tangible non-transitory computer-readable medium having instructions stored thereon that, when executed, cause a first playback device to:

receive, from a network device configured to control the first playback device and communicatively coupled to the first playback device over a local area network (LAN), control information comprising ~~(i) one or more instructions that cause the first playback device and a second playback device to playback audio information and (ii)~~ an address identifying a location of audio information available at an audio information source, wherein the audio information source is outside of the LAN; and

~~in response to~~ after receiving the control information, (i) obtain, from the audio information source outside of the LAN, the audio information; (ii) transmit, to the second playback device, the audio information, playback timing information associated with the audio information, and clock time information for the first playback device; and (iii) play back the audio information in synchrony with the second playback device by using the playback timing information associated with the audio information and the clock information of the first playback device to play back the audio information, wherein the first and second playback devices remain independently clocked during synchronous playback of the audio information.

REMARKS

I. Status of the Claims

Claims 21-40 are pending. Claims 21, 33 and 40 are independent. In the present Response, and without conceding the merits of the rejections and in an earnest attempt to advance prosecution, Applicant has amended claims 21-24, 28-29, 33-35, and 40 to further clarify the claim language. The subject matter of the amendments can be found generally throughout Applicant's originally-filed specification, including but not limited to ¶¶ 7-8, 28-38, 181, and 198 of Applicant's Patent Application Publication 2015/0039109. No new matter has been added.

The present amendments are made to expedite prosecution of this application to allowance. However, Applicant does not acquiesce in the Examiner's rejection of the originally-filed or previously-pending claims. Applicant reserves the right to pursue the subject matter of the originally-filed or previously-pending claims in one or more continuation applications.

II. Summary of the Final Office Action Mailed March 9, 2015

In the Final Office Action mailed on March 9, 2015, the Examiner rejected claims 21-40 under 35 U.S.C. § 103(a) as allegedly unpatentable over U.S. Pub. 2003/0073432 ("Meade") in view of U.S. Pub. 2007/0142944 ("Goldberg").

III. Summary of the Advisory Action mailed June 1, 2015

In the Advisory Action mailed on June 1, 2015, the Examiner (i) did not enter the amendments submitted in the Response filed on May 11, 2015 and (ii) maintained the rejection of the claims.

IV. Summary of the Examiner Interview on May 27, 2015

A telephonic Examiner Interview took place on May 27, 2015. Participants included Examiner Oleg Survillo and Applicant's Representatives, Chris Butts and Jeff Armstrong. No demonstrations were conducted and no exhibits were shown. During the call, the participants discussed (i) claims 21 and 29, (ii) the § 103 rejections, (iii) the Meade, Goldberg, and U.S. Pub. No. 2002/0114354 ("Sinha") references, and (iv) proposed claim amendments. Examiner Survillo suggested linking the "device clock information" to the playback of the audio information by the playback device. No agreement was reached on allowance of the claims.

V. Response to the § 103 Rejections

Applicant submits that Goldberg, Meade, and Sinha (the "cited references"), individually or in combination, fail to teach or suggest at least "play[ing] back the audio information in synchrony with the second playback device by using the playback timing information associated with the audio information and the clock information of the first playback device to play back the audio information, wherein the first and second playback devices remain independently clocked during synchronous playback of the audio information" in combination with the other elements recited in independent claims 21, 33, and 40.

Applicant has amended independent claims 21, 33, and 40 to recite "play[ing] back the audio information in synchrony with the second playback device by using the playback timing information associated with the audio information and the clock information of the first playback device to play back the audio information," based on the Examiner Interview of May 27, 2015. Applicant has also amended independent claims 21, 33, and 40 to recite "wherein the first and

second playback devices remain independently clocked during synchronous playback of the audio information" as yet a further distinction over the cited references.

Because the cited references fail to teach or suggest each of the elements recited in independent claims 21, 33, and 40, Applicant submits that independent claims 21, 33, and 40 are patentable over the cited references. Applicant further submits that the pending dependent claims are patentable over the cited references for at least the reason that they depend from patentable independent claims.

VI. Conclusion

Applicant submits that the application is in condition for allowance, and Applicant respectfully requests a Notice of Allowance. If further discussion would advance the application to issuance, the Examiner is invited to telephone the undersigned at 312-913-0001.

Respectfully submitted,
McDonnell Boehnen Hulbert & Berghoff LLP

Date: June 7, 2015

By: /Jeffrey P. Armstrong/
Jeffrey P. Armstrong
Reg. No. 54,967

PTO/AIA/22 (03-13)
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PETITION FOR EXTENSION OF TIME UNDER 37 CFR 1.136(a)

Docket Number (Optional): 04-0401-CON1014D (14-1800-CON2)

Application Number: 14/516,867

Filed: October 17, 2014

For: Obtaining Content from Remote Source For Playback

Art Unit: 2442

Examiner: Survillo

This is a request under the provisions of 37 CFR 1.136(a) to extend the period for filing a reply in the above-identified application.

The requested extension and fee are as follows (check time period desired and enter the appropriate fee below):

		Fee	Small Entity Fee	Micro Entity Fee	
☑	One month (37 CFR 1.17(a)(1))	$200	$100	$50	$ 200.00
☐	Two months (37 CFR 1.17(a)(2))	$600	$300	$150	$
☐	Three months (37 CFR 1.17(a)(3))	$1,400	$700	$350	$
☐	Four months (37 CFR 1.17(a)(4))	$2,200	$1,100	$550	$
☐	Five months (37 CFR 1.17(a)(5))	$3,000	$1,500	$750	$

☐ Applicant asserts small entity status. See 37 CFR 1.27.

☐ Applicant certifies micro entity status. See 37 CFR 1.29.
Form PTO/SB/15A or B or equivalent must either be enclosed or have been submitted previously.

☐ A check in the amount of the fee is enclosed.

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

☑ The Director has already been authorized to charge fees in this application to a Deposit Account.

☑ The Director is hereby authorized to charge any fees which may be required, or credit any overpayment, to Deposit Account Number 13-2490.

☑ Payment made via EFS-Web.

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.

I am the

☐ applicant.

☑ attorney or agent of record. Registration number 54,967.

☐ attorney or agent acting under 37 CFR 1.34. Registration number _____.

/Jeffrey P. Armstrong/ — Signature

July 7, 2015 — Date

Jeffrey P. Armstrong — Typed or printed name

312-913-0001 — Telephone Number

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

☑ * Total of 1 forms are submitted.

This collection of information is required by 37 CFR 1.136(a). The information is required to obtain or retain a benefit by the public, which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 6 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Mail Stop PCT, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

Electronic Patent Application Fee Transmittal

Application Number:	14516867
Filing Date:	17-Oct-2014
Title of Invention:	Obtaining Content from Remote Source for Playback
First Named Inventor/Applicant Name:	Nicholas A.J. Millington
Filer:	Jeffrey Armstrong
Attorney Docket Number:	04-0401-CON1014D

Filed as Large Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension - 1 month with $0 paid	1251	1	200	200
Miscellaneous:				
Request for Continued Examination	1801	1	1200	1200
		Total in USD ($)		**1400**

Electronic Acknowledgement Receipt	
EFS ID:	22839362
Application Number:	14516867
International Application Number:	
Confirmation Number:	9318
Title of Invention:	Obtaining Content from Remote Source for Playback
First Named Inventor/Applicant Name:	Nicholas A.J. Millington
Customer Number:	107361
Filer:	Jeffrey Armstrong
Filer Authorized By:	
Attorney Docket Number:	04-0401-CON1014D
Receipt Date:	07-JUL-2015
Filing Date:	17-OCT-2014
Time Stamp:	10:21:59
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$1400
RAM confirmation Number	9365
Deposit Account	132490
Authorized User	ARMSTRONG, JEFFREY P.
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Request for Continued Examination (RCE)	14_1800_CON2_RCE.pdf	85314 b3c5bb00347457ff64753f6a0b1d4d0a29c0e35b	no	2
Warnings:					
This is not a USPTO supplied RCE SB30 form.					
Information:					
2		14_1800_CON2_Response.pdf	105675 d39105cf725857e7b506ebe3092c1c524efcbeac	yes	11
	Multipart Description/PDF files in .zip description				
	Document Description		**Start**	**End**	
	Amendment Submitted/Entered with Filing of CPA/RCE		1	1	
	Claims		2	8	
	Applicant Arguments/Remarks Made in an Amendment		9	11	
Warnings:					
Information:					
3	Extension of Time	14_1800_CON2_EOT.pdf	103924 d570d1e16dec2dd0b5a6da936030c0aafea99725	no	1
Warnings:					
Information:					
4	Fee Worksheet (SB06)	fee-info.pdf	32178 3ff079f2f48546ceccef88d778b8afc27bd72bdf	no	2
Warnings:					
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National Stage of an International Application under 35 U.S.C. 371

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New International Application Filed with the USPTO as a Receiving Office

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PTO/SB/06 (09-11)
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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 14/516,867	Filing Date 10/17/2014	☐ To be Mailed

ENTITY: ☒ LARGE ☐ SMALL ☐ MICRO

APPLICATION AS FILED – PART I

	(Column 1)	(Column 2)		
FOR	NUMBER FILED	NUMBER EXTRA	RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).			
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL	

APPLICATION AS AMENDED – PART II

AMENDMENT	07/07/2015	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 20	Minus	** 20	= 0	X $80 =	0
	Independent (37 CFR 1.16(h))	* 3	Minus	***3	= 0	X $420 =	0
	☐ Application Size Fee (37 CFR 1.16(s))						
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
						TOTAL ADD'L FEE	0

AMENDMENT		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =	
	☐ Application Size Fee (37 CFR 1.16(s))						
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
						TOTAL ADD'L 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.

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/DONNA 1. SMALLS LOGAN/

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT
(Not for submission under 37 CFR 1.99)

Application Number	14516867
Filing Date	10-17-2014
First Named Inventor	MILLINGTON; Nicholas A.J.
Art Unit	2442
Examiner Name	SURVILLO, OLEG
Attorney Docket Number	04-0401-CON1014D

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	5761320		1998-06-02	FARINELLI; Robert et al.	
	2	6535121		2003-03-18	MATHNEY; Richard K. et al.	
	3	6816818		2004-11-09	WOLF; Michael Jaochim et al.	

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Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20020080783		2002-06-27	FUJIMORI; Junichi	
	2	20020114354		2002-08-22	SINHA; Pranesh et al.	
	3	20030018797		2003-01-23	DUNNING; Ted E. et al.	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	14516867
	Filing Date	10-17-2014
	First Named Inventor	MILLINGTON; Nicholas A.J.
	Art Unit	2442
	Examiner Name	SURVILLO, OLEG
	Attorney Docket Number	04-0401-CON1014D

	4	20030067437		2003-04-10	MCCLINTOCK; Dale Thomas et al.	
	5	20040208158		2004-10-21	FELLMAN; Ronald D. et al.	
	6	20040228367		2004-11-18	MOSIG; Rudiger et al.	
	7	20130018960		2013-01-17	KNYSZ; Matthew S. et al.	
	8	20140181569		2014-06-26	MILLINGTON; Nicholas A.J. et al.	

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	1							☐

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NON-PATENT LITERATURE DOCUMENTS Remove

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
	1	"Advisory Action mailed on 15 April 2015, issued in connection with U.S. Patent Application No. 14/184526, filed on 19 February 2014, 9 pages".	☐

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	14516867
	Filing Date	10-17-2014
	First Named Inventor	MILLINGTON; Nicholas A.J.
	Art Unit	2442
	Examiner Name	SURVILLO, OLEG
	Attorney Docket Number	04-0401-CON1014D

	2	"Advisory Action mailed on 15 April 2015, issued in connection with U.S. Patent Application No. 14/184935, filed on 20 February 2014, 9 pages".	☐
	3	"Advisory Action mailed on 25 March 2015, issued in connection with U.S. Patent Application No. 13/533105, filed 26 June 2012, 5 pages.".	☐
	4	"European Extended Search Report for Application No. 14181454.1 mailed on 31 March 2015, 9 pages.".	☐
	5	"Final Office Action mailed on 28 April 2015, issued in connection with U.S. Patent Application No. 14/186850, filed on 21 February 2014, 20 pages".	☐
	6	"Non-Final Office Action mailed on 12 March 2015, issued in connection with U.S. Patent Application No. 13/705174, filed 5 December 2012, 13 pages.".	☐
	7	"Non-Final Office Action mailed on 13 March 2015, issued in connection with U.S. Patent Application No. 13/705177, filed 5 December 2012, 15 pages.".	☐
	8	"Non-Final Office Action mailed on 26 March 2015, issued in connection with U.S. Patent Application No. 14/184528, filed on 19 February 2014, 18 pages".	☐
	9	"Non-Final Office Action mailed on 27 March 2015, issued in connection with U.S. Patent Application No. 13/705178, filed 5 December 2012, 14 pages.".	☐
	10	"Notice of Allowance mailed on 19 May 2015, issued in connection with U.S. Patent Application No. 13/907666, filed on 31 May 2013, 7 pages".	☐
	11	"Re-Exam Non-Final Office Action mailed on 22 April 2015, issued in connection with U.S. Patent Application No. 90/013423, filed on 5 January 2015, 16 pages.".	☐
If you wish to add additional non-patent literature document citation information please click the Add button Add			

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**		
	Application Number	14516867
	Filing Date	10-17-2014
	First Named Inventor	MILLINGTON; Nicholas A.J.
	Art Unit	2442
	Examiner Name	SURVILLO, OLEG
	Attorney Docket Number	04-0401-CON1014D

EXAMINER SIGNATURE			
Examiner Signature		Date Considered	

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

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	14516867
	Filing Date	10-17-2014
	First Named Inventor	MILLINGTON; Nicholas A.J.
	Art Unit	2442
	Examiner Name	SURVILLO, OLEG
	Attorney Docket Number	04-0401-CON1014D

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☒ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☐ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Benjamin M. Urban/	Date (YYYY-MM-DD)	2015-06-01
Name/Print	Benjamin M. Urban	Registration Number	71,591

This collection of information is required by 37 CFR 1.97 and 1.98. 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 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these record s.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Electronic Patent Application Fee Transmittal				
Application Number:	14516867			
Filing Date:	17-Oct-2014			
Title of Invention:	Obtaining Content from Remote Source for Playback			
First Named Inventor/Applicant Name:	Nicholas A.J. Millington			
Filer:	Benjamin Michael Urban			
Attorney Docket Number:	04-0401-CON1014D			
Filed as Large Entity				
Filing Fees for Utility under 35 USC 111(a)				
Description	**Fee Code**	**Quantity**	**Amount**	**Sub-Total in USD($)**
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
Submission- Information Disclosure Stmt	1806	1	180	180
		Total in USD ($)		**180**

Electronic Acknowledgement Receipt	
EFS ID:	22498210
Application Number:	14516867
International Application Number:	
Confirmation Number:	9318
Title of Invention:	Obtaining Content from Remote Source for Playback
First Named Inventor/Applicant Name:	Nicholas A.J. Millington
Customer Number:	107361
Filer:	Benjamin Michael Urban
Filer Authorized By:	
Attorney Docket Number:	04-0401-CON1014D
Receipt Date:	02-JUN-2015
Filing Date:	17-OCT-2014
Time Stamp:	12:22:12
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$180
RAM confirmation Number	9218
Deposit Account	132490
Authorized User	URBAN, BENJAMIN M
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Form (SB08)	04-0401-CON1014D_MBHB14-1800-CON2_IDS.pdf	707713 d74fae155f79509848cfba94df37bc8af54f57c9	no	6
Warnings:					
Information:					
2	Non Patent Literature	14184526_Advisory_Action_4-15-15.PDF	516345 0f04480f282fda55714f524181d3c36b64569268	no	9
Warnings:					
Information:					
3	Non Patent Literature	14184935_Advisory_Action_4-15-15.PDF	525787 ee0e8a368b1e5b3aae869a8dd938e0bef9550e7a	no	9
Warnings:					
Information:					
4	Non Patent Literature	13533105_Advisory_Action_3-25-15.pdf	217946 fa6ae97a319b18e494666b5e68939544780c2342	no	5
Warnings:					
Information:					
5	Non Patent Literature	European_No_141814541_Extended_Search_Report.pdf	391494 1106f6014f64d2cca986d44d5e77d1edb5813b56	no	9
Warnings:					
Information:					
6	Non Patent Literature	14186850_Final_OA_4-28-15.PDF	709014 d9e9dbd6b72a32d09fbed664a38c47e275cf7138	no	20
Warnings:					
Information:					
7	Non Patent Literature	13705174_NonFinal_OA_3-12-15.pdf	394770 e25d12e185b0e2a65d986160fdd7defc824d24aa	no	13
Warnings:					
Information:					

8	Non Patent Literature	13705177_Non-Final_OA_3-13-15.pdf	467010 fc8c0044897ca2dffa39ea3809826e7f1ee6e51e	no	15
Warnings:					
Information:					
9	Non Patent Literature	14184528_Non-Final_OA_3-26-15.pdf	605225 be7d8f272ef0fac402a93d9fa46f37954e4421bc	no	18
Warnings:					
Information:					
10	Non Patent Literature	13705178_Non-Final_OA_3-27-15.pdf	431284 6750b8453b33aa4e79f3847cbd61565171761aec	no	14
Warnings:					
Information:					
11	Non Patent Literature	13907666_NOA_5-19-15.PDF	407923 f502be4aefeae6f0c3ee493757b88ae48d95988a	no	7
Warnings:					
Information:					
12	Non Patent Literature	90013423_Non-Final_OA_4-22-15.pdf	585475 687eca797422ef5378b7be99928d400300c018a1	no	16
Warnings:					
Information:					
13	Fee Worksheet (SB06)	fee-info.pdf	30417 ef7f0c8f70eea5baf24f4a28d231cc2349ff1b01	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	5990403		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

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.
14/516,867	10/17/2014	Nicholas A.J. Millington	04-0401-CON1014D	9318

107361 7590 06/01/2015

McDonnell Boehnen Hulbert & Berghoff LLP
Sonos, Inc.
300 South Wacker Drive
Chicago, IL 60606

EXAMINER	
SURVILLO, OLEG	

ART UNIT	PAPER NUMBER
2442	

MAIL DATE	DELIVERY MODE
06/01/2015	PAPER

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

The time period for reply, if any, is set in the attached communication.

Applicant-Initiated Interview Summary	Application No.	Applicant(s)	
	14/516,867	MILLINGTON, NICHOLAS A.J.	
	Examiner	Art Unit	
	OLEG SURVILLO	2442	

All participants (applicant, applicant's representative, PTO personnel):

(1) *Oleg Survillo, Examiner AU 2442*.

(2) *Jeff Armstrong, Reg. No.: 54,967*.

(3) *Christopher Butts, Reg. No.: 67,558*.

(4)_____.

Date of Interview: *27 May 2015*.

Type: ☒ Telephonic ☐ Video Conference
☐ Personal [copy given to: ☐ applicant ☐ applicant's representative]

Exhibit shown or demonstration conducted: ☐ Yes ☒ No.
If Yes, brief description: _____.

Issues Discussed ☐101 ☐112 ☐102 ☒103 ☒Others
(For each of the checked box(es) above, please describe below the issue and detailed description of the discussion)

Claim(s) discussed: *21 and 29*.

Identification of prior art discussed: *Goldberg, Meade, Sinha*.

Substance of Interview
(For each issue discussed, provide a detailed description and indicate if agreement was reached. Some topics may include: identification or clarification of a reference or a portion thereof, claim interpretation, proposed amendments, arguments of any applied references etc...)

See Continuation Sheet.

Applicant recordation instructions: The formal written reply to the last Office action must include the substance of the interview. (See MPEP section 713.04). If a reply to the last Office action has already been filed, applicant is given a non-extendable period of the longer of one month or thirty days from this interview date, or the mailing date of this interview summary form, whichever is later, to file a statement of the substance of the interview

Examiner recordation instructions: Examiners must summarize the substance of any interview of record. A complete and proper recordation of the substance of an interview should include the items listed in MPEP 713.04 for complete and proper recordation including the identification of the general thrust of each argument or issue discussed, a general indication of any other pertinent matters discussed regarding patentability and the general results or outcome of the interview, to include an indication as to whether or not agreement was reached on the issues raised.

☒ Attachment

/OLEG SURVILLO/ Primary Examiner, Art Unit 2442	

Summary of Record of Interview Requirements

Manual of Patent Examining Procedure (MPEP), Section 713.04, Substance of Interview Must be Made of Record
A complete written statement as to the substance of any face-to-face, video conference, 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.

Title 37 Code of Federal Regulations (CFR) § 1.133 Interviews
Paragraph (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, 1.135. (35 U.S.C. 132)

37 CFR §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 an Interview Summary Form for each interview held where a matter of substance has been discussed during the interview by checking the appropriate boxes and filling in the blanks. 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, or pointing out typographical errors or unreadable script in Office actions or the like, are excluded from the interview recordation procedures below. Where the substance of an interview is completely recorded in an Examiners Amendment, no separate Interview Summary Record is required.

The Interview Summary Form shall be given an appropriate Paper No., placed in the right hand portion of the file, and listed on the "Contents" section of the file wrapper. In a personal interview, a duplicate of the Form is given to the applicant (or attorney or agent) at the conclusion of the interview. In the case of a telephone or video-conference interview, the copy is mailed to the applicant's correspondence address either with or prior to the next official communication. If additional correspondence from the examiner is not likely before an allowance or if other circumstances dictate, the Form should be mailed promptly after the interview rather than with the next official communication.

The Form provides for recordation of the following information:
- Application Number (Series Code and Serial Number)
- Name of applicant
- Name of examiner
- Date of interview
- Type of interview (telephonic, video-conference, or personal)
- Name of participant(s) (applicant, attorney or agent, examiner, other PTO personnel, etc.)
- An indication whether or not an exhibit was shown or a demonstration conducted
- 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). Note: Agreement as to allowability is tentative and does not restrict further action by the examiner to the contrary.
- The signature of the examiner who conducted the interview (if Form is not an attachment to a signed Office action)

It is desirable that the examiner orally remind the applicant of his or her obligation to record the substance of the interview of each case. It should be noted, however, that the Interview Summary Form will not normally be considered a complete and proper recordation of the interview unless it includes, or is supplemented by 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 the 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 or she 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 and accurate, the examiner will give the applicant an extendable one month time period to correct the record.

Examiner to Check for Accuracy

If the claims are allowable for other reasons of record, the examiner should send a letter setting forth the examiner's version of the statement attributed to him or her. 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.

Continuation of Substance of Interview including description of the general nature of what was agreed to if an agreement was reached, or any other comments: Discussed proposed claim amendments and whether the proposed changes render claims allowable over the art of record. In particular, discussed applicability of the newly cited references to teach the newly added limitation "transmitting device clock information of the first playback device". Applicant's Attorneys argued that since Goldberg already discloses a technique for synchronizing playback of audio between multiple devices, it would not have been obvious to modify Goldberg to additionally transmit device clock informaiton of the first playback device, where it was agreed that Goldberg fails to teach "transmitting device clock information of the first playback device". In support of their argument, Applicant's Attorneys relied on the BPAI decision in re Rinkevich. Examiner disagreed and maintained that the combination would have been obvious using one of the KSR rationales. In addition, Examiner stated that since device clock informaiton is not claimed (in at least claim 21) to be utilized for any specific purpose (such as to sychronize playback), Examiner is not required to provide additional reasoning linking device clock information to sychronization of playback and mere showing that technique for transmitting device clock information was well known in the art at the time of the invention is sufficient to satisfy Examiner's burden of establishing unpatentability of the claims. No agreement was reached regarding patentability. It was agreed to further discuss this issue with another Primary Examiner and/or Supervisor present during the next round of in-person interviews for related cases.

Advisory Action Before the Filing of an Appeal Brief	**Application No.** *14/516,867*	**Applicant(s)** MILLINGTON, NICHOLAS A.J.	
	Examiner OLEG SURVILLO	**Art Unit** 2442	**AIA (First Inventor to File) Status** No

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

THE REPLY FILED 11 May 2015 FAILS TO PLACE THIS APPLICATION IN CONDITION FOR ALLOWANCE.

NO NOTICE OF APPEAL FILED

1. ☒ The reply was filed after a final rejection. No Notice of Appeal has been filed. To avoid abandonment of this application, applicant must timely file one of the following replies: (1) an amendment, affidavit, or other evidence, which places the application in condition for allowance; (2) a Notice of Appeal (with appeal fee) in compliance with 37 CFR 41.31; or (3) a Request for Continued Examination (RCE) in compliance with 37 CFR 1.114 if this is a utility or plant application. Note that RCEs are not permitted in design applications. The reply must be filed within one of the following time periods:
   a) ☐ The period for reply expires _____months from the mailing date of the final rejection.
   b) ☒ The period for reply expires on: (1) the mailing date of this Advisory Action; or (2) the date set forth in the final rejection, whichever is later. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of the final rejection.
   c) ☐ A prior Advisory Action was mailed more than 3 months after the mailing date of the final rejection in response to a first after-final reply filed within 2 months of the mailing date of the final rejection. The current period for reply expires months from the mailing date of *the prior Advisory Action* or SIX MONTHS from the mailing date of the final rejection, whichever is earlier.
   Examiner Note: If box 1 is checked, check either box (a), (b) or (c). ONLY CHECK BOX (b) WHEN THIS ADVISORY ACTION IS THE FIRST RESPONSE TO APPLICANT'S FIRST AFTER-FINAL REPLY WHICH WAS FILED WITHIN TWO MONTHS OF THE FINAL REJECTION. ONLY CHECK BOX (c) IN THE LIMITED SITUATION SET FORTH UNDER BOX (c). See MPEP 706.07(f).

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

NOTICE OF APPEAL

2. ☐ The Notice of Appeal was filed on _____. A brief in compliance with 37 CFR 41.37 must be filed within two months of the date of filing the Notice of Appeal (37 CFR 41.37(a)), or any extension thereof (37 CFR 41.37(e)), to avoid dismissal of the appeal. Since a Notice of Appeal has been filed, any reply must be filed within the time period set forth in 37 CFR 41.37(a).

AMENDMENTS

3. ☒ The proposed amendments filed after a final rejection, but prior to the date of filing a brief, will not be entered because
   a) ☒ They raise new issues that would require further consideration and/or search (see NOTE below);
   b) ☐ They raise the issue of new matter (see NOTE below);
   c) ☐ They are not deemed to place the application in better form for appeal by materially reducing or simplifying the issues for appeal; and/or
   d) ☐ They present additional claims without canceling a corresponding number of finally rejected claims.
   NOTE: *See Continuation Sheet*. (See 37 CFR 1.116 and 41.33(a)).
4. ☐ The amendments are not in compliance with 37 CFR 1.121. See attached Notice of Non-Compliant Amendment (PTOL-324).
5. ☐ Applicant's reply has overcome the following rejection(s): _____.
6. ☐ Newly proposed or amended claim(s) _____ would be allowable if submitted in a separate, timely filed amendment canceling the non-allowable claim(s).
7. ☒ For purposes of appeal, the proposed amendment(s): (a) ☒ will not be entered, or (b) ☐ will be entered, and an explanation of how the new or amended claims would be rejected is provided below or appended.

AFFIDAVIT OR OTHER EVIDENCE

8. ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.
9. ☐ The affidavit or other evidence filed after final action, but before or on the date of filing a Notice of Appeal will not be entered because applicant failed to provide a showing of good and sufficient reasons why the affidavit or other evidence is necessary and was not earlier presented. See 37 CFR 1.116(e).
10. ☐ The affidavit or other evidence filed after the date of filing the Notice of Appeal, but prior to the date of filing a brief, will not be entered because the affidavit or other evidence failed to overcome all rejections under appeal and/or appellant fails to provide a showing of good and sufficient reasons why it is necessary and was not earlier presented. See 37 CFR 41.33(d)(1).
11. ☐ The affidavit or other evidence is entered. An explanation of the status of the claims after entry is below or attached.

REQUEST FOR RECONSIDERATION/OTHER

12. ☒ The request for reconsideration has been considered but does NOT place the application in condition for allowance because: See Continuation Sheet.
13. ☒ Note the attached Information *Disclosure Statement*(s). (PTO/SB/08) Paper No(s). 03/12/2015
14. ☒ Other: See attached PTOL-2323 Form; PTO-892 Form; and PTOL-413 Form.

STATUS OF CLAIMS

15. The status of the claim(s) is (or will be) as follows:
    Claim(s) allowed: .
    Claim(s) objected to: .
    Claim(s) rejected: 21-40.
    Claim(s) withdrawn from consideration: .

/OLEG SURVILLO/
Primary Examiner, Art Unit 2442

Continuation of 3. NOTE: The Examiner performed an updated search and completed additional consideration of the After Final amendment within the time authorized for this Pilot Program. The results of the updated search and completed consideration are that the After Final amendment would not overcome all of the rejections in the most recent Final Office action. In particular, previously cited prior art in related cases teaches the newly added limitations, as proposed.

Continuation of 12. does NOT place the application in condition for allowance because:
At page 9 of the Remarks, as filed, Applicants argue that "Applicant has removed the word "cause" from the independent claims to obviate the Examiner's objections to this term". Examiner disagrees and notes that no claim objections have been made in the last Office action and Applicants removed the word "cause" at their own discretion.

At page 10 of the Remarks Applicants argue that Meade in view of Goldberg fails to teach the newly added subject matter. Examiner agrees to the extent that Meade in view of Goldberg fails to teach transmitting device clock information of the first playback device, an agrement that was reached during earlier discussion of the case.

At page 11 of the Remarks Applicants argue against teachings of Goldberg that "Goldberg only describes the receiving unit (not the broadcast unit) as playing back audio based on the "synchronization signal". Examiner disagrees with such interpretation of Goldberg and notes that if "synchonization signal" was, in fact, used only by one party (receiving unit) and not by broadcast unit, this would not accomplish synchronization of audio playback between broadcast and receiver units. Therefore, both units much use sychronization signal in some fashion, where Examiner notes that the word "using" is overly broad and fails to specify how claimed playback timing information is utilized in performing synchronous playback. Therefore, Applicant's argument cannot be held as persuasive.

At page 12 of the Remarks Applicants argue against newly found, but not cited in the rejection of argued claims, reference to Wolf. In particular, Applicants argue that "neither the "first clock signal" nor the "second clock signal" in Wolf amounts to the "playback timing information". In response to this argument, Examiner notes that it was previously discussed that Wolf, if ever relied on in the rejection of pending claims, would be relied on to teach "transmitting device clock information of the first device" and not the argued "playback timing information" that is already taught by Goldberg. Therefore, Applicant's argument is misplaced.

At page 13 of the Remarks Applicants argue against newly found, but not cited in the rejection of argued claims, reference to Sinha. In particular, Applicants similarly argue that Sinha fails to teach "playback timing information". Examiner similarly notes that Sinha, if ever relied on in the rejection of pending claims, would be relied on to teach "transmitting device clock information of the first device" and not the argued "playback timing information" that is already taught by Goldberg. Therefore, Applicant's argument is misplaced. In response to Applciant's further argument that "even assuming for the sake of argument that Sinha's master network clock or master transfer clock amounts to one of the claimed "playback timing information" or "device clock information of the first playback device," Sinha only discloses "transmit[ting] information reflecting ONE of those clocks to a slave side…". In response to this argument, Examiner notes that Sinha does not have to teach transmitting both the playback timing information and device clock information since Goldberg already teaching transmitting the playback timing information. Therefore, Sinha would only be relied on to teach what is missing from Goldberg, i.e. transmitting device clock information.

At page 14 of the Remarks Applicants argue against newly found, but not cited in the rejection of argued claims, reference to Fellman. In particular, Applicants similarly argue that Fellman fails to teach "playback timing information". Examiner similarly notes that Fellman, if ever relied on in the rejection of pending claims, would be relied on to teach "transmitting device clock information of the first device" and not the argued "playback timing information" that is already taught by Goldberg. Therefore, Applicant's argument is misplaced.

At pages 15-16 of the Remarks Applicants argue against newly found, but not cited in the rejection of argued claims, reference to Fujimori. In particular, Applicants similarly argue that Fujimori fails to teach "playback timing information". Examiner similarly notes that Fujimori, if ever relied on in the rejection of pending claims, would be relied on to teach "transmitting device clock information of the first device" and not the argued "playback timing information" that is already taught by Goldberg. Therefore, Applicant's argument is misplaced. Examiner also notes that if Fujomori is relied on as a reference to teach any of the claimed features, it would be relied on in combination with Goldber, Meade and/or other references. Therefore, Applicant's argument against Fujimori alone (rather than in combination with Meade and Goldberg) cannot be held as persuasive.

At pages 16-17 of the Remarks Applicants argue against newly found, but not cited in the rejection of argued claims, reference to Mosig. In particular, Applicants argue that Mosig fails to teach "device clock information of the first playback device". Examiner agrees. However, Examiner notes that Applicants failed to present any argument as to whether Mosig teaches "playback timing information", something that was argued against all other newly found but not cited prior art references. Examiner notes that while Mosig fails to teach transmitting device clock information of the first playback device, Mosig can be properly relied on to teach transmitting playback timing information.

As to any arguments not specifically addressed, they are the same as those discussed above.

LINKPLAY EXHIBIT 1002
Page 145 of 1434

Applicant-Initiated Interview Summary	Application No.	Applicant(s)	
	14/516,867	MILLINGTON, NICHOLAS A.J.	
	Examiner	Art Unit	
	OLEG SURVILLO	2442	

All participants (applicant, applicant's representative, PTO personnel):

(1) *Oleg Survillo, Examiner AU 2442*.

(2) *Jeff Armstrong, Reg. No.: 54,967*.

(3) *Christopher Butts, Reg. No.: 67,558*.

(4)_____.

Date of Interview: *27 May 2015*.

Type: ☒ Telephonic ☐ Video Conference
☐ Personal [copy given to: ☐ applicant ☐ applicant's representative]

Exhibit shown or demonstration conducted: ☐ Yes ☒ No.
If Yes, brief description: _____.

Issues Discussed ☐101 ☐112 ☐102 ☒103 ☒Others
(For each of the checked box(es) above, please describe below the issue and detailed description of the discussion)

Claim(s) discussed: *21 and 29*.

Identification of prior art discussed: *Goldberg, Meade, Sinha*.

Substance of Interview
(For each issue discussed, provide a detailed description and indicate if agreement was reached. Some topics may include: identification or clarification of a reference or a portion thereof, claim interpretation, proposed amendments, arguments of any applied references etc...)

See Continuation Sheet.

Applicant recordation instructions: The formal written reply to the last Office action must include the substance of the interview. (See MPEP section 713.04). If a reply to the last Office action has already been filed, applicant is given a non-extendable period of the longer of one month or thirty days from this interview date, or the mailing date of this interview summary form, whichever is later, to file a statement of the substance of the interview

Examiner recordation instructions: Examiners must summarize the substance of any interview of record. A complete and proper recordation of the substance of an interview should include the items listed in MPEP 713.04 for complete and proper recordation including the identification of the general thrust of each argument or issue discussed, a general indication of any other pertinent matters discussed regarding patentability and the general results or outcome of the interview, to include an indication as to whether or not agreement was reached on the issues raised.

☒ Attachment

/OLEG SURVILLO/ Primary Examiner, Art Unit 2442	

Summary of Record of Interview Requirements

Manual of Patent Examining Procedure (MPEP), Section 713.04, Substance of Interview Must be Made of Record
A complete written statement as to the substance of any face-to-face, video conference, 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.

Title 37 Code of Federal Regulations (CFR) § 1.133 Interviews
Paragraph (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, 1.135. (35 U.S.C. 132)

37 CFR §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 an Interview Summary Form for each interview held where a matter of substance has been discussed during the interview by checking the appropriate boxes and filling in the blanks. 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, or pointing out typographical errors or unreadable script in Office actions or the like, are excluded from the interview recordation procedures below. Where the substance of an interview is completely recorded in an Examiners Amendment, no separate Interview Summary Record is required.

The Interview Summary Form shall be given an appropriate Paper No., placed in the right hand portion of the file, and listed on the "Contents" section of the file wrapper. In a personal interview, a duplicate of the Form is given to the applicant (or attorney or agent) at the conclusion of the interview. In the case of a telephone or video-conference interview, the copy is mailed to the applicant's correspondence address either with or prior to the next official communication. If additional correspondence from the examiner is not likely before an allowance or if other circumstances dictate, the Form should be mailed promptly after the interview rather than with the next official communication.

The Form provides for recordation of the following information:
- Application Number (Series Code and Serial Number)
- Name of applicant
- Name of examiner
- Date of interview
- Type of interview (telephonic, video-conference, or personal)
- Name of participant(s) (applicant, attorney or agent, examiner, other PTO personnel, etc.)
- An indication whether or not an exhibit was shown or a demonstration conducted
- 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). Note: Agreement as to allowability is tentative and does not restrict further action by the examiner to the contrary.
- The signature of the examiner who conducted the interview (if Form is not an attachment to a signed Office action)

It is desirable that the examiner orally remind the applicant of his or her obligation to record the substance of the interview of each case. It should be noted, however, that the Interview Summary Form will not normally be considered a complete and proper recordation of the interview unless it includes, or is supplemented by 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 the 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 or she 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 and accurate, the examiner will give the applicant an extendable one month time period to correct the record.

Examiner to Check for Accuracy

If the claims are allowable for other reasons of record, the examiner should send a letter setting forth the examiner's version of the statement attributed to him or her. 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.

Continuation of Substance of Interview including description of the general nature of what was agreed to if an agreement was reached, or any other comments: Discussed proposed claim amendments and whether the proposed changes render claims allowable over the art of record. In particular, discussed applicability of the newly cited references to teach the newly added limitation "transmitting device clock information of the first playback device". Applicant's Attorneys argued that since Goldberg already discloses a technique for synchronizing playback of audio between multiple devices, it would not have been obvious to modify Goldberg to additionally transmit device clock informaiton of the first playback device, where it was agreed that Goldberg fails to teach "transmitting device clock information of the first playback device". In support of their argument, Applicant's Attorneys relied on the BPAI decision in re Rinkevich. Examiner disagreed and maintained that the combination would have been obvious using one of the KSR rationales. In addition, Examiner stated that since device clock informaiton is not claimed (in at least claim 21) to be utilized for any specific purpose (such as to sychronize playback), Examiner is not required to provide additional reasoning linking device clock information to sychronization of playback and mere showing that technique for transmitting device clock information was well known in the art at the time of the invention is sufficient to satisfy Examiner's burden of establishing unpatentability of the claims. No agreement was reached regarding patentability. It was agreed to further discuss this issue with another Primary Examiner and/or Supervisor present during the next round of in-person interviews for related cases.

Notice of References Cited	Application/Control No. 14/516,867	Applicant(s)/Patent Under Reexamination MILLINGTON, NICHOLAS A.J	
	Examiner OLEG SURVILLO	Art Unit 2442	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-2006/0098936	05-2006	Ikeda et al.	386/046
*	B	US-5,923,869	07-1999	Kashiwagi et al.	713/501
*	C	US-2003/0200001	10-2003	Goddard, Mark D.	700/94
*	D	US-6,687,664	02-2004	Sussman et al.	704/201
*	E	US-5,726,989	03-1998	Dokic, Miroslav V.	370/509
	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.

DO NOT ENTER: /O.S./

05/27/2015

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
(Case No.: 04-0401-CON1014D)
(MBHB Docket No. 14-1800-CON2)

In the Application of:	)	
	)	
Millington	)	Art Unit: 2442
	)	
Serial No.: 14/516,867	)	Examiner: Survillo
	)	
Filed: October 17, 2014	)	Confirmation No. 9318
	)	
For: Obtaining Content from Remote Source For Playback	)	
	)	

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

RESPONSE TO THE FINAL OFFICE ACTION MAILED MARCH 9, 2015

Pursuant to 37 C.F.R. § 1.116 and the After Final Consideration Pilot Program 2.0, please consider the following **AMENDMENTS** and **REMARKS** in response to the Final Office Action mailed on March 9, 2015 in the above-captioned application.

AMENDMENTS TO THE CLAIMS begin on page 2.

REMARKS begin on page 9.

The Office is hereby authorized to charge any underpayment of fees or credit any overpayment of fees in connection with the prosecution of the above-captioned application to Deposit Account 13-2490.

AFCP 2.0 Decision	Application No.	Applicant(s)
	14/516,867	MILLINGTON, NICHOLAS A.J.
	Examiner	Art Unit
	OLEG SURVILLO	2442

This is in response to the After Final Consideration Pilot request filed May 11, 2015.

1. **Improper Request** – The AFCP 2.0 request is improper for the following reason(s) and the after final amendment submitted with the request will be treated under pre-pilot procedure.

☐ An AFCP 2.0 request form PTO/SB/434 (or equivalent document) was not submitted.

☐ A non-broadening amendment to at least one independent claim was not submitted.

☐ A proper AFCP 2.0 request was submitted in response to the most recent final rejection.

☐ Other:

2. **Proper Request**

A. After final amendment submitted with the request will not be treated under AFCP 2.0.
The after final amendment cannot be reviewed and a search conducted within the guidelines of the pilot program.

☐ The after final amendment will be treated under pre-pilot procedure.

B. Updated search and/or completed additional consideration.
The examiner performed an updated search and/or completed additional consideration of the after final amendment within the time authorized for the pilot program. The result(s) of the updated search and/or completed additional consideration are:

☐ 1. All of the rejections in the most recent final Office action are overcome and a Notice of Allowance is issued herewith.

☒ 2. The after final amendment would not overcome all of the rejections in the most recent final Office action. See attached interview summary for further details.

☐ 3. The after final amendment was reviewed, and it raises a new issue(s). See attached interview summary for further details.

☐ 4. The after final amendment raises new issues, but would overcome all of the rejections in the most recent final Office action. A decision on determining allowability could not be made within the guidelines of the pilot. See attached interview summary for further details, including any newly discovered prior art.

☐ 5. Other:

Examiner Note: Please attach an interview summary when necessary as described above.

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S188	5330422	@ad<"20040401" or @rlad<"20040401"	US-PGPUB; USPAT	OR	ON	2015/05/27 22:05
S189	3086	S188 and (playback or playing or play) with clock with time	US-PGPUB; USPAT	OR	ON	2015/05/27 22:07
S190	277	S188 and (playback or playing or play) with clock with time with (frame or packet)	US-PGPUB; USPAT	OR	ON	2015/05/27 22:07
S191	242	S188 and (playback or playing or play) with clock with time with (frame or packet) not millington.in.	US-PGPUB; USPAT	OR	ON	2015/05/27 22:07
S192	90	S188 and (playback or playing or play) with clock with time with (frame) not millington.in.	US-PGPUB; USPAT	OR	ON	2015/05/27 22:11
S193	398	S188 and (playback or playing or play) with clock with time with (audio) not millington.in.	US-PGPUB; USPAT	OR	ON	2015/05/27 22:14
S194	350	S188 and (playback or playing or play adj back) with clock with time with (audio) not millington.in.	US-PGPUB; USPAT	OR	ON	2015/05/27 22:15
S195	135	S188 and (playback or playing or play adj back) with clock with time with (audio) same (synchroniz$5) not millington.in.	US-PGPUB; USPAT	OR	ON	2015/05/27 22:21
S196	77	S188 and (playback or playing or play adj back) near5 (synchroniz$5) with clock with time with (audio) not millington.in.	US-PGPUB; USPAT	OR	ON	2015/05/27 22:26

EAST Search History (Interference)

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5/27/2015 10:46:44 PM
C:\Users\osurvillo\Documents\EAST\Workspaces\14186850.wsp

dated 03/12/2015

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
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Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**		
	Application Number	14516867
	Filing Date	10-17-2014
	First Named Inventor	MILLINGTON; Nicholas A.J.
	Art Unit	2442
	Examiner Name	SURVILLO, OLEG
	Attorney Docket Number	04-0401-CON1014D

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
/O.S./	1	5153579		1992-10-06	FISCH; Kenneth D. et al.	
/O.S./	2	7206967		2007-04-17	MARTI; Philippe et al.	
/O.S./	3	7711774		2010-05-04	ROTHSCHILD; Leigh M.	

If you wish to add additional U.S. Patent citation information please click the Add button. Add

U.S.PATENT APPLICATION PUBLICATIONS Remove

Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
/O.S./	1	20010046235		2001-11-29	TREVITT; Stephen et al.	
/O.S./	2	20020173273		2002-11-21	SPURGAT; Jeffrey Jonathan et al.	
/O.S./	3	20040098754		2004-05-20	VELLA; Zane et al.	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	14516867
	Filing Date	10-17-2014
	First Named Inventor	MILLINGTON; Nicholas A.J.
	Art Unit	2442
	Examiner Name	SURVILLO, OLEG
	Attorney Docket Number	04-0401-CON1014D

/O.S./	4	20050062637		2005-03-24	EL; Zabadani Hicham Mahmoud et al.		
/O.S./	5	20130022221		2013-01-24	KALLAI; Christopher et al.		

If you wish to add additional U.S. Published Application citation information please click the Add button. Add

FOREIGN PATENT DOCUMENTS Remove

Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
/O.S./	1	2338374	GB		1999-12-15	MOTOROLA LTD.		☐
/O.S./	2	07-210129	JP		1995-08-11	INTERNAT'L BUSINESS MACH CORP (IBM)	Abstract only	☒
/O.S./	3	2005108427	JP		2005-04-21	RICOH KK.		☐

If you wish to add additional Foreign Patent Document citation information please click the Add button Add

NON-PATENT LITERATURE DOCUMENTS Remove

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
/O.S./	1	"Advisory Action mailed on 2 March 2015, issued in connection with U.S. Patent Application No. 13/848932, filed on March 22, 2013, 3 pages.".	☐
/O.S./	2	"Advisory Action mailed on 26 February 2015, issued in connection with U.S. Patent Application No. 14/184,528, filed on 19 February 2014, 3 pages.".	☐

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	14516867
	Filing Date	10-17-2014
	First Named Inventor	MILLINGTON; Nicholas A.J.
	Art Unit	2442
	Examiner Name	SURVILLO, OLEG
	Attorney Docket Number	04-0401-CON1014D

/O.S./	3	"Final Office Action mailed on 11 February 2015, issued in connection with U.S. Patent Application No. 14/184526, filed on 19 February 2014, 13 pages".	☐
	4	"Final Office Action mailed on 11 February 2015, issued in connection with U.S. Patent Application No. 14/184,935, filed on 20 February 2014, 17 pages".	☐
	5	"Final Office Action mailed on 12 February 2015, issued in connection with U.S. Patent Application No. 14/184522, filed on 19 February 2014, 20 pages".	☐
	6	"INTERNATIONAL BUREAU,"International Preliminary Report on Patentability" issued in connection with International Patent application No. PCT/US2013/046372, mailed December 31, 2014, 5 pages.".	☐
	7	"International Preliminary Report on Patentability and Written Opinion, issued by the International Searching Authority in connection with International Patent Application No. PCT/US2013/046386, mailed on January 8, 2015, 8 pages".	☐
	8	"Non-Final Office Action mailed on 26 February 2015, issued in connection with U.S. Patent Application No. 14/186,850, filed on 21 February 2014, 25 pages.".	☐
	9	"Non-Final Office Action mailed on 30 January 2015, issued in connection with U.S. Patent Application No. 14/504,812, filed on 2 October 2014, 13 pages".	☐
	10	"Non-Final Office Action mailed on 30 January 2015, issued in connection with U.S. Patent Appliction No. 14/290,493, filed on 29 May 2014, 30 pages.".	☐
	11	Final Office Action mailed on 3 March 2015, issued in connection with U.S. Patent Application No. 13/864251, filed on 17 April 2013, 13 pages.	☐
	12	Final Office Action mailed on 4 March 2015, issued in connection with U.S. Patent Application No. 13/848904, filed on 22 March 2013, 16 pages.	☐
/O.S./	13	Final Office Action mailed on 5 March 2015, issued in connection with U.S. Patent Application No. 13/888203, filed on 6 May 2013, 13 pages.	☐

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	14516867
	Filing Date	10-17-2014
	First Named Inventor	MILLINGTON; Nicholas A.J.
	Art Unit	2442
	Examiner Name	SURVILLO, OLEG
	Attorney Docket Number	04-0401-CON1014D

/O.S./	14	Non-Final Office Action mailed on 4 March 2015, issued in connection with U.S. Patent Application No. 13/435776, filed on 30 March 2012, 16 pages.	☐
/O.S./	15	Pre-Interview First Office Action mailed on 10 March 2015, issued in connection with U.S. Patent Application No. 14/505027, filed on 2 October 2014, 4 pages.	☐

If you wish to add additional non-patent literature document citation information please click the Add button **Add**

EXAMINER SIGNATURE

Examiner Signature	/Oleg Survillo/	Date Considered	05/27/2015

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

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/516,867	10/17/2014	Nicholas A.J. Millington	04-0401-CON1014D	9318

107361 7590 05/13/2015

McDonnell Boehnen Hulbert & Berghoff LLP
Sonos, Inc.
300 South Wacker Drive
Chicago, IL 60606

EXAMINER	
SURVILLO, OLEG	

ART UNIT	PAPER NUMBER
2442	

MAIL DATE	DELIVERY MODE
05/13/2015	PAPER

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

The time period for reply, if any, is set in the attached communication.

Applicant-Initiated Interview Summary	Application No.	Applicant(s)	
	14/516,867	MILLINGTON, NICHOLAS A.J.	
	Examiner	Art Unit	
	OLEG SURVILLO	2442	

All participants (applicant, applicant's representative, PTO personnel):

(1) *Oleg Survillo, Examiner AU 2442*.

(2) *Jeff Armstrong, Reg. No.: 54,967*.

(3) *Christopher Butts, Reg. No.: 67,558*.

(4)_____.

Date of Interview: *11 May 2015*.

Type: ☒ Telephonic ☐ Video Conference
☐ Personal [copy given to: ☐ applicant ☐ applicant's representative]

Exhibit shown or demonstration conducted: ☐ Yes ☒ No.
If Yes, brief description: _____.

Issues Discussed ☐101 ☐112 ☐102 ☒103 ☒Others
(For each of the checked box(es) above, please describe below the issue and detailed description of the discussion)

Claim(s) discussed: *21*.

Identification of prior art discussed: *Wolf*.

Substance of Interview
(For each issue discussed, provide a detailed description and indicate if agreement was reached. Some topics may include: identification or clarification of a reference or a portion thereof, claim interpretation, proposed amendments, arguments of any applied references etc...)

See Continuation Sheet.

Applicant recordation instructions: The formal written reply to the last Office action must include the substance of the interview. (See MPEP section 713.04). If a reply to the last Office action has already been filed, applicant is given a non-extendable period of the longer of one month or thirty days from this interview date, or the mailing date of this interview summary form, whichever is later, to file a statement of the substance of the interview

Examiner recordation instructions: Examiners must summarize the substance of any interview of record. A complete and proper recordation of the substance of an interview should include the items listed in MPEP 713.04 for complete and proper recordation including the identification of the general thrust of each argument or issue discussed, a general indication of any other pertinent matters discussed regarding patentability and the general results or outcome of the interview, to include an indication as to whether or not agreement was reached on the issues raised.

☒ Attachment

/OLEG SURVILLO/ Primary Examiner, Art Unit 2442	

Summary of Record of Interview Requirements

Manual of Patent Examining Procedure (MPEP), Section 713.04, Substance of Interview Must be Made of Record
A complete written statement as to the substance of any face-to-face, video conference, 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.

Title 37 Code of Federal Regulations (CFR) § 1.133 Interviews
Paragraph (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, 1.135. (35 U.S.C. 132)

37 CFR §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 an Interview Summary Form for each interview held where a matter of substance has been discussed during the interview by checking the appropriate boxes and filling in the blanks. 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, or pointing out typographical errors or unreadable script in Office actions or the like, are excluded from the interview recordation procedures below. Where the substance of an interview is completely recorded in an Examiners Amendment, no separate Interview Summary Record is required.

The Interview Summary Form shall be given an appropriate Paper No., placed in the right hand portion of the file, and listed on the "Contents" section of the file wrapper. In a personal interview, a duplicate of the Form is given to the applicant (or attorney or agent) at the conclusion of the interview. In the case of a telephone or video-conference interview, the copy is mailed to the applicant's correspondence address either with or prior to the next official communication. If additional correspondence from the examiner is not likely before an allowance or if other circumstances dictate, the Form should be mailed promptly after the interview rather than with the next official communication.

The Form provides for recordation of the following information:
- Application Number (Series Code and Serial Number)
- Name of applicant
- Name of examiner
- Date of interview
- Type of interview (telephonic, video-conference, or personal)
- Name of participant(s) (applicant, attorney or agent, examiner, other PTO personnel, etc.)
- An indication whether or not an exhibit was shown or a demonstration conducted
- 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). Note: Agreement as to allowability is tentative and does not restrict further action by the examiner to the contrary.
- The signature of the examiner who conducted the interview (if Form is not an attachment to a signed Office action)

It is desirable that the examiner orally remind the applicant of his or her obligation to record the substance of the interview of each case. It should be noted, however, that the Interview Summary Form will not normally be considered a complete and proper recordation of the interview unless it includes, or is supplemented by 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 the 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 or she 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 and accurate, the examiner will give the applicant an extendable one month time period to correct the record.

Examiner to Check for Accuracy

If the claims are allowable for other reasons of record, the examiner should send a letter setting forth the examiner's version of the statement attributed to him or her. 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.

Continuation of Substance of Interview including description of the general nature of what was agreed to if an agreement was reached, or any other comments: Discussed proposed amendments and whether the proposed changes render claims allowable over the art of record. In particular, discussed whether the newly cited references, including a reference to Wolf, teaches the newly added subject matter. Applicant's Attorney stated that Wolf (as well as other cited art) fails to teach play back of the audio information based at least in part on the playback timing information associated with the audio information and the clock information of the first playback device. In particular, Applicant's Attorney stated that none of the cited references teach that playback is based on the clock information, where Wolf specifically fails to teach playback of any audio information. Examiner disagreed and stated the the rejection was made over a combination of references and "based at least in part on" is not specific enough to elaborate how the clock information is incorporated into the playback of the audio information that would distinguish from prior art. Examiner advised to replace "based at least in part on" with a limitation that would provide specificity as to how playback timing information and clock information are incorporated into play back of the audio information. Examiner stated that providing this information in the claim is essential for allowability because this is the core of the inventive concept. Applicant's Attorneys indicated that such feature would be too specific for the Client to find acceptable. No agreement was reached on allowability of any of the pending claims.

McDonnell Boehnen Hulbert & Berghoff
Law Offices

300 South Wacker Drive
Chicago, Illinois 60606-6709
www.mbhb.com

312-913-0001 phone
312-913-0002 fax

May 6, 2015

Via email: oleg.survillo@uspto.gov

Examiner Oleg Survillo
U.S. Patent & Trademark Office
P.O. Box 1450
Arlington, VA 22313-1450

RE: Agenda for App. 14/516,867 (Sonos 04-0401-CON1014D; MBHB 14-1800-CON2)

Examiner Survillo:

Thank you for agreeing to interview the above-referenced application on Monday, May 11, 2015 at 10:00am ET / 9:00am CT via telephone. An agenda of topics and proposed claim amendments are outlined below:

Agenda for the Examiner Interview:

- The § 103 rejections in the Final Office Action mailed March 9, 2015
- Claim 21
- References:
  - U.S. Pat. Pub. No. 2003/0073432 ("Meade")
  - U.S. Pat. Pub. No. 2007/0142944 ("Goldberg")
  - U.S. Pat. Pub. No. 2002/0114354 ("Sinha")
  - U.S. Pat. Pub. No. 2004/0208158 ("Fellman")
  - U.S. Pat. Pub. No. 2002/0080783 ("Fujimori")
  - U.S. Pat. Pub. No. 2004/0228367 ("Mosig")
  - U.S. Pat. No. 6,816,818 ("Wolf")

Proposed Amendments for Review:

- Applicant contends that the Meade and Goldberg references cited in the Final Office Action do not teach or suggest each of the recited claim elements. Nevertheless, without conceding the merits of the rejections, and in an earnest attempt to advance prosecution, Applicant proposes the draft clarifying amendments outlined below for review and consideration.

  21. (Proposed Amendments) A first playback device comprising:

  a network interface; and

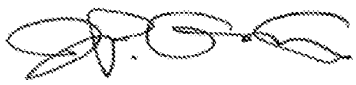
memory comprising program instructions that, when executed by a processor, cause the playback device to:

receive, via the network interface from a network device configured to control the first playback device and communicatively coupled to the first playback device over a local area network (LAN), control information comprising (i) one or more instructions ~~that cause~~ for the first playback device and a second playback device to playback audio information and (ii) an address identifying a network location of the audio information available at an audio information source, wherein the audio information source is outside of the LAN; and

in response to receiving the control information, (i) obtain, via the network interface from the audio information source outside of the LAN, the audio information; (ii) transmit, via the network interface of the first playback device to the second playback device, the audio information, playback timing information associated with the audio information, and clock information of the first playback device; and (iii) play back the audio information based at least in part on the playback timing information associated with the audio information and the clock information of the first playback device.

If you have questions, or if you would like additional information to prepare for the interview, please feel free to call me. Otherwise, I look forward to speaking with you on Monday, May 11, 2015, at 10:00am ET / 9:00am CT.

Best regards,



Jeff Armstrong
312-913-2104 (office)

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	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
14/516,867	10/17/2014	Nicholas A.J. Millington	04-0401-CON1014D

CONFIRMATION NO. 9318

107361
McDonnell Boehnen Hulbert & Berghoff LLP
Sonos, Inc.
300 South Wacker Drive
Chicago, IL 60606

POA ACCEPTANCE LETTER

OC000000075091385

Date Mailed: 05/11/2015

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 05/07/2015.

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

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

/byemane/

UNITED STATES PATENT AND TRADEMARK OFFICE

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

APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
14/516,867	10/17/2014	2442	1740	04-0401-CON1014D	20	3

CONFIRMATION NO. 9318

CORRECTED FILING RECEIPT

107361
McDonnell Boehnen Hulbert & Berghoff LLP
Sonos, Inc.
300 South Wacker Drive
Chicago, IL 60606

OC000000075091404

Date Mailed: 05/11/2015

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Inventor(s)

Nicholas A.J. Millington, Santa Barbara, CA;

Applicant(s)

Sonos, Inc., Santa Barbara, CA;

Power of Attorney: The patent practitioners associated with Customer Number 107361

Domestic Priority data as claimed by applicant

This application is a CON of 13/297,000 11/15/2011
which is a CON of 10/816,217 04/01/2004 PAT 8234395
which claims benefit of 60/490,768 07/28/2003

Foreign Applications for which priority is claimed (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.) - None.
Foreign application information must be provided in an Application Data Sheet in order to constitute a claim to foreign priority. See 37 CFR 1.55 and 1.76.

If Required, Foreign Filing License Granted: 10/24/2014

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 14/516,867**

Projected Publication Date: Not Applicable

Non-Publication Request: No

Early Publication Request: No

Title

Obtaining Content from Remote Source for Playback

Preliminary Class

709

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at http://www.uspto.gov/web/offices/pac/doc/general/index.html.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, http://www.stopfakes.gov. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

LICENSE FOR FOREIGN FILING UNDER

Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

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The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign AssetsControl, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

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The United States represents the largest, most dynamic marketplace in the world and is an unparalleled location for business investment, innovation, and commercialization of new technologies. The U.S. offers tremendous resources and advantages for those who invest and manufacture goods here. Through SelectUSA, our nation works to promote and facilitate business investment. SelectUSA provides information assistance to the international investor community; serves as an ombudsman for existing and potential investors; advocates on behalf of U.S. cities, states, and regions competing for global investment; and counsels U.S. economic development organizations on investment attraction best practices. To learn more about why the United States is the best country in the world to develop technology, manufacture products, deliver services, and grow your business, visit http://www.SelectUSA.gov or call +1-202-482-6800.

Doc Code: A.NE.AFCP
Document Description: After Final Consideration Pilot Program Request

PTO/SB/434 (05-13)

CERTIFICATION AND REQUEST FOR CONSIDERATION UNDER THE AFTER FINAL CONSIDERATION PILOT PROGRAM 2.0

Practitioner Docket No.:	Application No.:	Filing Date:
04-0401-CON1014D (14-1800-CON2)	14/516,867	October 17, 2014
First Named Inventor:	**Title:**	
Millington	Obtaining Content from a Remote Server for Playback	

APPLICANT HEREBY CERTIFIES THE FOLLOWING AND REQUESTS CONSIDERATION UNDER THE AFTER FINAL CONSIDERATION PILOT PROGRAM 2.0 (AFCP 2.0) OF THE ACCOMPANYING RESPONSE UNDER 37 CFR 1.116.

1. The above-identified application is (i) an original utility, plant, or design nonprovisional application filed under 35 U.S.C. 111(a) [a continuing application (*e.g.*, a continuation or divisional application) is filed under 35 U.S.C. 111(a) and is eligible under (i)], or (ii) an international application that has entered the national stage in compliance with 35 U.S.C. 371(c).
2. The above-identified application contains an outstanding final rejection.
3. Submitted herewith is a response under 37 CFR 1.116 to the outstanding final rejection. The response includes an amendment to at least one independent claim, and the amendment does not broaden the scope of the independent claim in any aspect.
4. This certification and request for consideration under AFCP 2.0 is the only AFCP 2.0 certification and request filed in response to the outstanding final rejection.
5. Applicant is willing and available to participate in any interview requested by the examiner concerning the present response.
6. This certification and request is being filed electronically using the Office's electronic filing system (EFS-Web).
7. Any fees that would be necessary consistent with current practice concerning responses after final rejection under 37 CFR 1.116, *e.g.*, extension of time fees, are being concurrently filed herewith. [There is no additional fee required to request consideration under AFCP 2.0.]
8. By filing this certification and request, applicant acknowledges the following:
   - Reissue applications and reexamination proceedings are not eligible to participate in AFCP 2.0.
   - The examiner will verify that the AFCP 2.0 submission is compliant, *i.e.*, that the requirements of the program have been met (see items 1 to 7 above). For compliant submissions:
     - The examiner will review the response under 37 CFR 1.116 to determine if additional search and/or consideration (i) is necessitated by the amendment and (ii) could be completed within the time allotted under AFCP 2.0. If additional search and/or consideration is required but cannot be completed within the allotted time, the examiner will process the submission consistent with current practice concerning responses after final rejection under 37 CFR 1.116, *e.g.*, by mailing an advisory action.
     - If the examiner determines that the amendment does not necessitate additional search and/or consideration, or if the examiner determines that additional search and/or consideration is required and could be completed within the allotted time, then the examiner will consider whether the amendment places the application in condition for allowance (after completing the additional search and/or consideration, if required). If the examiner determines that the amendment does not place the application in condition for allowance, then the examiner will contact the applicant and request an interview.
       - The interview will be conducted by the examiner, and if the examiner does not have negotiation authority, a primary examiner and/or supervisory patent examiner will also participate.
       - If the applicant declines the interview, or if the interview cannot be scheduled within ten (10) calendar days from the date that the examiner first contacts the applicant, then the examiner will proceed consistent with current practice concerning responses after final rejection under 37 CFR 1.116.

Signature	Date
/Jeffrey P. Armstrong/	May 11, 2015
Name (Print/Typed) Jeffrey P. Armstrong	**Practitioner Registration No.** 54,967

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

☑ * Total of 1 forms are submitted.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
(Case No.: 04-0401-CON1014D)
(MBHB Docket No. 14-1800-CON2)

In the Application of:	)	
	)	
Millington	)	Art Unit: 2442
	)	
Serial No.: 14/516,867	)	Examiner: Survillo
	)	
Filed: October 17, 2014	)	Confirmation No. 9318
	)	
For: Obtaining Content from Remote Source For Playback	)	
	)	

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

RESPONSE TO THE FINAL OFFICE ACTION MAILED MARCH 9, 2015

Pursuant to 37 C.F.R. § 1.116 and the After Final Consideration Pilot Program 2.0, please consider the following **AMENDMENTS** and **REMARKS** in response to the Final Office Action mailed on March 9, 2015 in the above-captioned application.

AMENDMENTS TO THE CLAIMS begin on page 2.

REMARKS begin on page 9.

The Office is hereby authorized to charge any underpayment of fees or credit any overpayment of fees in connection with the prosecution of the above-captioned application to Deposit Account 13-2490.

AMENDMENTS TO THE CLAIMS

1-20. (Canceled)

21. (Currently Amended) A first playback device comprising:

a network interface; and

memory comprising program instructions that, when executed by a processor, cause the playback device to:

receive, via the network interface from a network device configured to control the first playback device and communicatively coupled to the first playback device over a local area network (LAN), control information comprising (i) one or more instructions ~~that cause~~ for the first playback device and a second playback device to playback audio information and (ii) an address identifying a network location of the audio information available at an audio information source, wherein the audio information source is outside of the LAN; and

in response to receiving the control information, (i) obtain, via the network interface from the audio information source outside of the LAN, the audio information; (ii) transmit, via the network interface of the first playback device to the second playback device, the audio information, playback timing information associated with the audio information, and device clock information of the first playback device; and (iii) play back the audio information in synchrony with the second playback device by using the playback timing information associated with the audio information to play back the audio information.

22. (Currently Amended) The first playback device of claim 21, wherein the program instructions, when executed by the processor, further cause the first playback device to:

generate the playback timing information ~~based on~~ associated with the audio information; and

generate the device clock time information of the first playback device.

~~transmit, to the second playback device, the timing information, and~~

~~wherein causing the first playback device to play back the audio information comprises causing the first playback device to play back the audio information according to the timing information.~~

23. (Currently Amended) The first playback device of claim 21, wherein device clocks of the first and second playback devices operate independently of each other. ~~the program instructions, when executed by the processor, further cause the first playback device to:~~

~~before transmitting the audio information to the second playback device, receive, from the network device, an instruction to join a synchrony group that includes the second playback device~~.

24. (Previously Presented) The first playback device of claim 23, wherein the program instructions, when executed by the processor, further cause the first playback device to:

transmit, to the network device, status information that comprises a status of the synchrony group.

25. (Previously Presented) The first playback device of claim 24, wherein the status information further comprises an identification of each playback device in the synchrony group.

26. (Previously Presented) The first playback device of claim 24, wherein the status information further comprises an identification of a master playback device of the synchrony group.

27. (Previously Presented) The first playback device of claim 26, wherein the first playback device is the master playback device of the synchrony group.

28. (Currently Amended) The first playback device of claim 24, wherein the status information further comprises an identification of one or more slave playback devices in the synchrony group, and wherein the second playback device is one of the one or more slave playback devices in the synchrony group.

29. (Currently Amended) The first playback device of claim 28, wherein ~~the second playback device is one of the one or more slave playback devices in the synchrony group~~ the audio information comprises a plurality of frames, wherein the playback timing information associated with the audio information comprises a playback time for each frame of the audio information, and wherein using the playback timing information associated with the audio information to play back the audio information comprises, for each frame of the audio information, playing back the frame when the device clock of the first playback device is the same as the playback time for the frame.

30. (Previously Presented) The playback device of claim 21, wherein the audio information comprises one of audio files or packetized streaming audio information.

31. (Previously Presented) The playback device of claim 21, wherein obtaining, from the audio information source outside of the LAN, the audio information, comprises obtaining, from the audio information source via the Internet, the audio information.

32. (Previously Presented) The playback device of claim 21, wherein obtaining, from the audio information source outside of the LAN, the audio information, comprises sending, to the audio information source, a request for the audio information.

33. (Currently Amended) A method comprising:

receiving, by a first playback device from a network device configured to control the first playback device and communicatively coupled to the first playback device over a local area network (LAN), control information comprising (i) one or more instructions ~~that cause~~ for the first playback device and a second playback device to playback audio information and (ii) an address identifying a location of the audio information available at an audio information source, wherein the audio information source is outside of the LAN; and

in response to receiving the control information (i) obtaining, by the first playback device from the audio information source outside of the LAN, the audio information; (ii) transmitting, by the first playback device to the second playback device, the audio information, playback timing information associated with the audio information, and device clock time information of the first playback device; and (iii) playing back, by the first playback device, the audio information in synchrony with the second playback device by using the timing information associated with the audio information to play back the audio information.

34. (Currently Amended) The method of claim 33, further comprising:

in response to receiving the control information, additionally (i) generating, by the first playback device, the playback timing information ~~based on~~ associated with the audio information; and (ii) ~~transmitting, by the first playback device to the second playback device, the timing information, and wherein playing back the audio information comprises playing back the audio information according to the timing information~~ generating, by the first playback device, the clock time information of the first playback device.

35. (Currently Amended) The method of claim 33, wherein device clocks of the first and second playback devices operate independently of each other.

~~further comprising:~~

~~before transmitting the audio information to the second playback device, receiving, by the first playback device from the network device, an instruction to join a synchrony group that includes the second playback device.~~

36. (Currently Amended) The method of claim 35, further comprising:

transmitting, by the first playback device to the network device, status information that comprises a status of the synchrony group, wherein the status information further comprises an identification of each playback device in the synchrony group.

37. (Currently Amended) The method of claim 35, wherein ~~the status information further comprises an identification of each playback device in the synchrony group~~ the audio information comprises a plurality of frames, wherein the playback timing information associated with the audio information comprises a playback time for each frame of the audio information,

and wherein using the playback timing information associated with the audio information to play back the audio information comprises, for each frame of the audio information, playing back the frame when the device clock of the first playback device is the same as the playback time for the frame.

38. (Currently Amended) The method of claim [[37]] 36, wherein the status information further comprises an identification of a master playback device of the synchrony group.

39. (Previously Presented) The method of claim 38, wherein the first playback device is the master playback device of the synchrony group.

40. (Currently Amended) A tangible non-transitory computer-readable medium having instructions stored thereon that when executed cause a first playback device to:

receive, from a network device configured to control the first playback device and communicatively coupled to the first playback device over a local area network (LAN), control information comprising (i) one or more instructions ~~that cause~~ for the first playback device and a second playback device to playback audio information and (ii) an address identifying a location of audio information available at an audio information source, wherein the audio information source is outside of the LAN; and

in response to receiving the control information, (i) obtain, from the audio information source outside of the LAN, the audio information; (ii) transmit, to the second playback device, the audio information, playback timing information associated with the audio information, and clock time information for the first playback device; and (iii) play back the audio information in

synchrony with the second playback device by using the timing information associated with the audio information to play back the audio information.

REMARKS

I. Status of the Claims

Claims 21-40 are pending. Claims 21, 33 and 40 are independent. In the present Response, and without conceding the merits of the rejections and in an earnest attempt to advance prosecution, Applicant has amended claims 21-23, 28-29, 33-38, and 40 to further clarify the claim language. For example, Applicant disagrees with the contention that no specific meaning can be attributed to the word "cause" because the word is undefined in the specification, and Applicant disagrees with the Examiner's interpretation of the word "cause" as having any meaning other than its ordinary and customary meaning. Office Action, pp. 2-4. The word "cause" is basic, fundamental word in the English language that any English-language speaker would understand within the context of the claim language, including English-language speakers having ordinary skill in the art at the time of the claimed inventions. Nevertheless, to advance prosecution and ease the burden of examination, Applicant has removed the word "cause" from the independent claims to obviate the Examiner's objections to this term. The subject matter of the amendments can be found generally throughout Applicant's originally-filed specification, including but not limited to ¶¶ 7-8, 28-38, 181, and 198 of Applicant's Patent Application Publication 2015/0039109. No new matter has been added.

The present amendments are made to expedite prosecution of this application to allowance. However, Applicant does not acquiesce in the Examiner's rejection of the originally-filed or previously-pending claims. Applicant reserves the right to pursue the subject matter of the originally-filed or previously-pending claims in one or more continuation applications.

II. Summary of the Final Office Action Mailed March 9, 2015

In the Final Office Action mailed on March 9, 2015, the Examiner rejected claims 21-40 under 35 U.S.C. § 103(a) as allegedly unpatentable over U.S. Pub. 2003/0073432 ("Meade") in view of U.S. Pub. 2007/0142944 ("Goldberg").

III. Summary of the Examiner Interview on May 11, 2015

A telephonic Examiner Interview took place on May 11, 2015. Participants included Examiner Oleg Survillo and Applicant's Representatives, Chris Butts and Jeff Armstrong. No demonstrations were conducted and no exhibits were shown. During the call, the participants discussed (i) claim 21, (ii) the § 103 rejections, (iii) the Meade, Goldberg, U.S. Pat. No. 6,816,818 ("Wolf"), U.S. Pub. No. 2002/0114354 ("Sinha"), U.S. Pub. No. 2004/0208158 ("Fellman"), U.S. Pub. No. 2002/0080783 ("Fujimori"), and U.S. Pub. No. 2004/0228367 ("Mosig") references, and (iv) proposed claim amendments. No agreement was reached.

IV. Response to the § 103 Rejections based on Meade and Goldberg

Applicant submits that amended claims 21, 33 and 40 are allowable over Meade and Goldberg for at least the reason that the cited references, individually or in combination, fail to teach or suggest all of the recited claim elements. For example, with reference to claim 21, Meade and Goldberg fail to teach or suggest at least "a first playback device" configured to "(ii) transmit…to the second playback device, the audio information, playback timing information associated with the audio information, and device clock information of the first playback device; and (iii) play back the audio information in synchrony with the second playback device by using

the playback timing information associated with the audio information to play back the audio information," as recited in claim 21.

Applicant's review of Meade found no teaching or suggestion of a playback device that transmits playback timing information to another playback device, and indeed, the Office Action does not cite Meade as teaching this aspect of the claim language. Office Action, p. 8. Thus, Meade fails to teach or suggest at least "a first playback device" configured to "(ii) transmit…to the second playback device, the audio information, playback timing information associated with the audio information, and device clock information of the first playback device; and (iii) play back the audio information in synchrony with the second playback device by using the playback timing information associated with the audio information to play back the audio information," as recited in claim 21.

The addition of Goldberg does not overcome the deficiency of Meade for at least two reasons. First, Goldberg is silent as to any sort of "device clock information of the first playback device," and thus, Goldberg cannot possibly teach or suggest "transmit[ting]…to the second playback device,…device clock information of the first playback device," as recited in claim 21. Second, and assuming solely for the sake of argument that Goldberg's synchronization signal suggests the claimed "playback timing information associated with the audio information," Goldberg is silent as to the first playback device "play[ing] back the audio information in synchrony with the second playback device by using the timing information associated with the audio information." At most, Goldberg explains "the synchronization signal can be the time stamp from the beginning of the music file to the current position of the music file being played on the broadcast unit…[or a] sample number that is currently being played on the broadcast unit 100." Goldberg, ¶¶ 201-203. But Goldberg only describes the receiving unit

(not the broadcast unit) as playing back audio based on the "synchronization signal." *Id.* Thus, like Meade, Goldberg also fails to teach or suggest "a first playback device" configured to "(ii) transmit…to the second playback device, the audio information, playback timing information associated with the audio information, and device clock information of the first playback device; and (iii) play back the audio information in synchrony with the second playback device by using the playback timing information associated with the audio information to play back the audio information," as recited in claim 21.

Because Meade and Goldberg, whether considered individually or in combination, fail to teach or suggest all of the elements recited in independent claim 21, Applicant submits that claim 21 is patentable over Meade and Goldberg. Additionally, because independent claims 33 and 40 recite elements similar to those recited in claim 21, Applicant submits that claims 33 and 40 are patentable over Meade and Goldberg for reasons similar to those set forth herein regarding claim 21. Furthermore, and without conceding the merits of the other rejections set forth in the Office Action, Applicant submits that the pending dependent claims are patentable over Meade and Goldberg for at least the reason that they depend from patentable independent claims.

V. The Additional References Discussed during the Examiner Interview Fail to Overcome the Deficiencies of Meade and Goldberg

The addition of Wolf, Sinha, Fellman, Fujimori, and/or Mosig would not overcome the deficiencies of Meade and Goldberg for at least the reason that Wolf, Sinha, Fellman, Fujimori, and Mosig also fail to teach or suggest "a first playback device" configured to "(ii) transmit…to the second playback device, the audio information, playback timing information associated with the audio information, and device clock information of the first playback device; and (iii) play back the audio information in synchrony with the second playback device by using the playback

timing information associated with the audio information to play back the audio information," as recited in claim 21.

Wolf discloses transmitting a "first clock signal and a second clock signal" to a "receiver module" and explains that the "receiver module" then (i) "selects the at least one first clock signal or the second clock signal as master synchronization signal for its synchronization," and (ii) "selects the clock signal identified as master synchronization signal for its synchronization and thus synchronizes itself with the clock signal operating with a higher degree of precision." Wolf, 2:16-29. However, neither the "first clock signal" nor the "second clock signal" in Wolf amounts to the "playback timing information" for at least the reasons that: (i) Wolf does not disclose any type of audio or other media information, (ii) neither of Wolf's first or second synchronization signals is "associated with [] audio information" as in the claims, and (iii) there is no teaching or suggestion of the source of Wolf's first and second clock signals using either the first or second clock signals to "play back the audio information," as recited in claim 21. Thus, like Meade and Goldberg, Wolf also fails to teach or suggest "a first playback device" configured to "(ii) transmit…to the second playback device, the audio information, playback timing information associated with the audio information, and device clock information of the first playback device; and (iii) play back the audio information in synchrony with the second playback device by using the playback timing information associated with the audio information to play back the audio information," as recited in claim 21.

Sinha discloses "synchroniz[ing] one or more pairs of initially independent clocks over a communications link…to facilitate synchronous data transfers and/or consistent data transfer rates across a link where "[a] master side establishes a master transfer clock ***or*** a master network clock, and transmits information reflecting ***one*** of those clocks to a slave side." Sinha, ¶¶ 8, 12,

16 (emphasis added). As an initial matter, the synchronization is Sinha is related to "data transfers" -- not synchronization of audio or other media playback. Sinha is silent as to media playback, and thus, Sinha fails to teach or suggest "transmit[ting]…playback timing information associated with the audio information" or "play[ing] back the audio information in synchrony with the second playback device by using the playback timing information associated with the audio information to play back the audio information," as recited in claim 21. Moreover, even assuming for the sake of argument that Sinha's master network clock or master transfer clock amounts to one of the claimed "playback timing information" or "device clock information of the first playback device," Sinha only discloses "transmit[ting] information reflecting ***one*** of those clocks to a slave side," Sinha, ¶ 16 (emphasis added), whereas claim 21 recites transmitting both "playback timing information associated with the audio information, and device clock information of the first playback device" to the second playback device. Thus, like Meade, Goldberg, and Wolf, Sinha also fails to teach or suggest "a first playback device" configured to "(ii) transmit…to the second playback device, the audio information, playback timing information associated with the audio information, and device clock information of the first playback device; and (iii) play back the audio information in synchrony with the second playback device by using the playback timing information associated with the audio information to play back the audio information," as recited in claim 21.

Fellman discloses a "synchronization mechanism [that] may use two types of synchronization signals: a fine resolution synchronization signal and a coarse-resolution synchronization signal." Fellman, ¶ 30. As an initial matter, Fellman does not describe either the fine or coarse-resolution synchronization signals in connection with audio or other media playback, and thus, neither the fine or coarse-resolution synchronization signal amounts to the

claimed "playback timing information associated with the audio information." And while Fellman describes "a master timing device" that sends the two types of signals to a "slave device," there is no teaching or suggestion in Fellman that the master device plays audio or any other media based on either the fine or coarse resolution synchronization signals, and thus, Fellman fails to teach or suggest "play[ing] back the audio information in synchrony with the second playback device by using the playback timing information associated with the audio information to play back the audio information," as recited in claim 21. Therefore, like Meade, Goldberg, Wolf, and Sinha, Fellman also fails to teach or suggest "a first playback device" configured to "(ii) transmit…to the second playback device, the audio information, playback timing information associated with the audio information, and device clock information of the first playback device; and (iii) play back the audio information in synchrony with the second playback device by using the playback timing information associated with the audio information to play back the audio information," as recited in claim 21.

Fujimori discloses a system with a "clock master node" and "a plurality of nodes" where (1) "a word clock master node…transmits a reference time stamp to each of the nodes (slave nodes) every predetermined cycle," and (2) "of the slave nodes, a transmitting node [(i)] reads out an audio waveform signal, on the basis of the reference time stamp, from the clock master node and [(ii)] generates a transmission time stamp indicative of a transmission time, so as to transmit, to the communication network, audio data along with the thus-generated transmission time stamp." Fujimori, ¶ 2. In operation, Fujimori's "[r]eceiving node also performs real-time audio data reproduction, on the basis of the time stamp and audio data transmitted from the transmitting node, in synchronism with the reference time stamp [transmitted from the clock master node]." *Id*. Because Fujimori's "clock master node" transmits the "reference time

stamp" and Fujimori's "transmitting node" transmits the "audio data along with the thus-generated transmission time stamp," neither Fujimori's "clock master node" nor Fujimori's "transmitting node" amounts to the claimed "first playback device" because neither the "clock master node" nor the "transmitting node" transmits all three of "the audio information, playback timing information associated with the audio information, and device clock information of the first playback device," as in claim 21. And while Fujimori states that the "master nodes…can have other necessary functions than the master clock generating function, such as a tone generating function and performance data generating function," Fujimori, ¶ 37, Fujimori never describes a "master node" that "play[s] back the audio information in synchrony with the second playback device by using the playback timing information associated with the audio information to play back the audio information," as recited in claim 21. Therefore, like Meade, Goldberg, Wolf, Sinha, and Fellman, Fujimori also fails to teach or suggest "a first playback device" configured to "(ii) transmit…to the second playback device, the audio information, playback timing information associated with the audio information, and device clock information of the first playback device; and (iii) play back the audio information in synchrony with the second playback device by using the playback timing information associated with the audio information to play back the audio information," as recited in claim 21.

Mosig describes "two different embodiments" of an audio playback system having a media source and multiple media sinks. Mosig, ¶¶ 11, 47; Fig 1. "In both embodiments a common play-out time is determined and associated to each media data packet and the media data packet is played-out by a media sink exactly at this common play-out time." *Id.* "In the first embodiment, the common play-out time is determined by the media sinks by adding a play-out time offset to the time indicated by a timestamp of a media data packet." *Id.* "The ***play-out***

time offset is determined by the media source and transmitted to the media sinks." *Id.* (emphasis added). "In the second embodiment, the ***common play-out time*** is determined by the media source for each packet and sent out together with each media data packet in form of a corresponding timestamp." *Id.* (emphasis added). Neither the play-out time offset nor the common play-out time that the media source sends to each media sink in the first and second embodiments, respectively, amount to "device clock information of the first playback device," as recited in claim 21. First, instead of "device clock information," the play-out time offset that the media source sends to each media sink in the first embodiment is an offset that each media sink adds to a timestamp in each received media packet to determine a common play-out time for each received packet. Mosig, ¶ 47. In the second embodiment, the common play-out time that the media source sends to each media sink is also not "device clock information of the first playback device." Instead, the common play-out time is the time when each media sink plays out a particular media data packet. Mosig, ¶ 11. Because Mosig fails to disclose "device clock information," Mosig cannot possibly teach or suggest "transmit[ting]…to the second playback device,…device clock information of the first playback device." Therefore, like Meade, Goldberg, Wolf, Sinha, Fellman, and Fujimori, Mosig also fails to teach or suggest "a first playback device" configured to "(ii) transmit…to the second playback device, the audio information, playback timing information associated with the audio information, and device clock information of the first playback device; and (iii) play back the audio information in synchrony with the second playback device by using the playback timing information associated with the audio information to play back the audio information," as recited in claim 21.

Because Meade and Goldberg, whether considered individually or in combination, do not teach or suggest "a first playback device" configured to "(ii) transmit…to the second playback

device, the audio information, playback timing information associated with the audio information, and device clock information of the first playback device; and (iii) play back the audio information in synchrony with the second playback device by using the playback timing information associated with the audio information to play back the audio information," as recited in claim 21 as described in Section IV, and because the addition of Wolf, Sinha, Fellman, Fujimori, and/or Mosig would not overcome at least this deficiency of Meade and Goldberg, Applicant submits that claim 21 is patentable over Meade, Goldberg, Wolf, Sinha, Fellman, Fujimori, and Mosig. Additionally, because independent claims 33 and 40 recite elements similar to those recited in claim 21, Applicant submits that claims 33 and 40 are patentable over Meade, Goldberg, Wolf, Sinha, Fellman, Fujimori, and Mosig for reasons similar to those set forth herein regarding claim 21. Furthermore, and without conceding the merits of the other rejections set forth in the Office Action, Applicant submits that the pending dependent claims are patentable over Meade, Goldberg, Wolf, Sinha, Fellman, Fujimori, and Mosig for at least the reason that they depend from patentable independent claims.

VI. Conclusion

Applicant submits that the application is in condition for allowance, and Applicant respectfully requests a Notice of Allowance. If further discussion would advance the application to issuance, the Examiner is invited to telephone the undersigned at 312-913-0001.

Respectfully submitted,
McDonnell Boehnen Hulbert & Berghoff LLP

Date: May 11, 2015

By: /Jeffrey P. Armstrong/
Jeffrey P. Armstrong
Reg. No. 54,967

Electronic Acknowledgement Receipt

EFS ID:	22315679
Application Number:	14516867
International Application Number:	
Confirmation Number:	9318
Title of Invention:	Obtaining Content from Remote Source for Playback
First Named Inventor/Applicant Name:	Nicholas A.J. Millington
Customer Number:	107361
Filer:	Jeffrey Armstrong
Filer Authorized By:	
Attorney Docket Number:	04-0401-CON1014D
Receipt Date:	11-MAY-2015
Filing Date:	17-OCT-2014
Time Stamp:	22:50:31
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	After Final Consideration Program Request	14_1800_CON2_AFCP_Request.pdf	134643 c94e22f0c6eb11a9d6b3130711ffc633345f3a4f	no	1
Warnings:					
Information:					

2		14_1800_CON2_Response.pdf	156434 b3ebe477996c5003ba60791fc3ba00768313ff7f	yes	18

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Response After Final Action	1	1
	Claims	2	8
	Applicant Arguments/Remarks Made in an Amendment	9	18

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PTO/SB/06 (09-11)
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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 14/516,867	Filing Date 10/17/2014	☐ To be Mailed

ENTITY: ☒ LARGE ☐ SMALL ☐ MICRO

APPLICATION AS FILED – PART I

	(Column 1)	(Column 2)		
FOR	NUMBER FILED	NUMBER EXTRA	RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).			
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL	

APPLICATION AS AMENDED – PART II

AMENDMENT	05/11/2015	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 20	Minus	** 20	= 0	X $80 =	0
	Independent (37 CFR 1.16(h))	* 3	Minus	***3	= 0	X $420 =	0
	☐ Application Size Fee (37 CFR 1.16(s))						
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
						TOTAL ADD'L FEE	0

AMENDMENT		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =	
	☐ Application Size Fee (37 CFR 1.16(s))						
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
						TOTAL ADD'L 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.

LIE
/BRENDA J. DENNY/

This collection of information is required by 37 CFR 1.16. 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, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
(Attorney Docket No. 04-0401-CON1014D (MBHB 14-1800-CON2))

In re Application of:	)	
	)	Confirmation No.: 9318
Sonos, Inc.	)	
	)	Group Art Unit: 2442
Serial No.: 14/516,867	)	
	)	Examiner: SURVILLO, OLEG
Filed: October 17, 2014	)	
	)	
Title: Obtaining Content from Remote Source for Playback	)	

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

REQUEST FOR CORRECTED FILING RECEIPT

Submitted with this request are (1) a statement under 37 CFR § 3.73(c); and (2) a Power of Attorney from the Applicant. Applicant requests registration of the Power of Attorney from the Applicant.

Respectfully submitted,

McDONNELL BOEHNEN
HULBERT & BERGHOFF LLP

Date: May 7, 2015

By: /Benjamin M. Urban/
Benjamin M. Urban
Registration No. 71591

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

Applicant/Patent Owner: Sonos, Inc.

Application No./Patent No.: 14/516,867 Filed/Issue Date: October 17, 2014

Titled: Obtaining Content from Remote Source for Playback

Sonos, Inc., a corporation

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

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

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

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

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

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

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

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

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

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

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

A. ☑ An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel 035518, Frame 0127, or for which a copy thereof is attached.

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

   1. From: _____ To: _____

      The document was recorded in the United States Patent and Trademark Office at

      Reel _____, Frame _____, or for which a copy thereof is attached.

   2. From: _____ To: _____

      The document was recorded in the United States Patent and Trademark Office at

      Reel _____, Frame _____, or for which a copy thereof is attached.

This collection of information is required by37 CFR3.73(b). The information is required toobtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentialityis governed by35 U.S.C. 122and 37 CFR1.11 and1.14. Thiscollection is estimated to take 12 minutes to complete, including gathering, preparing, and submittingthe 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 tothe Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS.**SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450**

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

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

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

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

/Benjamin M. Urban/	May 7, 2015
Signature	Date
Benjamin M. Urban	71591
Printed or Typed Name	Title or Registration Number

Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that yoube given certain informationin connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, pleasebe advised that: (1) the general authority forthe collection of thisinformation is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and(3) the principal purpose forwhich the information isused by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent applicationor patent. If you do not furnish the requested information,the U.S. Patent and Trademark Office may not be able to process and/or examineyour submission,which may result in termination of proceedings or abandonment of the applicationor expiration of the patent.

The informationprovided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the informationin order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an InternationalApplication filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, arecord may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from thissystem of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

PTO/AIA/80 (07-12)
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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.

POWER OF ATTORNEY TO PROSECUTE APPLICATIONS BEFORE THE USPTO

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

I hereby appoint:

■ Practitioners associated with Customer Number: 107361

OR

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

Name	Registration Number	Name	Registration Number

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

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

■ The address associated with Customer Number: 107361

OR

☐	Firm or Individual Name			
	Address			
	City		State	Zip
	Country			
	Telephone		Email	

Assignee Name and Address: Sonos, Inc, 223 E. De La Guerra St.
Santa Barbara, CA 93101

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

SIGNATURE of Assignee of Record

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

Signature	[signature]	Date	10/2/2012
Name	Mark Triplett	Telephone	(805) 965-3001
Title	Director, IP		

This collection of information is required by 37 CFR 1.31, 1.32 and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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

Electronic Acknowledgement Receipt	
EFS ID:	22286138
Application Number:	14516867
International Application Number:	
Confirmation Number:	9318
Title of Invention:	Obtaining Content from Remote Source for Playback
First Named Inventor/Applicant Name:	Nicholas A.J. Millington
Customer Number:	107361
Filer:	Benjamin Michael Urban
Filer Authorized By:	
Attorney Docket Number:	04-0401-CON1014D
Receipt Date:	07-MAY-2015
Filing Date:	17-OCT-2014
Time Stamp:	17:05:32
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Request for Corrected Filing Receipt	Sonos_04-0401-CON1014D_MBHB_14-1800-CON2_RequestForCorrectedFilingReceipt.pdf	81907 8810feb510e4f0fc13b27f35dd48a2daa7c63544	no	1

Warnings:
Information:

2	Assignee showing of ownership per 37 CFR 3.73	Sonos_04-0401-CON1014D_MBHB_14-1800-CON2_373c_statement.pdf	118175 471124bc9a08a3eb89456e7a5c6882cdc93676f7	no	3
Warnings:					
Information:					
3	Power of Attorney	Sonos_04-0401-CON1014D_MBHB_14-1800-CON2_POA.pdf	59138 06120be9da8cd654b320c9bf30d4fbd5fba620c1	no	1
Warnings:					
Information:					
		Total Files Size (in bytes):	259220		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
(Attorney Docket No. 04-0401-CON1014D (MBHB 14-1800-CON2))

In re Application of:		)
		) Confirmation No.: 9318
	Sonos Inc.	)
		) Group Art Unit: 2442
Serial No.:	14/516,867	)
		) Examiner: Survillo, Oleg
Filed:	October 17, 2014	)
		)
Title:	Obtaining Content from Remote Source for Playback	)

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

RESPONSE TO THE INFORMATIONAL NOTICE TO APPLICANT MAILED OCTOBER 27, 2014

Responsive to the Informational Notice mailed October 27, 2014, Applicant submits an executed inventor's declaration for the following inventors: Nicholas A.J. Millington.

Applicant believes that no fee is due. However, if a fee is due, the Office is authorized to charge the fee to Deposit Account 132490.

Respectfully submitted,

Dated: April 28, 2015

By: /Benjamin M. Urban/
Benjamin M. Urban
Reg. No. 71,591

McDONNELL BOEHNEN
HULBERT & BERGHOFF LLP
300 SOUTH WACKER DRIVE
CHICAGO, ILLINOIS 60606
TELEPHONE (312) 913-0001

Doc Code: Oath
Document Description: Oath or declaration filed

PTO/AIA/08 (06-12)
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DECLARATION FOR UTILITY OR DESIGN PATENT APPLICATION (37 CFR 1.63)

☐ Declaration Submitted With Initial Filing OR ■ Declaration Submitted After Initial Filing (surcharge (37 CFR 1.16(f)) required)

Attorney Docket Number	04-0401-CON1014D (MBHB 14-1800-CON2)
First Named Inventor	Nicholas A.J. Millington
COMPLETE IF KNOWN	
Application Number	14/516,867
Filing Date	October 17, 2014
Art Unit	2442
Examiner Name	

Obtaining Content from Remote Source for Playback

(Title of the Invention)

As a below named inventor, I hereby declare that:

This declaration is directed to:

☐ The attached application,

OR

■ United States Application Number or PCT International application number 14/516,867 filed on October 17, 2014.

The above-identified application was made or authorized to be made by me.

I believe I am the original inventor or an original joint inventor of a claimed invention in the application.

I hereby acknowledge that any willful false statement made in this declaration is punishable under 18 U.S.C. 1001 by fine or imprisonment of not more than five (5) years, or both.

Authorization To Permit Access To Application by Participating Office

☐ If checked, the undersigned hereby grants the USPTO authority to provide the European Patent Office (EPO), the Japan Patent Office (JPO), the Korean Intellectual Property Office (KIPO), the World Intellectual Property Office (WIPO), and any other intellectual property offices in which a foreign application claiming priority to the above-identified patent application is filed access to the above-identified patent application. See 37 CFR 1.14(c) and (h). This box should not be checked if the applicant does not wish the EPO, JPO, KIPO, WIPO, or other intellectual property office in which a foreign application claiming priority to the above-identified patent application is filed to have access to the above-identified patent application.

In accordance with 37 CFR 1.14(h)(3), access will be provided to a copy of the above-identified patent application with respect to: 1) the above-identified patent application-as-filed; 2) any foreign application to which the above-identified patent application claims priority under 35 U.S.C. 119(a)-(d) if a copy of the foreign application that satisfies the certified copy requirement of 37 CFR 1.55 has been filed in the above-identified patent application; and 3) any U.S. application-as-filed from which benefit is sought in the above-identified patent application.

In accordance with 37 CFR 1.14(c), access may be provided to information concerning the date of filing the Authorization to Permit Access to Application by Participating Offices.

This collection of information is required by 35 U.S.C. 115 and 37 CFR 1.63. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 21 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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DECLARATION — Utility or Design Patent Application

Direct all correspondence to:	■	The address associated with Customer Number:	107361	OR	☐ Correspondence address below

Name		
Address		
City	State	Zip
Country	Telephone	Email

WARNING:

Petitioner/applicant is cautioned to avoid submitting personal information in documents filed in a patent application that may contribute to identity theft. Personal information such as social security numbers, bank account numbers, or credit card numbers (other than a check or credit card authorization form PTO-2038 submitted for payment purposes) is never required by the USPTO to support a petition or an application. If this type of personal information is included in documents submitted to the USPTO, petitioners/applicants should consider redacting such personal information from the documents before submitting them to the USPTO. Petitioner/applicant is advised that the record of a patent application is available to the public after publication of the application (unless a non-publication request in compliance with 37 CFR 1.213(a) is made in the application) or issuance of a patent. Furthermore, the record from an abandoned application may also be available to the public if the application is referenced in a published application or an issued patent (see 37 CFR 1.14). Checks and credit card authorization forms PTO-2038 submitted for payment purposes are not retained in the application file and therefore are not publicly available. Petitioner/applicant is advised that documents which form the record of a patent application (such as the PTO/SB/01) are placed into the Privacy Act system of records DEPARTMENT OF COMMERCE, COMMERCE-PAT-7, System name: *Patent Application Files* . Documents not retained in an application file (such as the PTO-2038) are placed into the Privacy Act system of COMMERCE/PAT-TM-10, System name: *Deposit Accounts and Electronic Funds Transfer Profiles* .

LEGAL NAME OF SOLE OR FIRST INVENTOR:

(*E.g.*, Given Name (first and middle (if any)) and Family Name or Surname)

Nicholas A.J. Millington

Inventor's Signature: Nicholas Millington (Mar 6, 2015)	Date (Optional): 3/6/2015

Residence: City: Santa Barbara	State: CA	Country: US

Mailing Address: 223 East De La Guerra

City: Santa Barbara	State: CA	Zip: 93101	Country: US

☐ Additional inventors are being named on the _____ supplemental sheet(s) PTO/AIA/10 attached hereto

Electronic Acknowledgement Receipt	
EFS ID:	22193804
Application Number:	14516867
International Application Number:	
Confirmation Number:	9318
Title of Invention:	Obtaining Content from Remote Source for Playback
First Named Inventor/Applicant Name:	Nicholas A.J. Millington
Customer Number:	107361
Filer:	Benjamin Michael Urban
Filer Authorized By:	
Attorney Docket Number:	04-0401-CON1014D
Receipt Date:	28-APR-2015
Filing Date:	17-OCT-2014
Time Stamp:	16:36:57
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Applicant Response to Pre-Exam Formalities Notice	04-0401-CON1014D_MBHB_14-1800-CON2_Response_to_Informational_Notice.pdf	124629 49831f2757c4f998506e3eee326aad1a60260ef4	no	1
Warnings:					
Information:					

2	Oath or Declaration filed	Sonos_04-0401-CON1014D_Declaration_MBHB_14-1800-CON2.pdf	943542 6ffb98fd83d57741e0877ed79139f7dbf5eca3ed	no	2
Warnings:					
Information:					
			Total Files Size (in bytes):	1068171	

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT
(Not for submission under 37 CFR 1.99)

Application Number	14516867
Filing Date	10-17-2014
First Named Inventor	MILLINGTON; Nicholas A.J.
Art Unit	2442
Examiner Name	SURVILLO, OLEG
Attorney Docket Number	04-0401-CON1014D

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	5153579		1992-10-06	FISCH; Kenneth D. et al.	
	2	7206967		2007-04-17	MARTI; Philippe et al.	
	3	7711774		2010-05-04	ROTHSCHILD; Leigh M.	

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Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20010046235		2001-11-29	TREVITT; Stephen et al.	
	2	20020173273		2002-11-21	SPURGAT; Jeffrey Jonathan et al.	
	3	20040098754		2004-05-20	VELLA; Zane et al.	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	14516867
	Filing Date	10-17-2014
	First Named Inventor	MILLINGTON; Nicholas A.J.
	Art Unit	2442
	Examiner Name	SURVILLO, OLEG
	Attorney Docket Number	04-0401-CON1014D

	4	20050062637		2005-03-24	EL; Zabadani Hicham Mahmoud et al.	
	5	20130022221		2013-01-24	KALLAI; Christopher et al.	

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Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1	2338374	GB		1999-12-15	MOTOROLA LTD.		☐
	2	07-210129	JP		1995-08-11	INTERNAT'L BUSINESS MACH CORP (IBM)	Abstract only	☒
	3	2005108427	JP		2005-04-21	RICOH KK.		☐

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NON-PATENT LITERATURE DOCUMENTS Remove

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
	1	"Advisory Action mailed on 2 March 2015, issued in connection with U.S. Patent Application No. 13/848932, filed on March 22, 2013, 3 pages.".	☐
	2	"Advisory Action mailed on 26 February 2015, issued in connection with U.S. Patent Application No. 14/184,528, filed on 19 February 2014, 3 pages.".	☐

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	14516867
	Filing Date	10-17-2014
	First Named Inventor	MILLINGTON; Nicholas A.J.
	Art Unit	2442
	Examiner Name	SURVILLO, OLEG
	Attorney Docket Number	04-0401-CON1014D

	3	"Final Office Action mailed on 11 February 2015, issued in connection with U.S. Patent Application No. 14/184526, filed on 19 February 2014, 13 pages".	☐
	4	"Final Office Action mailed on 11 February 2015, issued in connection with U.S. Patent Application No. 14/184,935, filed on 20 February 2014, 17 pages".	☐
	5	"Final Office Action mailed on 12 February 2015, issued in connection with U.S. Patent Application No. 14/184522, filed on 19 February 2014, 20 pages".	☐
	6	"INTERNATIONAL BUREAU,"International Preliminary Report on Patentability" issued in connection with International Patent application No. PCT/US2013/046372, mailed December 31, 2014, 5 pages.".	☐
	7	"International Preliminary Report on Patentability and Written Opinion, issued by the International Searching Authority in connection with International Patent Application No. PCT/US2013/046386, mailed on January 8, 2015, 8 pages".	☐
	8	"Non-Final Office Action mailed on 26 February 2015, issued in connection with U.S. Patent Application No. 14/186,850, filed on 21 February 2014, 25 pages.".	☐
	9	"Non-Final Office Action mailed on 30 January 2015, issued in connection with U.S. Patent Application No. 14/504,812, filed on 2 October 2014, 13 pages".	☐
	10	"Non-Final Office Action mailed on 30 January 2015, issued in connection with U.S. Patent Appliction No. 14/290,493, filed on 29 May 2014, 30 pages.".	☐
	11	Final Office Action mailed on 3 March 2015, issued in connection with U.S. Patent Application No. 13/864251, filed on 17 April 2013, 13 pages.	☐
	12	Final Office Action mailed on 4 March 2015, issued in connection with U.S. Patent Application No. 13/848904, filed on 22 March 2013, 16 pages.	☐
	13	Final Office Action mailed on 5 March 2015, issued in connection with U.S. Patent Application No. 13/888203, filed on 6 May 2013, 13 pages.	☐

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**		
	Application Number	14516867
	Filing Date	10-17-2014
	First Named Inventor	MILLINGTON; Nicholas A.J.
	Art Unit	2442
	Examiner Name	SURVILLO, OLEG
	Attorney Docket Number	04-0401-CON1014D

	14	Non-Final Office Action mailed on 4 March 2015, issued in connection with U.S. Patent Application No. 13/435776, filed on 30 March 2012, 16 pages.	☐
	15	Pre-Interview First Office Action mailed on 10 March 2015, issued in connection with U.S. Patent Application No. 14/505027, filed on 2 October 2014, 4 pages.	☐

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EXAMINER SIGNATURE

Examiner Signature		Date Considered	

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

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	14516867
	Filing Date	10-17-2014
	First Named Inventor	MILLINGTON; Nicholas A.J.
	Art Unit	2442
	Examiner Name	SURVILLO, OLEG
	Attorney Docket Number	04-0401-CON1014D

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☒ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☒ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☐ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Benjamin M. Urban/	Date (YYYY-MM-DD)	2015-03-12
Name/Print	Benjamin M. Urban	Registration Number	71,591

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(12) UK Patent Application (19) GB (11) 2 338 374 (13) A

(43) Date of A Publication 15.12.1999

(21) Application No 9812404.3

(22) Date of Filing 10.06.1998

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(51) INT CL[6]
G01S 5/06 , H04Q 7/38

(52) UK CL (Edition Q)
H4L LDSL L1H10
H4D DPAB D512 D536 D568 D576 D580 D584 D585

(56) Documents Cited

GB 2316823 A	**GB 2310098 A**	**GB 2250154 A**
EP 0733912 A2	**EP 0385600 A2**	**US 5327144 A**
US 5317323 A	**US 4916455 A**	**US 4698781 A**

(58) Field of Search
UK CL (Edition P) **H4D DPAB , H4L LDSL**
INT CL[6] **G01S 5/00 5/06 , H04Q 7/38**
ONLINE: WPI

(54) Abstract Title
Locating a mobile telephone using time of arrival measurements

(57) Apparatus and method for determining the location of a subscriber unit 1 in a mobile telecommunications network and particularly in a GSM cellular network, includes the provision of several receiver or "slave" stations 4, 5, 6, controlled by a "master" base transceiver station 2 and positioned at separate known locations within each cell. Each of the receiver slave stations 4, 5, 6, which are synchronised by means of an on-board GPS receiver clock (10 fig. 2), measures the time of arrival of a signal (e.g. fill frame) transmitted from the subscriber unit 1. The time of arrival measurements recorded by each "slave" station 4, 5, 6 are then transmitted (e.g. via SMS, GPRS or USSD) to a computation device 3 for computation of the subscriber unit's 1 location relative to the "slave" stations 4, 5, 6. The computation device 3 may be provided at the "master" station. In operation, the "master" station may on reception of a location request from the subscriber unit 1 or network, perform a rough estimate of the location of the unit 1 using GSM data (e.g. power measurement, timing advance data etc), decide which "slave" stations 4, 5, 6 to use in the location determination and then instruct the "slave" stations to start receiving signals and the subscriber unit 1 to transmit a signal burst. Power and signal quality estimates may be provided along with time of arrival and spatial or polarisation diversity techniques may be used to improve sensitivity,(e.g. reception of two successive signal bursts on different antennas at the slave stations).

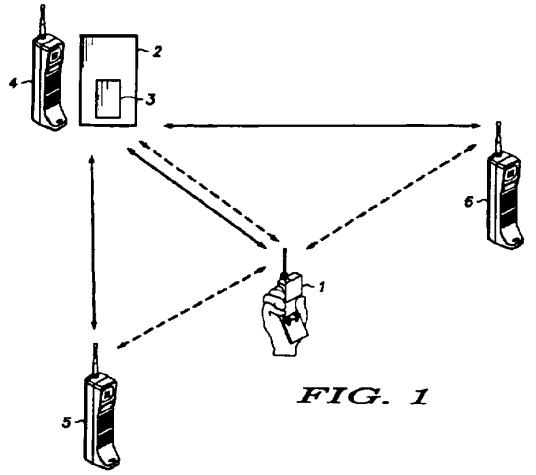

FIG. 1

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

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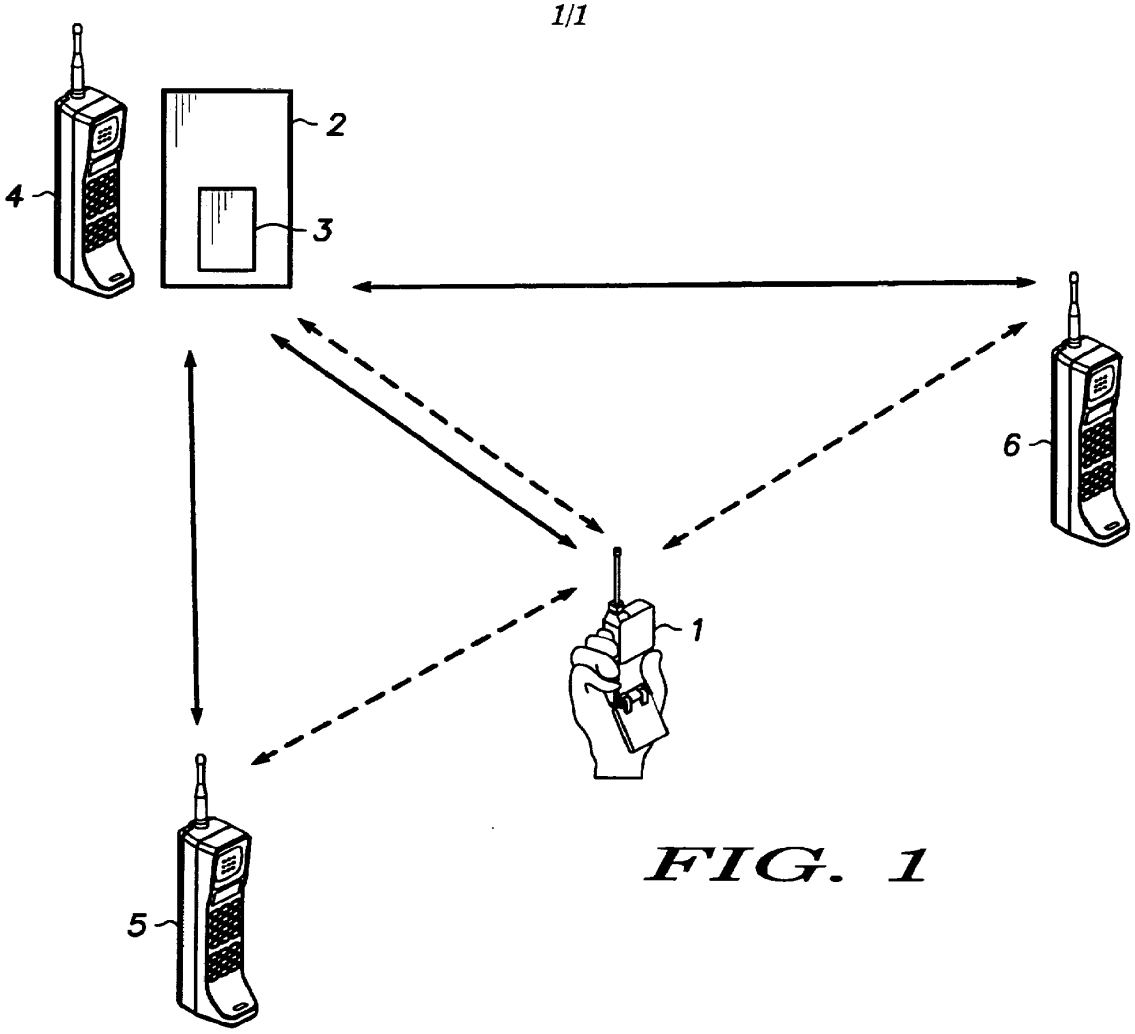
2
4
3
6
1
5

FIG. 1

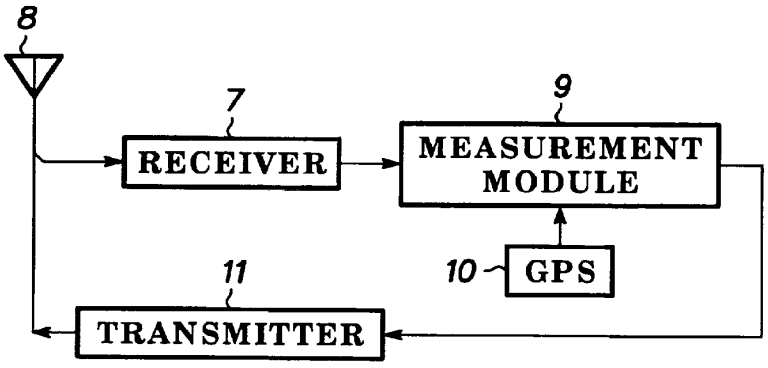
8
7
RECEIVER
9
MEASUREMENT MODULE
10
GPS
11
TRANSMITTER

FIG. 2

2338374

LOCATION APPARATUS AND METHOD IN A MOBILE TELECOMMUNICATIONS SYSTEM

This invention relates to determining location in mobile communication systems and particularly though not exclusively, to the cellular GSM system (Global System for Mobile Communications), a description of which can be found in the book "The GSM System for Mobile Communications" by M. Mouley and M. Pautet.

A cellular radio telephone radio system generally includes a switch controller coupled to the public switched telephone network (PSTN) and a plurality of base stations. Each of the plurality of base stations generally defines a geographic region or "cell" proximate to the base station to produce coverage areas. One or more mobile stations communicate with a base station that facilitates a call between the mobile station and the PSTN. The communication link over a carrier signal from the base station to a mobile station is referred to as the downlink. Conversely, the communication link from a mobile station to the base station is referred to as the uplink.

GSM networks are made up of mobile services switching centres, base station systems and mobile stations. These three entities can be broken down further into smaller entities such as within the base station system there are base station controllers, base transceiver stations and transcoders.

It may be advantageous to determine the location of a mobile station. For example, such information would be useful to emergency, tariffing services and traffic routing services. The accuracy required is dictated by the service for which location determination is needed. For example, for tariffing, an accuracy of 500 metres might be acceptable. However, for the purpose of locating the nearest restaurant, for example, an accuracy of less than 100 metres would be needed. The initial driving force for location

determination was the legislation brought out in the United States of America (known as E911) which requires that a mobile station can be located to within 125 metres for 67% of the time for the emergency services. This is to be introduced in stages and is expected to be operational by the year 2001. At present, in countries operating GSM networks there is no such legislation in place. However, the need for location determination in GSM systems is gaining momentum with a plethora of services being anticipated and also location-selective tariffing being proposed.

Most known methods of locating a mobile station in a mobile telecommunications network involve a calculation of the distances between three or more base stations and mobile stations. One known method of estimating the distance between a base station and a mobile station in a GSM network involves measuring the propagation delay incurred by the carrier signal during its return trip from the base station to a mobile station. (See for example, WO-A-9205672). Once the distance between three or more known fixed points and the mobile stations are known, the mobile station's relative position can be calculated. For example, the so-called "circle method" described in WO-A-9205672 is based on measurements of three independent distances. With three given known reference points in a plane, it is possible to establish the co-ordinates of any other point in the same plane using the distances between the reference points and the point in question.

Location of a mobile station by using the known technique based on measurements of propagation delay require that the mobile station is simultaneously visible to at least three base stations. Environmental constraints on the cellular network may not always make this possible.

The present invention seeks to remove this constraint.

In one aspect, the present invention consists of apparatus for determining the location of a mobile station in a mobile telecommunications system, the apparatus comprising:

a computation device,
a master station, and
a plurality of slave stations positioned at known locations,

in which the master station incorporates a transmitter and a receiver for communicating with the mobile station and with the plurality of slave stations,

and in which each slave station incorporates a clock, a receiver for receiving signals from the mobile station, measuring means for measuring the time of arrival of the signals, and a transmitter for facilitating transmission of the time of arrival measurements to the computation device for calculating the location of the mobile station.

The computation device may be located at the master station or at some other remote location. Time of arrival measurements may be transmitted directly to such a remote location or via the master station.

The master station may, in part, comprise a conventional base transceiver station fitted with additional components in accordance with the invention.

The slave stations may comprise a modified form of radio telecommunication handset and may, conveniently, be mounted at the top of lamp posts, for example.

The clock required by each slave station could comprise part of a commercially available GPS receiver (Global Positioning System).

Hence the invention advantageously requires only relatively inexpensive equipment additional to the mobile telecommunication infrastructure. Each base transceiver station in the network would preferably control a minimum of three slave stations (in order to give a reasonably accurate fix on the location of the mobile station) within the cell it serves. Conveniently, one could be co-located with the master station. The slave stations need only be small and can be mounted almost anywhere, preferably at a site with an electrical power supply. They could, of course, be powered by battery or solar cells. Another advantage is that they do not require a dedicated leased telecommunications line.

The invention provides the further advantage in that only one transceiver station needs to be used in the location process. Therefore, in large cells where there may be no or very weak signals from neighbouring base transceivers stations, location estimates can still be performed.

Further, by virtue of this invention, location determination by time of arrival measurements does not require time synchronisation of the entire telecommunications network. This would otherwise have to be done by the additional, complicated method of using a common clock, or establishing a reference station which calculates the time offsets between different components of the network. Using this invention, it is sufficient for just the slave stations peculiar to a cell to be synchronised.

The signals sent by the mobile station to the slave stations can be kept very simple in content, i.e. no large amount of data needs to be transmitted over the network. The signals may comprise conventional "fill-frames" for example.

Further, the data generated by the slave stations e.g. time of arrival measurements can be transmitted in SMS format (short message service), GPRS or USSD. This latter facet enables multiple measurements to be

made in order to improve the accuracy of the location computation without putting a prohibitive load on the network.

Hence the location apparatus of the present invention can be "overlaid" on an existing radio communications network and be invisible to it.

Initial control commands may originate from the master station (i.e. a serving base transceiver station in one particular embodiment) or the location procedure can be initiated either by the mobile station or by the controlling network components. (For example, a mobile switching centre).

The apparatus can be extended in the cellular network context so that any slave station can be used by any base transceiver station within range.

In a second aspect, the invention consists of a method for determining the location of a mobile station in a mobile telecommunication system, the method including the steps of:

receiving at a plurality of time-synchronised slave station, control signals from a master station,

receiving at each of the slave stations signals from the mobile station,

measuring at each of the slave stations the time of arrival of the signals, from the mobile station.

transmitting from each of the slave stations the time of arrival measurements to a computation device,

and computing in the computation device the location of the mobile station with respect to the slave stations according to the time of arrival measurements.

The method may further comprise the step, in the master station, of receiving a location request from either the mobile station or from a controlling element of the telecommunications network.

In a preferred embodiment, the master station designates particular slave stations for receiving signals from the mobile station and for performing the time of arrival measurements. It may also instruct the mobile station when, at a particular moment in time, to transmit a signal burst.

Some embodiments of the invention will now be described by way of example only, with reference to the drawings of which;

Figure 1 is a schematic diagram of location apparatus in accordance with the invention and incorporated in a GSM cellular network,

and Figure 2 is a schematic block diagram of the components of a slave station of Figure 1.

Referring then to Figure 1, a mobile station 1 is located in a cell served by a base transceiver station (BTS) 2. The BTS 2 incorporates a computation device 3. Co-located with the BTS 2 and powered therefrom is a first slave station 4. Two additional slave stations 5 and 6 are located within the cell and are remote from the BTS 2. Other slave stations may also be located in the cell but only two remote stations are shown here for clarity. Each slave station 4, 5, 6 comprises a modified handset.

The locations of the BTS 2 and all three slave station 4, 5, 6 are known. The location of the mobile station 1 is initially not known at all.

Communications links exist between mobile station 1 and the BTS 2 (on an uplink and a downlink), between the BTS 2 and the slave stations 4, 5, 6 (on

an uplink and a downlink) and between the mobile station 1 and the slave stations 4, 5, 6 (on an uplink only).

With reference to Figure 2, each slave station includes the following components. A receiver 7 connected to an antenna 8 receives signals from the mobile station 1. The output of the receiver 7 is fed to a first input of a measurement module 9. A second input of the measurement module is connected to the clock output of a conventional GPS receiver 10 for time synchronisation of each slave station.

The measurement module 9 performs time of arrival measurements on signals received from the mobile station 1 and feeds the measured values to a transmitter 11 for onward transmission via the antenna 8 to the computation device 3 in the BTS 2.

The BTS 2 and the mobile station 1 comprise, for the most part, conventional commercial equipment and function in the conventional manner in addition to facilitating the location operation.

The location apparatus of Figures 1 and 2 operates as follows.

The mobile station 1 (or alternatively the GSM network) initiates a location request to the BTS 2. The BTS 2 firstly on reception of the location request either directly or via the GSM network, performs a rough estimate of the position of the mobile station 1 by using data generic to the GSM system. Such data could include power measurement data, timing advance data, sector data, etc.

The BTS 2 then decides which slave stations are to be used in the location estimate. In this example, slave stations 4, 5 and 6 are to be used. The BTS 2 then checks the GPS clock 10 of the co-located slave station 4 and calculates a time for the designated slave stations to start receiving signals

from the mobile station 1. This time can be roughly synchronised with the GSM frame structure, timing advance, etc.

BTS 2 then contacts the relevant slave stations 4, 5, 6 via paging or SMS signal, to inform them of the start time of the receiving and measurement process, the frequency the mobile station 1 will transmit on and the GSM time slot. Optionally, each slave station 4, 5, 6 can confirm to the BTS that this message has arrived correctly.

The BTS 2 then instructs the mobile station 1 to transmit a signal burst. The slave stations now have knowledge of the frequency and timing parameters relating to this signal burst and are therefore able to measure time of arrival at the measurement module 9. As all slave stations are synchronised via the GPS receiver clock, the time of arrival measurements will be relatively accurate.

The slave stations 4, 5, 6 then each transmit their time of arrival measurements to the computation device 3 in the BTS 2 via an SMS message. Optionally, the slave stations 4, 5, 6 also transmit to the BTS 2 signal power estimate and signal quality estimate to assist in predicting the accuracy of the computed location of the mobile station 1.

The computation device 3 then calculates the mobile stations location (relative to the slave stations 4, 5, 6) by any one of several known methods, e.g. the aforementioned circle method.

As one of the slave stations 4 is co-located with the BTS 2, the BTS location can be used in the location calculation.

Finally, the BTS 2 transmits the computed location information to the network service provider via a mobile switching centre for example.

In an alternative embodiment, the computation device 3 is not located at the BTS 2 but at some other remote location. In this case the BTS 2 forwards the time of arrival measurement on to this remote location.

Location apparatus in accordance with this invention is less susceptible to interference than systems which rely on downlink measurements. This is because downlink measurements systems rely on receiving signals which originate well outside the serving cell.

The sensitivity of the invention may be improved by employing spatial or polarisation diversity techniques. E.g. by receiving and measuring two successive location signal bursts from the mobile station on different antennas incorporated in the slave stations.

CLAIMS

1. Apparatus for determining the location of a mobile station in a mobile telecommunications system, the apparatus comprising:

A computation device;
A master station, and
a plurality of slave stations positioned at known locations;

in which the master station incorporates a transmitter and a receiver for communicating with the mobile station and with the plurality of slave stations, and in which each slave station incorporates a clock, a receiver for receiving signals from the mobile station, measuring means for measuring the time of arrival of the signals and a transmitter for facilitating transmission of the time of arrival measurements to the computation device for calculating the location of the mobile station.

2. Apparatus as claimed in Claim 1 in which the master station includes a processor for performing an estimate of the location of the mobile station and for determining which slave stations to communicate with.

3. Apparatus as claimed in Claim 2 in which the processor is configured to generate transmission instructions to the mobile station.

4. A method for determining the location of a mobile station in a mobile telecommunications system, a method including the steps of:

receiving at a plurality of time-synchronised slave stations, control signals from a master station;

receiving at each of the slave stations, signals from the mobile station;

measuring at each of the slave stations, the time of arrival of the signals from the mobile station;

transmitting from each of the slave stations, the time of arrival measurements to a computation device;

and computing in the computation device, the location of the mobile station with respect to the slave stations according to the time of arrival measurements.

5. A method as claimed in Claim 4 and further comprising the step of:

in the master station receiving a location request from the mobile station.

6. A method as claimed in either of Claims 4 or 5 and further including the step of in the master station performing an estimate of the location of the mobile station and designating particular slave stations for receiving signals from the mobile station and for performing time of arrival measurements.

7. A method as claimed in any of Claims 4 to 6 and further including the step of in the master station instructing the mobile station when to transmit signals to the slave stations.

8. A method as claimed in claim 6 and including the further step of at each slave station transmitting a message to the master station confirming receipt of the destination message.

9. Apparatus for determining the location of a mobile station in a mobile telecommunications system substantially as hereinbefore described with reference to the drawings.

10. A method for determining the location of a mobile station in as mobile telecommunications system substantially hereinbefore described with reference to the drawings.

5

The Patent Office

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INVESTOR IN PEOPLE

Application No: GB 9812404.3 **Examiner:** Anita Keogh
Claims searched: 1-8 **Date of search:** 1 December 1998

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.P): H4D (DPAB), H4L (LDSL)

Int Cl (Ed.6): G01S (5/00, 5/06), H04Q (7/38)

Other: Online: WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X,Y	GB 2316823 A	(MOTOROLA) see whole document, especially page 2 line 24 to page 3 line 2 and figure 1.	X: 4 Y: 1
X,Y	GB 2310098 A	(WESBY) see whole document, especially page 4 line 1 to page 5 line 7 and page 6 lines 23-30	X: 4 Y: 1
X,Y	GB 2250154 A	(ROKE MANOR) see whole document especially page 19 line 23-page 22 line 15	X: 4 Y:1
X	EP 0733912 A2	(GEC) see whole document especially column 4 line 19 to column 5 line 37	1, 4, 7
X,Y	EP 0385600 A2	(ISC CARDION) see whole document	X: 4 Y: 1
X	US 5327144	(STILP et al.) See whole document, especially claim 1	4
X,Y	US 5317323	(KENNEDY et al.) See whole document especially col. 2 line 65 to col. 5 line 29	X: 4 Y: 1
X	US 4916455	(BENT et al.) See whole document, especially column 4 lines 9-41	4

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

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The Patent Office

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INVESTOR IN PEOPLE

Application No: GB 9812404.3 **Examiner:** Anita Keogh
Claims searched: 1-8 **Date of search:** 1 December 1998

Category	Identity of document and relevant passage	Relevant to claims
Y	US 4698781 (COCKERELL) see whole document	1

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.

LINKPLAY EXHIBIT 1002
Page 222 of 1434

PATENT ABSTRACTS OF JAPAN

(11)Publication number : 07-210129
(43)Date of publication of application : 11.08.1995

(51)Int.Cl. G09G 5/00
G09G 5/00

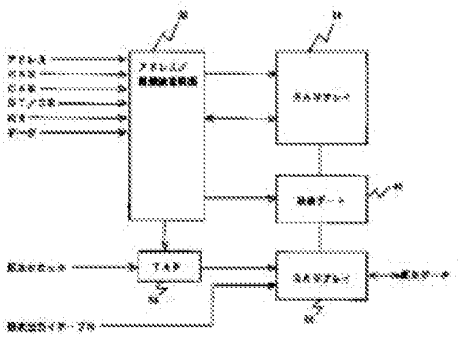
(21)Application number : 06-255216
(22)Date of filing : 20.10.1994

(71)Applicant : INTERNATL BUSINESS MACH CORP <IBM>
(72)Inventor : BATES MATTHEW D
WEST RODERICK M P

(30)Priority
Priority number : 93 175874 Priority date : 30.12.1993 Priority country : US

(54) SELF-TIMING TYPE REAL-TIME DATA TRANSFER FOR VIDEO RAM

(57)Abstract:
PURPOSE: To easily and efficiently eliminate the need of a complicated high- speed circuit from a VRAM base memory subsystem for making real-time data transfer.
CONSTITUTION: A video RAM semiconductor memory device is constituted of a RAM array 10 having address inputs for inputting row addresses, column addresses, and target addresses and a sequential access array 20 having a sequential output port. The video RAM is provided with an address/control logic circuit 30 which detects stimulation, such as the RAS clock, indicating the rough timing for data transfer between the arrays 10 and 20 from an external controller. The circuit 30 supplies a control signal which is internally synchronized to a sequential clock and the control signal is generated during the period during which the value of a tap point is equal to a value which is smaller than a target programmable value or input target address by '1'. Therefore, the row in the array 10 corresponding to an input row address is transferred between the arrays 10 and 20.



LINKPLAY EXHIBIT 1002
Page 223 of 1434

(19)日本国特許庁（ＪＰ）　(12) **公開特許公報**（Ａ）　(11)特許出願公開番号

特開平7－210129

(43)公開日　平成７年(1995)８月11日

(51)Int.Cl.[6]	識別記号	庁内整理番号	ＦＩ	技術表示箇所
Ｇ０９Ｇ　5/00	５５０　Ｍ	9471－5G		
	５５５　Ｋ	9471－5G		

審査請求　有　　請求項の数55　ＯＬ　（全 12 頁）

(21)出願番号　特願平6－255216

(22)出願日　平成６年(1994)10月20日

(31)優先権主張番号　１７５８７４

(32)優先日　1993年12月30日

(33)優先権主張国　米国（ＵＳ）

(71)出願人　390009531
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(74)代理人　弁理士　合田　潔　（外２名）

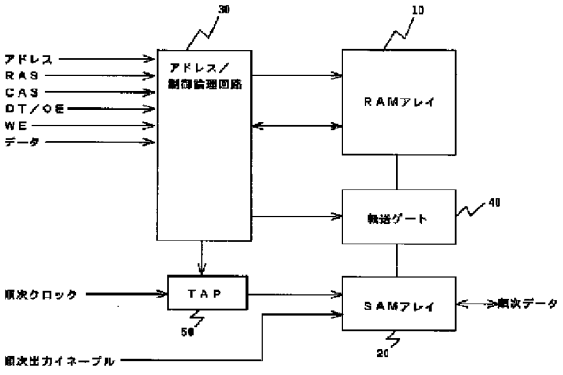
最終頁に続く

(54)【発明の名称】　ビデオＲＡＭにおける自己タイミング式リアルタイム・データ転送

(57)【要約】

【目的】　ＶＲＡＭベース・メモリ・サブシステムに使用されるリアルタイム・データ転送に関連する複雑で高速な回路の必要を簡単かつ効率的に除去すること。

【構成】　ビデオＲＡＭ半導体メモリ・デバイスが、行アドレス、列アドレスおよび目標アドレスを入力するためのアドレス入力を有するＲＡＭアレイと、順次出力ポートを有する順次アクセス・アレイから構成される。このビデオＲＡＭは、ＲＡＭアレイと順次アクセス・アレイの間のデータ転送のための粗タイミング位置を示す外部コントローラからのＲＡＳクロックなどの刺激を検出するアドレス／制御論理回路を有する。制御論理回路は、内部的に順次クロックと同期化される制御信号を供給し、この制御信号は、タップ・ポインタがプログラム可能目標値または入力目標アドレスより１つ小さい値に等しい期間の間に発生する。これによって、入力行アドレスに対応するＲＡＭアレイ内の行が、ＲＡＭアレイと順次アクセス・アレイの間で転送される。



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【特許請求の範囲】

【請求項１】データ転送を指令する刺激を外部コントローラから受け取るステップと、

タップ・ポインタがプログラム可能な目標値と等しい期間の間にＲＡＭ内の１行から順次アクセス・メモリへの、内部的に順次クロックに同期化されたデータ転送を実行するステップとを含む、ＲＡＭ、順次アクセス・メモリおよびタップ・ポインタを有するビデオＲＡＭ半導体メモリ・デバイス内での自己タイミング式データ転送の方法。

【請求項２】刺激が、データ転送信号の状態遷移であることを特徴とする、請求項１に記載のビデオＲＡＭ半導体メモリ・デバイス内での自己タイミング式データ転送の方法。

【請求項３】転送されるデータが、前の順次アクセス・メモリ内容より１つ大きい行アドレスを有するＲＡＭ行に含まれるデータであることを特徴とする、請求項１に記載のビデオＲＡＭ半導体メモリ・デバイス内での自己タイミング式データ転送の方法。

【請求項４】さらに、アドレス入力に存在する行アドレスを読み取るステップを含む、請求項１に記載のビデオＲＡＭ半導体メモリ・デバイス内での自己タイミング式データ転送の方法。

【請求項５】転送されるデータが、行アドレスに対応するＲＡＭ行に含まれるデータであることを特徴とする、請求項４に記載のビデオＲＡＭ半導体メモリ・デバイス内での自己タイミング式データ転送の方法。

【請求項６】刺激が、データ転送信号がイネーブル状態である時のＲＡＳの状態遷移であることを特徴とする、請求項４に記載のビデオＲＡＭ半導体メモリ・デバイス内での自己タイミング式データ転送の方法。

【請求項７】プログラム可能な目標値が、事前に選択された値にセットされることを特徴とする、請求項４に記載のビデオＲＡＭ半導体メモリ・デバイス内での自己タイミング式データ転送の方法。

【請求項８】データ転送を実行するステップが、列アドレスを事前に選択された値にセットするステップと、タップ・ポインタに列アドレスをロードするステップとを含むことを特徴とする、請求項１に記載のビデオＲＡＭ半導体メモリ・デバイス内での自己タイミング式データ転送の方法。

【請求項９】さらに、アドレス入力に存在する列アドレスを読み取るステップを含む、請求項１に記載のビデオＲＡＭ半導体メモリ・デバイス内での自己タイミング式データ転送の方法。

【請求項１０】プログラム可能な目標値が、事前に選択された値にセットされることを特徴とする、請求項９に記載のビデオＲＡＭ半導体メモリ・デバイス内での自己タイミング式データ転送の方法。

【請求項１１】プログラム可能な目標値が、列アドレス

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より１つ小さい値にセットされることを特徴とする、請求項９に記載のビデオＲＡＭ半導体メモリ・デバイス内での自己タイミング式データ転送の方法。

【請求項１２】列アドレスが、０であることを特徴とする、請求項１１に記載のビデオＲＡＭ半導体メモリ・デバイス内での自己タイミング式データ転送の方法。

【請求項１３】列アドレスを読み取るステップが、第１入力信号の状態の変化に応答して発生することを特徴とする、請求項９に記載のビデオＲＡＭ半導体メモリ・デバイス内での自己タイミング式データ転送の方法。

【請求項１４】第１入力信号が、ＣＡＳであることを特徴とする、請求項１３に記載のビデオＲＡＭ半導体メモリ・デバイス内での自己タイミング式データ転送の方法。

【請求項１５】データ転送を実行するステップが、タップ・ポインタに列アドレスをロードするステップを含むことを特徴とする、請求項９に記載のビデオＲＡＭ半導体メモリ・デバイス内での自己タイミング式データ転送の方法。

【請求項１６】さらに、アドレス入力に存在する目標アドレスを読み取るステップを含む、請求項４に記載のビデオＲＡＭ半導体メモリ・デバイス内での自己タイミング式データ転送の方法。

【請求項１７】プログラム可能な目標値が、目標アドレスより１つ小さい値にセットされることを特徴とする、請求項１６に記載のビデオＲＡＭ半導体メモリ・デバイス内での自己タイミング式データ転送の方法。

【請求項１８】データ転送を実行するステップが、列アドレスを事前に選択された値にセットするステップと、タップ・ポインタに列アドレスをロードするステップとを含むことを特徴とする、請求項１７に記載のビデオＲＡＭ半導体メモリ・デバイス内での自己タイミング式データ転送の方法。

【請求項１９】目標が、０に等しいことを特徴とする、請求項１７に記載のビデオＲＡＭ半導体メモリ・デバイス内での自己タイミング式データ転送の方法。

【請求項２０】さらに、アドレス入力に存在する列アドレスを読み取るステップを含む、請求項１７に記載のビデオＲＡＭ半導体メモリ・デバイス内での自己タイミング式データ転送の方法。

【請求項２１】列アドレスを読み取るステップが、第１入力信号の状態の変化に応答して発生することを特徴とする、請求項２０に記載のビデオＲＡＭ半導体メモリ・デバイス内での自己タイミング式データ転送の方法。

【請求項２２】第１入力信号が、ＣＡＳであることを特徴とする、請求項２１に記載のビデオＲＡＭ半導体メモリ・デバイス内での自己タイミング式データ転送の方法。

【請求項２３】データ転送を実行するステップが、タップ・ポインタに列アドレスをロードするステップを含む

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ことを特徴とする、請求項２０に記載のビデオＲＡＭ半導体メモリ・デバイス内での自己タイミング式データ転送の方法。

【請求項２１】目標アドレスを読み取るステップが、第２入力信号の状態が変化する時に発生することを特徴とする、請求項１６に記載のビデオＲＡＭ半導体メモリ・デバイス内での自己タイミング式データ転送の方法。

【請求項２５】第２入力信号が、データ転送信号であることを特徴とする、請求項２４に記載のビデオＲＡＭ半導体メモリ・デバイス内での自己タイミング式データ転送の方法。

【請求項２６】行アドレスの読取りが、第３入力信号の状態が変化する時に発生することを特徴とする、請求項４に記載のビデオＲＡＭ半導体メモリ・デバイス内での自己タイミング式データ転送の方法。

【請求項２７】第３入力信号が、ＲＡＳであることを特徴とする、請求項２６に記載のビデオＲＡＭ半導体メモリ・デバイス内での自己タイミング式データ転送の方法。

【請求項２８】さらに、順次アクセス・メモリの内容を直列ポートから出力するステップを含む、請求項４に記載のビデオＲＡＭ半導体メモリ・デバイス内での自己タイミング式データ転送の方法。

【請求項２９】出力のステップが、データ転送を実行するステップの後に発生する最初の順次クロック・サイクルの立ち上がりエッジに応答して開始されることを特徴とする、請求項２８に記載のビデオＲＡＭ半導体メモリ・デバイス内での自己タイミング式データ転送の方法。

【請求項３０】ＲＡＭアレイと、

直列出力ポートを有する順次アクセス・アレイと、

アドレスを入力するためのアドレス入力と、

ＲＡＭアレイと順次アクセス・アレイとの間でのデータ転送の粗いタイミング位置を示す、外部コントローラからの刺激を検出するための感知手段と、

感知手段が刺激を検出するのに応答して、ＲＡＭアレイと順次アクセス・アレイとの間でのデータ転送を指令する制御信号を出力することを特徴とし、順次クロックに同期化され、タップ・ポインタがプログラム可能な目標値より１つ小さい値に等しい期間の間発生する制御信号を供給するための、制御論理回路と、

制御論理回路によって供給される制御信号に応答して、ＲＡＭアレイと順次アクセス・アレイとの間でデータを転送するための転送ゲートとを含む、ビデオＲＡＭ半導体メモリ・デバイス。

【請求項３１】刺激が、データ転送信号の状態遷移であることを特徴とする、請求項３０に記載のビデオＲＡＭ半導体メモリ・デバイス。

【請求項３２】転送されるデータが、前の順次アクセス・メモリ内容より１つ大きい行アドレスを有するＲＡＭ行に含まれるデータであることを特徴とする、請求項３０に記載のビデオＲＡＭ半導体メモリ・デバイス。

【請求項３３】転送されるデータが、アドレス入力で読み取られる行アドレスに対応するＲＡＭ行に含まれることを特徴とする、請求項３０に記載のビデオＲＡＭ半導体メモリ・デバイス。

【請求項３４】刺激が、データ転送信号がイネーブル状態である時のＲＡＳの状態遷移であることを特徴とする、請求項３０に記載のビデオＲＡＭ半導体メモリ・デバイス。

【請求項３５】プログラム可能な目標値が、事前に選択された値にセットされることを特徴とする、請求項３０に記載のビデオＲＡＭ半導体メモリ・デバイス。

【請求項３６】プログラム可能な目標値が、アドレス入力で読み取られた列アドレスより１つ小さい値にセットされることを特徴とする、請求項３０に記載のビデオＲＡＭ半導体メモリ・デバイス。

【請求項３７】列アドレスが０であることを特徴とする、請求項３６に記載のビデオＲＡＭ半導体メモリ・デバイス。

【請求項３８】列アドレスが、第１入力信号の状態の変化に応答して読み取られることを特徴とする、請求項３６に記載のビデオＲＡＭ半導体メモリ・デバイス。

【請求項３９】第１入力信号がＣＡＳであることを特徴とする、請求項３８に記載のビデオＲＡＭ半導体メモリ・デバイス。

【請求項４０】データ転送を指令する制御信号が出力されるのと同時に、制御論理回路が、列アドレスをタップ・ポインタにロードすることを特徴とする、請求項３６に記載のビデオＲＡＭ半導体メモリ・デバイス。

【請求項４１】プログラム可能な目標値が、アドレス入力で読み取られた目標アドレスより１つ小さい値にセットされることを特徴とする、請求項３３に記載のビデオＲＡＭ半導体メモリ・デバイス。

【請求項４２】目標アドレスが、０に等しいことを特徴とする、請求項４１に記載のビデオＲＡＭ半導体メモリ・デバイス。

【請求項４３】目標アドレスが、第２入力信号の状態の変化に応答して読み取られることを特徴とする、請求項４１に記載のビデオＲＡＭ半導体メモリ・デバイス。

【請求項４４】第２入力信号が、データ転送信号であることを特徴とする、請求項４３に記載のビデオＲＡＭ半導体メモリ・デバイス。

【請求項４５】列アドレスが、アドレス入力で読み取られることを特徴とする、請求項４１に記載のビデオＲＡＭ半導体メモリ・デバイス。

【請求項４６】データ転送を指令する制御信号が出力されるのと同時に、制御論理回路が、タップ・ポインタに列アドレスをロードすることを特徴とする、請求項４５に記載のビデオＲＡＭ半導体メモリ・デバイス。

【請求項４７】列アドレスが、第１入力信号の状態の変

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化に応答して読み取られることを特徴とする、請求項４５に記載のビデオＲＡＭ半導体メモリ・デバイス。

【請求項４８】第１入力信号が、ＣＡＳであることを特徴とする、請求項４７に記載のビデオＲＡＭ半導体メモリ・デバイス。

【請求項４９】行アドレスが、第３入力信号の状態の変化に応答して読み取られることを特徴とする、請求項３３に記載のビデオＲＡＭ半導体メモリ・デバイス。

【請求項５０】第３入力信号が、ＲＡＳであることを特徴とする、請求項４９に記載のビデオＲＡＭ半導体メモリ・デバイス。

【請求項５１】直列ポートが、データ転送の後の最初に発生する順次クロック・サイクルの立ち上がりエッジに応答して、順次アクセス・アレイの内容を出力し始めることを特徴とする、請求項３０に記載のビデオＲＡＭ半導体メモリ・デバイス。

【請求項５２】アドレス入力に存在する行アドレスを読み取るステップと、

アドレス入力に存在する列アドレスを読み取るステップと、

データ転送信号がイネーブル状態である時にＲＡＳの状態遷移を検出するステップと、

タップ・ポインタが列アドレスより１つ小さい値に等しい期間の間に、行アドレスに対応するＲＡＭ内の行から順次アクセス・メモリへ、内部的に順次クロックに同期化された状態で、行アドレスに対応するＲＡＭ行に含まれるデータを転送するステップとを含む、ＲＡＭ、順次アクセス・メモリおよびタップ・ポインタを有するビデオＲＡＭ半導体メモリ・デバイス内での自己タイミング式リアルタイム・データ転送の方法。

【請求項５３】列アドレスが０であることを特徴とする、請求項５２に記載のビデオＲＡＭ半導体メモリ・デバイス内での自己タイミング式リアルタイム・データ転送の方法。

【請求項５４】列アドレスを読み取るステップが、ＣＡＳの状態の変化に応答して発生することを特徴とする、請求項５２に記載のビデオＲＡＭ半導体メモリ・デバイス内での自己タイミング式リアルタイム・データ転送の方法。

【請求項５５】行アドレスを読み取るステップが、ＲＡＳの状態の変化に応答して発生することを特徴とする、請求項５２に記載のビデオＲＡＭ半導体メモリ・デバイス内での自己タイミング式リアルタイム・データ転送の方法。

【発明の詳細な説明】

【０００１】

【産業上の利用分野】本発明は、全般的には表示メモリ・サブシステム、グラフィックスおよび表示装置アダプタのシステムおよびサブシステムに関し、具体的は半導体メモリ・デバイスに関する。さらに具体的にいうと、

本発明は、ビデオＲＡＭおよび同様のメモリ・デバイスに関する。

【０００２】

【従来の技術】ビデオＲＡＭ（ＶＲＡＭ）とは、２ポートＲＡＭ（ランダム・アクセス・メモリ）であり、本質的には従来のＤＲＡＭにメモリ・データを順次アクセスできる第２ポートを追加したものである。ＶＲＡＭは、ＲＡＭアレイ、順次アクセス・メモリ（ＳＡＭ）・アレイ、アドレス／制御論理回路および転送ゲートからなる。ＲＡＭアレイは、ＶＲＡＭの主（ＲＡＭ）ポートに接続され、ＤＲＡＭやＳＲＡＭのＲＡＭアレイと同一の形で振る舞う。ＳＡＭアレイは、シフト・レジスタと称する場合もあるが、ＶＲＡＭの副（ＳＡＭまたは直列）ポートに接続され、外部非同期クロックである順次クロックの制御下で順次アクセスできる。アドレス／制御論理回路は、ＲＡＭポートのアドレス多重化を管理し、ＶＲＡＭの制御と大域タイミング機能のすべてを提供する。転送ゲートは、アドレス／制御論理回路の制御下で、メモリ・データをＲＡＭアレイとＳＡＭアレイの間で受け渡しできるようにする機構である。

【０００３】ＶＲＡＭの利点は、ＲＡＭアレイとＳＡＭアレイの間でデータを転送しなければならない時を除いて、２つのポートを独立に非同期に操作できることである。ＳＡＭアレイは、通常はＲＡＭアレイ１行分の記憶容量を有し、完全に１行分のメモリ・データが、単一のデータ転送サイクルでＲＡＭとＳＡＭの間で転送される。２つのポートの独立非同期動作は、表示メモリ・サブシステムへの応用に優れており、この場合、ＲＡＭポートは表示メモリの内容更新に使用され、ＳＡＭポートは、ＣＲＴなどの表示装置上でラスタ化される表示データを供給する。ＲＡＭポートは、一般に、更新ハードウェア（たとえばグラフィックス・プロセッサ）の周波数で動作する。ＳＡＭポートは、一般に、表示装置の要件によって指定される周波数で動作する。表示装置上でラスタ化される表示データは、ＳＡＭポートから取得されるので、ＲＡＭポート帯域幅のほぼ全てを、表示メモリの内容の更新に使用できる。

【０００４】表示メモリ・サブシステムでは、ＶＲＡＭがＳＡＭポートに表示データを供給する。ＳＡＭアレイは、表示データの１行分の容量しかないので、表示フレームの時間の間、表示データの新しい行を連続的に再ロードされなければならない。一般に、表示データの新しい行のそれぞれは、前の行よりアドレスが１つ大きい行から取得される。ＲＡＭアレイから表示データの新しい行をＳＡＭアレイに再ロードする作業は、ＲＡＭポートでデータ転送サイクルを実行することによって達成される。ＲＡＭアレイとＳＡＭアレイの間でのデータの転送は、ＲＡＭポートでの通常のＤＲＡＭアクセス・サイクルに対する唯一の割込みである。このデータ転送は、２つの別個のタイプに分けることができる。すなわち、

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１　順次クロックが停止しており、ＳＡＭポートがインアクティブの時

２　順次クロックが動作しており、ＳＡＭポートがアクティブの時

【０００５】前者は通常、表示フレームの帰線消去期間中に次の水平走査線の表示データをＳＡＭにロードすることに関連しており、順次クロックが停止しているので、ＲＡＭポートでのデータ転送サイクルは、順次クロックと同期する必要がない。後者は通常、表示フレームの水平走査線に関するアクティブ・ビデオ期間に関連しており、順次クロックが動作しているので、ＳＡＭポートでの表示データに必要な継ぎ目のない流れを維持するために、ＲＡＭポートでのデータ転送サイクルを順次クロックと正確に同期させる必要がある。後者はしばしば、ＶＲＡＭの術語で「リアルタイム・データ転送」と称し、ＶＲＡＭベース表示サブシステムの術語で「ミッドライン再ロード」と称する。

【０００６】表示メモリ・サブシステムの設計では、「リアルタイム・データ転送」の制御とタイミングが大きな問題になる。「リアルタイム・データ転送」は、時間にクリティカルなリアルタイム・アクセスであり、ＲＡＭポートとＳＡＭポートの間の正確な同期を必要とする。このように時間にクリティカルなリアルタイム・アクセスは、アクセスの同期と制御のために複雑で高速な回路を必要とする可能性がある。このため、ＶＲＡＭベース表示メモリ・サブシステムの設計者は、しばしば、表示データの「ミッドライン再ロード」とそれに関連するＶＲＡＭの「リアルタイム・データ転送」を避けるために、柔軟性を犠牲にしたり表示メモリを活用しないことを選択する。

【０００７】多くのＶＲＡＭベース表示メモリ・サブシステムに使用されている、ミッドライン再ロードを避けるための通常の方法には、表示メモリの内容をビデオ表示画面にマッピングする方法に対する複数の制約が含まれる。この制約には、通常は下記が含まれる。

・表示フレームの最初の水平走査線の表示データの開始アドレスが固定される。

・後続水平走査線のそれぞれの開始アドレスを生成するためのアドレス増分が、表示メモリ・サブシステム内のＶＲＡＭのＳＡＭアレイの容量と等しい値か、その２進分数に固定される。

・水平走査線の長さは、表示データの量が表示メモリ・サブシステム内のＶＲＡＭのＳＡＭアレイの容量を超えないものにする必要がある。

【０００８】「ミッドライン再ロード」を避け、従って「リアルタイム・データ転送」を避けるためには、これらの制約のすべてを満たさなければならない。汎用のグラフィックス・アダプタや表示装置コントローラの場合、これらの制約を適用することはできない。

【０００９】「リアルタイム・データ転送」を避けるためのもう１つの手段が、いわゆる「スプリット・レジスタ」機構を組み込んだ最近の１ＭＢ　ＶＲＡＭの一部に見られる。これらのＶＲＡＭでは、ＳＡＭアレイが、いわゆる「スプリット・レジスタ・データ転送」によって独立にロードすることのできる２つの半分に分割され、これによって、ＳＡＭの半分がアクティブである間にＳＡＭの他方の半分にロードすることが可能になっている。この機構は、問題の軽減に大いに役立つが、ＳＡＭアレイの容量を完全かつ効率的に利用してはおらず、潜在的に、「スプリット・レジスタ」機構を使用しない時に必要になるはずのデータ転送アクセスの２倍のアクセスをもたらす可能性がある。

【００１０】時間にクリティカルなデータ転送に必要な高精度を維持しながら「リアルタイム・データ転送」を可能にする、代替手法の提案の１つが、転送に関するタイミングのすべてを、コントローラを介して外部から供給するのではなく、ＶＲＡＭの内部で維持するというものである。この場合、ＶＲＡＭに事前プログラミングされたパラメータに基づいて、すべての転送が自動的にＶＲＡＭによって内部的に開始され、順次クロックと同期化されるので、転送が簡単に順次出力ストリームと同期化される。この手法を用いる場合、外部制御はタイミングに導入されず、したがって、リアルタイム・データ転送に必要な高精度のタイミングが達成される。

【００１１】しかし、この手法にはいくつかの短所がある。第１に、内部タイミングによる転送に適応するために、ＶＲＡＭ設計が非常に複雑になり、通常のＶＲＡＭと非互換になる。第２に、パラメータが静的であり、通常動作中の順次データ出力の再配列が困難になっているので、この設計は柔軟性に欠ける。第３に、このＶＲＡＭは、内部データ転送を行っている時に、ＲＡＭポートでの同時アクセスを回避するために、ＶＲＡＭメモリ・コントローラにビジー信号を供給するか、待ち状態をもたらす必要があるはずである。第４に、このビジー・プロトコルの処理のために、特に複数のＶＲＡＭからのビジー信号を管理しなければならない場合に、ビデオ・コントローラ回路の複雑さが増す。さらに、このビジー・ハンドシェーク・プロトコルが存在するが故に、既存のビデオ・コントローラのいずれもが、このＶＲＡＭと共に利用するのに適したものでなくなる。

【００１２】

【発明が解決しようとする課題】本発明の目的は、従来のビデオ・ランダム・アクセス・メモリ（ＶＲＡＭ）・デバイスに対する新規の機能強化によって、通常はＶＲＡＭベース・メモリ・サブシステムに使用されるリアルタイム・データ転送に関連する潜在的に複雑で高速な回路の必要を、簡単かつ効率的に除去することである。本発明のもう１つの目的は、厳密なマッピング制限がシステムに課せられず、ＳＡＭの効率が犠牲にされないようにすることである。本発明のもう１つの目的は、過度に

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複雑でなく、非常に柔軟かつ動的であり、待ち状態ハンドシェーク・プロトコルを導入せず、既存のビデオ・コントローラとの完全な互換性を有し、従来のＶＲＡＭデータ転送の自然な拡張であるＶＲＡＭ回路設計を提供することである。

【００１３】

【課題を解決するための手段】本発明によれば、ビデオＲＡＭ半導体メモリ・デバイスが、行アドレス、列アドレスおよび目標アドレスを入力するためのアドレス入力を有するＲＡＭアレイと、順次出力ポートを有する順次アクセス・アレイから構成される。このビデオＲＡＭは、ＲＡＭアレイと順次アクセス・アレイの間のデータ転送のための粗タイミング位置を示す外部コントローラからのＲＡＳクロックなどの刺激を検出するアドレス／制御論理回路を有する。制御論理回路は、内部的に順次クロックと同期化される制御信号を供給し、この制御信号は、タップ・ポインタがプログラム可能目標値または入力目標アドレスより１つ小さい値に等しい期間の間に発生する。これによって、入力行アドレスに対応するＲＡＭアレイ内の行が、ＲＡＭアレイと順次アクセス・アレイの間で転送される。

【００１４】本発明の上記ならびに他の目的、特徴および長所は、下記の詳細な説明から明らかになる。

【００１５】

【実施例】これより図面を参照するが、具体的には図１を参照すると、本発明の好ましい実施例によるＶＲＡＭのブロック図が示されている。このＶＲＡＭには、ＲＡＭアレイ１０、ＳＡＭアレイ２０、アドレス／制御論理回路３０、転送ゲート４０およびタップ・ポインタ（ＴＡＰ）５０が含まれる。ＲＡＭアレイ１０は、ＶＲＡＭの主（ＲＡＭ）ポートに接続され、アドレス／制御論理回路３０の制御下でＤＲＡＭまたはＳＲＡＭと同一の形で振る舞う。ＳＡＭアレイ２０は、シフト・レジスタと呼ばれる場合もあるが、ＶＲＡＭの副（ＳＡＭまたは直列）ポートに接続され、外部非同期クロックである順次クロックの制御下で順次アクセスすることができる。ＳＡＭアレイ２０に対する順次アクセスは、タップ・ポインタ（ＴＡＰ）５０によって制御され、タップ・ポインタ（ＴＡＰ）５０は、順次クロックのサイクルごとに増分されるカウンタからＳＡＭアレイ２０のアドレスを生成する。タップ・ポインタ（ＴＡＰ）５０は、アドレス／制御論理回路３０の制御下で初期値をロードされ、そのカウントの末尾に達するまで順次クロックのサイクルごとにカウンタを増分し、末尾に達した後には、ラップして最初の値に戻る。アドレス／制御論理回路３０は、アドレス多重化とＲＡＭポート上のデータ・フローを管理し、ＶＲＡＭの制御と大域タイミング機能のすべてを提供する。転送ゲート４０は、アドレス／制御論理回路３０の制御下で、ＲＡＭアレイ１０とＳＡＭアレイ２０の間でメモリ・データを受け渡しできるようにする機構である。

【００１６】ここで図２を参照すると、順次クロックがインアクティブの状態での通常のデータ読取り転送サイクルのタイミング図が示されている。通常のＶＲＡＭでは、データ読取り転送サイクルは、行アドレス・ストローブ（ＲＡＳ）の立ち下がりエッジでデータ転送／出力イネーブル（ＤＴ／ＯＥ）をロー・レベルにセットすることによって示される。ＲＡＳの立ち下がりエッジでは、アドレス入力から行アドレス（Ｒ）が取得され、行Ｒがアクティブにされる。列アドレス・ストローブ（ＣＡＳ）の立ち下がりエッジでは、アドレス入力から列アドレス（Ｃ）が取得される。その後、ＤＴ／ＯＥの立ち上がりエッジで、実際のＲＡＭ→ＳＡＭデータ転送が発生する。データ転送時には、ＳＡＭアレイ２０に、ＲＡＭアレイ１０の行Ｒの内容がロードされ、タップ・ポインタ（ＴＡＰ）５０に、列アドレスＣがロードされる。実際のデータ転送後の順次クロックの最初の立ち上がりエッジで、ＳＡＭアレイ２０の新しい内容が、最初の順次クロック立ち上がりエッジの時刻でのタップ・ポインタ値によって与えられるＳＡＭ位置から始まるＳＡＭポートで使用可能になる。順次データの最初の項目は、列アドレスＣの行Ｒからのデータである（このデータの簡略表記が｛Ｒ；Ｃ｝である。本明細書全体を通じて、データの記述のすべてを簡略化するためにこの表記を使用する）。順次クロックの後続の立ち上がりエッジのそれぞれで、タップ・ポインタ（ＴＡＰ）５０の増分が発生し、ＳＡＭポートにＳＡＭアレイ２０の内容が順次提示される。すなわち、｛Ｒ；Ｃ｝の後に、｛Ｒ；Ｃ＋１｝、｛Ｒ；Ｃ＋２｝などが続く。

【００１７】図３は、順次クロックがアクティブの状態での、いわゆる「リアルタイム・データ転送」の通常のデータ読取り転送サイクルのタイミング図である。図３からわかるように、順次クロックが動作している状態でデータ読取り転送が実行される場合、ＳＡＭポートでのデータの正しいシーケンスを維持するために、ＤＴ／ＯＥの立ち上がりエッジによって示されるデータ転送のタイミングは、正しい順次クロック・サイクル中に発生するように正確に維持されなければならない。現在のＶＲＡＭは、最小１５ｎｓの順次クロック・サイクルを有し、通常は、ＤＴ／ＯＥの立ち上がりエッジが、前の順次クロックの立ち上がりエッジから５ｎｓ以上後、次の順次クロックの立ち上がりエッジから５ｎｓ以上前に発生することを必要とする。これは、転送のタイミングを、５ｎｓの狭さになる可能性のある「窓」の中に納めなければならず、非常に高速の回路が必要になることを意味する。将来のＶＲＡＭは、さらに高速の順次クロックを有する可能性があり、「窓」もそれ相応に狭くなる可能性がある。

【００１８】本発明の自己タイミング式リアルタイム・データ転送ＶＲＡＭは、高速の外部制御回路を必要とせ

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ずに、非常に狭いタイミング「窓」の中でリアルタイム・データ転送のタイミングを正確に定める能力を有する。このＶＲＡＭは、外部コントローラが転送タイミングを供給することを必要とするのではなく、タイミングにクリティカルなリアルタイム・アクセスを簡単かつ効率的に同期化する内部タイミング式データ転送を介してこのような高精度をもたらす。

【００１９】ここで図１を参照すると、本発明の好ましい実施例による３パラメータの一般事例での自己タイミング式データ転送（ＳＴＤＴ）リアルタイム・データ読取り転送サイクルのタイミング図が示されている。この図には、ＳＴＤＴ機能の制御の有利な手段が示されている。当業者であれば了解できるように、制御入力の相対タイミング、シーケンス、極性および動作機能を変更した、他の有利な制御手段を考案することができる。ＳＴＤＴアクセスの実際の動作は、ＳＴＤＴ機能が従来のリアルタイム・データ転送アクセスの代替として提供されるのか、それに追加して提供されるのかを含む、複数の要因に依存する。

【００２０】ＳＴＤＴ機能の最も一般的な場合では、３つのパラメータが必要である。必要なパラメータは、下記のとおりである。

・Ｒ　行アドレス
・Ｃ　列アドレス
・Ｔ　ＳＴＤＴの目標

【００２１】この３つの必要なパラメータは、「ＳＴＤＴ目標」（Ｔ）が必ず列アドレス（Ｃ）と等しくなるようにすることによって、２つに減らすことができる。ここでは、３パラメータを有するＳＴＤＴ機能の一般事例を説明し、下で、２パラメータの事例（Ｃ＝Ｔ）を、ＳＴＤＴの有用な変形の例として説明する。ＳＴＤＴ機能のこのような他の変形および単純化の詳細と応用分野は、当業者であれば容易に識別できるであろう。

【００２２】ＲＡＳの立ち下がりエッジで、アドレス入力から行アドレス（Ｒ）を取得し、行Ｒをアクティブにする。さらに、ＲＡＳの立ち下がりエッジで、ＤＴ／ＯＥがロー・レベルであれば、そのアクセスがデータ読取り転送であることが示される（ＶＲＡＭでは通常こうなっている）。ＣＡＳの立ち下がりエッジで、アドレス入力から列アドレス（Ｃ）を取得する。ＤＴ／ＯＥの立ち上がりエッジで、入力アドレスから目標アドレスを取得し、ＳＴＤＴ目標を、目標アドレスと等しい値にセットする。タップ・ポインタが、ＳＴＤＴ目標より１つ少ない値に達し（ＴＡＰ＝Ｔ　１）、ＳＴＤＴ目標（Ｔ）へ増分されようとしている時に、順次クロックの立ち上がりエッジに応答してデータ転送が行われる。データ転送時には、データが行ＲとＳＡＭの間で転送され、タップ・ポインタに、列アドレス（Ｃ）がロードされる。

【００２３】データ転送後の最初の順次クロックの立ち上がりエッジに応答して、ＳＡＭの新しい内容が、直列

ポートで使用可能になる。タップ・ポインタは、順次クロックに応答して、データ転送中にシーケンスＴ－２、Ｔ－１、Ｃ、Ｃ＋１、Ｃ＋２に従う。ＳＡＭポートでの直列データの流れは、このデータ転送中に継ぎ目なしにステップし、シーケンス｛Ｑ；Ｔ　２｝、｛Ｑ；Ｔ　１｝、｛Ｒ；Ｃ｝、｛Ｒ；Ｃ＋１｝、｛Ｒ；Ｃ＋２｝に従う。おそらく、ほとんどの場合に、このシーケンスは、Ｑ＝Ｒ－１かつＣ＝Ｔ＝０であって、メモリ・アドレス空間内で連続したものになるはずである。しかし、このＳＴＤＴ機能の３パラメータの事例では、非常に有利な柔軟性と応用の有用性がもたらされる。

【００２４】ご存じのように、ＲＡＳ、ＣＡＳおよびＤＴ／ＯＥを含む、ビデオ表示システムの外部コントローラからのクロック刺激は、粗い粒度でのデータ転送のタイミングを示す。ＶＲＡＭがこの刺激を受け取ったならば、データ転送は、タップ・ポインタが目標アドレスより１つ小さい値に達する際に、内部的に順次クロックと同期化される。したがって、本発明のＶＲＡＭは、極度に狭いタイミング「窓」の間に転送を行うのに必要であり、直列ポートから順次データをリアルタイムで継ぎ目なしに転送するのに必要な微細タイミング粒度で、高精度自己タイミング式データ転送を行う能力を有する。

【００２５】図５は、本発明の好ましい実施例の２パラメータ事例（Ｃ＝Ｔ）でのＳＴＤＴリアルタイム・データ読取り転送サイクルのタイミング図である。この図は、ＳＴＤＴ機能の変形の制御の有利な手段を示す図である。前と同様に、制御入力の相対タイミング、シーケンス、極性および動作機能を変更した、他の有利な制御手段を考案することができる。２パラメータ事例（Ｃ＝Ｔ）は、行アドレスと列アドレスだけを供給する必要があり、ＤＴ／ＯＥの立ち上がりエッジのタイミングは、このＳＴＤＴの変形に本質的に無関係なので、同一のままにすることができるという点で、従来のデータ読取り転送とある種の共同作用を有する。

【００２６】ＲＡＳの立ち下がりエッジで、アドレス入力から行アドレス（Ｒ）を取得し、行Ｒをアクティブにする。さらに、ＲＡＳの立ち下がりエッジで、ＤＴ／ＯＥがロー・レベルであれば、そのアクセスがデータ読取り転送であることが示される（ＶＲＡＭでは通常こうなっている）。これは、ＳＴＤＴのＣ＝Ｔ変形でのＤＴ／ＯＥの唯一の機能であり、唯一のタイミング必要条件である。したがって、図５に示されているように、ＤＴ／ＯＥの立ち上がりエッジのタイミングは無関係である。ＣＡＳの立ち下がりエッジで、アドレス入力から列アドレス（Ｃ）を取得する。この２パラメータ変形では、列アドレス（Ｃ）がＳＴＤＴ目標でもある（Ｃ＝Ｔ）。タップ・ポインタが、ＳＴＤＴ目標より１つ少ない値に達し（ＴＡＰ＝Ｃ－１）、ＳＴＤＴ目標（Ｃ）へ増分されようとしている時に、順次クロックの立ち上がりエッジに応答してデータ転送が行われる。データ転送時には、

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データが行ＲとＳＡＭの間で転送される。データ転送時にタップ・ポインタに列アドレス（Ｃ）をロードしてもよいが、タップ・ポインタは、順次クロックによってその値まで増分されるはずなので、この動作は不要である。

【００２７】データ転送後の最初の順次クロックの立ち上がりエッジに応答して、ＳＡＭの新しい内容が、直列ポートで使用可能になる。タップ・ポインタは、順次クロックに応答して、データ転送中にシーケンスＣ　２、Ｃ－１、Ｃ、Ｃ＋１、Ｃ＋２に従う。ＳＡＭポートでの直列データの流れは、このデータ転送中に継ぎ目なしにステップし、シーケンス｛Ｑ；Ｃ－２｝、｛Ｑ；Ｃ－１｝、｛Ｒ；Ｃ｝、｛Ｒ；Ｃ＋１｝、｛Ｒ；Ｃ＋２｝に従う。おそらく、ほとんどの場合に、このシーケンスは、Ｑ＝Ｒ－１かつＣ＝Ｔ＝０であって、メモリ・アドレス空間内で連続したものになるはずである。

【００２８】２パラメータ事例の代替事例が発生するのは、行アドレスと目標アドレスだけが入力される時である。列アドレスは、０になるか（Ｃ＝０）、ＶＲＡＭにプログラムされた事前に選択された別の値になり、ＳＴＤＴ目標（Ｔ）は、目標アドレスと同一にセットされる。タップ・ポインタが、ＳＴＤＴ目標より１つ少ない値に達し（ＴＡＰ＝Ｔ－１）、ＳＴＤＴ目標（Ｔ）へ増分されようとしている時に、順次クロックの立ち上がりエッジに応答してデータ転送が行われる。データ転送時には、データが行ＲとＳＡＭの間で転送され、タップ・ポインタに、事前に選択された列アドレス（Ｃ）がロードされる。

【００２９】ＳＴＤＴの１パラメータ変形または無パラメータ変形を実施することも可能である。１パラメータ事例では、行アドレスＲだけが供給され、列アドレスとＳＴＤＴ目標には、なんらかの事前に選択された値がセットされる。たとえば、ビット長５１２のＳＡＭの場合、ＳＴＤＴ目標を０にセットし、列アドレスを１２にセットすることができる。タップ・ポインタがＳＴＤＴ目標より１つ小さい値に達し、ＳＴＤＴ目標へ増分されようとしている時に、順次クロックの立ち上がりエッジに応答してデータ転送が行われる。この例では、タップ・ポインタが最大カウント値（すなわち、９ビットＴＡＰの場合は５１１または２進数の「１１１１１１１１１」）に達し、次の増分の際にラップアラウンドして０に戻ろうとしている時に、順次クロックに応答してデータ転送が行われる。データ転送時には、データがＲＡＭの行ＲとＳＡＭの間で転送され、タップ・ポインタに、列アドレス（Ｃ）、たとえば値１２がロードされる。

【００３０】無パラメータ事例では、列アドレスとＳＴＤＴ目標が、０または事前に選択された何らかの値になり、ＳＡＭの新しい内容になるデータの行アドレスが、ＳＡＭの前の内容をロードするのに使用された前の行アドレスより１つ大きい値になる。この０パラメータ事例では、行アドレス・シーケンスを起動し、再起動するための何らかの手段を使用できるようにする必要がある。それでも、外部コントローラからのタイミング刺激が、データ転送の粗タイミング位置を供給するために必要である。さらに、望むならば、３つを超えるパラメータを有するＳＴＤＴの変形を設けることが可能である。

【００３１】上で述べたどの事例でも、データ転送は、ＶＲＡＭデバイスによって内部的にタイミングを取られ、順次クロック・ストリームにデータ転送が同期化された。従来のリアルタイム・データ転送と異なり、ＳＴＤＴデータ転送は、ＲＡＭポートに制御信号を印加する外部回路によってタイミングを決定されるのではなく、ＶＲＡＭデバイス自体によってタイミングを決定されている。外部制御信号に対する唯一のタイミング必要条件は、データ転送の前に、ＳＴＤＴアクセスが開始され、必要なＳＴＤＴパラメータが供給されていることと、ＳＴＤＴアクセスがデータ転送の後に打ち切られることである。これらの必要条件を満足するには、複雑な回路や高速回路は必要ない。というのは、タイミング粒度を、高速順次クロック・ストリームへの同期に必要なものよりはるかに粗くすることができるからである。

【００３２】本発明を実施するのに必要な、従来のＶＲＡＭに対する追加修正のサイズは、ＶＲＡＭの全サイズを大きく増加させるものではない。ＶＲＡＭ設計にＳＴＤＴを実施するには、ＳＴＤＴ機能の検出と制御のためにＶＲＡＭのアドレス／制御論理回路にわずかな追加修正を行うことだけが必要である。また、ＴＡＰカウンタ回路に取り付けられる比較器を追加する必要がある。この比較器のビット数は、ＴＡＰカウンタのビット数（長さ５１２のＳＡＭの場合９ビット）と同一である。ＳＴＤＴ機能のうちの可能な変形の１つまたはすべてを、現在のＶＲＡＭ内で使用可能な通常のデータ転送アクセスの代わりに、またはそれに追加して提供することができる。さらに、本発明を、表示メモリ・サブシステムで使用されるものとして、主にデータ読取り転送（ＲＡＭ→ＳＡＭ）に関して説明してきたが、本発明は、現在のＶＲＡＭの一部に見られるデータ書込み転送（ＳＡＭ→ＲＡＭ）に関連して応用することもできる。

【００３３】好ましい実施例に関して本発明を具体的に図示し、説明してきたが、当業者であれば、本発明の趣旨と範囲から逸脱せずに形態と詳細にさまざまな変更を加えられることを理解するであろう。

【００３４】まとめとして、本発明の構成に関して以下の事項を開示する。

【００３５】（１）データ転送を指令する刺激を外部コントローラから受け取るステップと、タップ・ポインタがプログラム可能な目標値と等しい期間の間にＲＡＭ内の１行から順次アクセス・メモリへの、内部的に順次クロックに同期化されたデータ転送を実行するステップとを含む、ＲＡＭ、順次アクセス・メモリおよびタップ・

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ポインタを有するビデオＲＡＭ半導体メモリ・デバイス内での自己タイミング式データ転送の方法。

（２）刺激が、データ転送信号の状態遷移であることを特徴とする、上記（１）に記載のビデオＲＡＭ半導体メモリ・デバイス内での自己タイミング式データ転送の方法。

（３）転送されるデータが、前の順次アクセス・メモリ内容より１つ大きい行アドレスを有するＲＡＭ行に含まれるデータであることを特徴とする、上記（１）に記載のビデオＲＡＭ半導体メモリ・デバイス内での自己タイミング式データ転送の方法。

（４）さらに、アドレス入力に存在する行アドレスを読み取るステップを含む、上記（１）に記載のビデオＲＡＭ半導体メモリ・デバイス内での自己タイミング式データ転送の方法。

（５）転送されるデータが、行アドレスに対応するＲＡＭ行に含まれるデータであることを特徴とする、上記（４）に記載のビデオＲＡＭ半導体メモリ・デバイス内での自己タイミング式データ転送の方法。

（６）刺激が、データ転送信号がイネーブル状態である時のＲＡＳの状態遷移であることを特徴とする、上記（４）に記載のビデオＲＡＭ半導体メモリ・デバイス内での自己タイミング式データ転送の方法。

（７）プログラム可能な目標値が、事前に選択された値にセットされることを特徴とする、上記（４）に記載のビデオＲＡＭ半導体メモリ・デバイス内での自己タイミング式データ転送の方法。

（８）データ転送を実行するステップが、列アドレスを事前に選択された値にセットするステップと、タップ・ポインタに列アドレスをロードするステップとを含むことを特徴とする、上記（４）に記載のビデオＲＡＭ半導体メモリ・デバイス内での自己タイミング式データ転送の方法。

（９）さらに、アドレス入力に存在する列アドレスを読み取るステップを含む、上記（４）に記載のビデオＲＡＭ半導体メモリ・デバイス内での自己タイミング式データ転送の方法。

（１０）プログラム可能な目標値が、事前に選択された値にセットされることを特徴とする、上記（９）に記載のビデオＲＡＭ半導体メモリ・デバイス内での自己タイミング式データ転送の方法。

（１１）プログラム可能な目標値が、列アドレスより１つ小さい値にセットされることを特徴とする、上記（９）に記載のビデオＲＡＭ半導体メモリ・デバイス内での自己タイミング式データ転送の方法。

（１２）列アドレスが、０であることを特徴とする、上記（１１）に記載のビデオＲＡＭ半導体メモリ・デバイス内での自己タイミング式データ転送の方法。

（１３）列アドレスを読み取るステップが、第１入力信号の状態の変化に応答して発生することを特徴とする、

上記（９）に記載のビデオＲＡＭ半導体メモリ・デバイス内での自己タイミング式データ転送の方法。

（１４）第１入力信号が、ＣＡＳであることを特徴とする、上記（１３）に記載のビデオＲＡＭ半導体メモリ・デバイス内での自己タイミング式データ転送の方法。

（１５）データ転送を実行するステップが、タップ・ポインタに列アドレスをロードするステップを含むことを特徴とする、上記（９）に記載のビデオＲＡＭ半導体メモリ・デバイス内での自己タイミング式データ転送の方法。

（１６）さらに、アドレス入力に存在する目標アドレスを読み取るステップを含む、上記（４）に記載のビデオＲＡＭ半導体メモリ・デバイス内での自己タイミング式データ転送の方法。

（１７）プログラム可能な目標値が、目標アドレスより１つ小さい値にセットされることを特徴とする、上記（１６）に記載のビデオＲＡＭ半導体メモリ・デバイス内での自己タイミング式データ転送の方法。

（１８）データ転送を実行するステップが、列アドレスを事前に選択された値にセットするステップと、タップ・ポインタに列アドレスをロードするステップとを含むことを特徴とする、上記（１７）に記載のビデオＲＡＭ半導体メモリ・デバイス内での自己タイミング式データ転送の方法。

（１９）目標が、０に等しいことを特徴とする、上記（１７）に記載のビデオＲＡＭ半導体メモリ・デバイス内での自己タイミング式データ転送の方法。

（２０）さらに、アドレス入力に存在する列アドレスを読み取るステップを含む、上記（１７）に記載のビデオＲＡＭ半導体メモリ・デバイス内での自己タイミング式データ転送の方法。

（２１）列アドレスを読み取るステップが、第１入力信号の状態の変化に応答して発生することを特徴とする、上記（２０）に記載のビデオＲＡＭ半導体メモリ・デバイス内での自己タイミング式データ転送の方法。

（２２）第１入力信号が、ＣＡＳであることを特徴とする、上記（２１）に記載のビデオＲＡＭ半導体メモリ・デバイス内での自己タイミング式データ転送の方法。

（２３）データ転送を実行するステップが、タップ・ポインタに列アドレスをロードするステップを含むことを特徴とする、上記（２０）に記載のビデオＲＡＭ半導体メモリ・デバイス内での自己タイミング式データ転送の方法。

（２４）目標アドレスを読み取るステップが、第２入力信号の状態が変化する時に発生することを特徴とする、上記（１６）に記載のビデオＲＡＭ半導体メモリ・デバイス内での自己タイミング式データ転送の方法。

（２５）第２入力信号が、データ転送信号であることを特徴とする、上記（２４）に記載のビデオＲＡＭ半導体メモリ・デバイス内での自己タイミング式データ転送の

方法。
（２６）行アドレスの読取りが、第３入力信号の状態が変化する時に発生することを特徴とする、上記（４）に記載のビデオＲＡＭ半導体メモリ・デバイス内での自己タイミング式データ転送の方法。
（２７）第３入力信号が、ＲＡＳであることを特徴とする、上記（２６）に記載のビデオＲＡＭ半導体メモリ・デバイス内での自己タイミング式データ転送の方法。
（２８）さらに、順次アクセス・メモリの内容を直列ポートから出力するステップを含む、上記（４）に記載のビデオＲＡＭ半導体メモリ・デバイス内での自己タイミング式データ転送の方法。
（２９）出力のステップが、データ転送を実行するステップの後に発生する最初の順次クロック・サイクルの立ち上がりエッジに応答して開始されることを特徴とする、上記（２８）に記載のビデオＲＡＭ半導体メモリ・デバイス内での自己タイミング式データ転送の方法。
（３０）ＲＡＭアレイと、直列出力ポートを有する順次アクセス・アレイと、アドレスを入力するためのアドレス入力と、ＲＡＭアレイと順次アクセス・アレイとの間でのデータ転送の粗いタイミング位置を示す、外部コントローラからの刺激を検出するための感知手段と、感知手段が刺激を検出するのに応答して、ＲＡＭアレイと順次アクセス・アレイとの間でのデータ転送を指令する制御信号を出力することを特徴とし、順次クロックに同期化され、タップ・ポインタがプログラム可能な目標値より１つ小さい値に等しい期間の間発生する制御信号を供給するための、制御論理回路と、制御論理回路によって供給される制御信号に応答して、ＲＡＭアレイと順次アクセス・アレイとの間でデータを転送するための転送ゲートとを含む、ビデオＲＡＭ半導体メモリ・デバイス。
（３１）刺激が、データ転送信号の状態遷移であることを特徴とする、上記（３０）に記載のビデオＲＡＭ半導体メモリ・デバイス。
（３２）転送されるデータが、前の順次アクセス・メモリ内容より１つ大きい行アドレスを有するＲＡＭ行に含まれるデータであることを特徴とする、上記（３０）に記載のビデオＲＡＭ半導体メモリ・デバイス。
（３３）転送されるデータが、アドレス入力で読み取られる行アドレスに対応するＲＡＭ行に含まれることを特徴とする、上記（３０）に記載のビデオＲＡＭ半導体メモリ・デバイス。
（３４）刺激が、データ転送信号がイネーブル状態である時のＲＡＳの状態遷移であることを特徴とする、上記（３０）に記載のビデオＲＡＭ半導体メモリ・デバイス。
（３５）プログラム可能な目標値が、事前に選択された値にセットされることを特徴とする、上記（３０）に記載のビデオＲＡＭ半導体メモリ・デバイス。
（３６）プログラム可能な目標値が、アドレス入力で読み取られた列アドレスより１つ小さい値にセットされることを特徴とする、上記（３０）に記載のビデオＲＡＭ半導体メモリ・デバイス。
（３７）列アドレスが０であることを特徴とする、上記（３６）に記載のビデオＲＡＭ半導体メモリ・デバイス。
（３８）列アドレスが、第１入力信号の状態の変化に応答して読み取られることを特徴とする、上記（３６）に記載のビデオＲＡＭ半導体メモリ・デバイス。
（３９）第１入力信号がＣＡＳであることを特徴とする、上記（３８）に記載のビデオＲＡＭ半導体メモリ・デバイス。
（４０）データ転送を指令する制御信号が出力されるのと同時に、制御論理回路が、列アドレスをタップ・ポインタにロードすることを特徴とする、上記（３６）に記載のビデオＲＡＭ半導体メモリ・デバイス。
（４１）プログラム可能な目標値が、アドレス入力で読み取られた目標アドレスより１つ小さい値にセットされることを特徴とする、上記（３３）に記載のビデオＲＡＭ半導体メモリ・デバイス。
（４２）目標アドレスが、０に等しいことを特徴とする、上記（４１）に記載のビデオＲＡＭ半導体メモリ・デバイス。
（４３）目標アドレスが、第２入力信号の状態の変化に応答して読み取られることを特徴とする、上記（４１）に記載のビデオＲＡＭ半導体メモリ・デバイス。
（４４）第２入力信号が、データ転送信号であることを特徴とする、上記（４３）に記載のビデオＲＡＭ半導体メモリ・デバイス。
（４５）列アドレスが、アドレス入力で読み取られることを特徴とする、上記（４１）に記載のビデオＲＡＭ半導体メモリ・デバイス。
（４６）データ転送を指令する制御信号が出力されるのと同時に、制御論理回路が、タップ・ポインタに列アドレスをロードすることを特徴とする、上記（４５）に記載のビデオＲＡＭ半導体メモリ・デバイス。
（４７）列アドレスが、第１入力信号の状態の変化に応答して読み取られることを特徴とする、上記（４５）に記載のビデオＲＡＭ半導体メモリ・デバイス。
（４８）第１入力信号が、ＣＡＳであることを特徴とする、上記（４７）に記載のビデオＲＡＭ半導体メモリ・デバイス。
（４９）行アドレスが、第３入力信号の状態の変化に応答して読み取られることを特徴とする、上記（３３）に記載のビデオＲＡＭ半導体メモリ・デバイス。
（５０）第３入力信号が、ＲＡＳであることを特徴とする、上記（４９）に記載のビデオＲＡＭ半導体メモリ・デバイス。
（５１）直列ポートが、データ転送の後の最初に発生する順次クロック・サイクルの立ち上がりエッジに応答し

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て、順次アクセス・アレイの内容を出力し始めることを特徴とする、上記（３０）に記載のビデオＲＡＭ半導体メモリ・デバイス。

（５２）アドレス入力に存在する行アドレスを読み取るステップと、アドレス入力に存在する列アドレスを読み取るステップと、データ転送信号がイネーブル状態である時にＲＡＳの状態遷移を検出するステップと、タップ・ポインタが列アドレスより１つ小さい値に等しい期間の間に、行アドレスに対応するＲＡＭ内の行から順次アクセス・メモリへ、内部的に順次クロックに同期化された状態で、行アドレスに対応するＲＡＭ行に含まれるデータを転送するステップとを含む、ＲＡＭ、順次アクセス・メモリおよびタップ・ポインタを有するビデオＲＡＭ半導体メモリ・デバイス内での自己タイミング式リアルタイム・データ転送の方法。

（５３）列アドレスが０であることを特徴とする、上記（５２）に記載のビデオＲＡＭ半導体メモリ・デバイス内での自己タイミング式リアルタイム・データ転送の方法。

（５４）列アドレスを読み取るステップが、ＣＡＳの状態の変化に応答して発生することを特徴とする、上記（５２）に記載のビデオＲＡＭ半導体メモリ・デバイス内での自己タイミング式リアルタイム・データ転送の方法。

（５５）行アドレスを読み取るステップが、ＲＡＳの状態の変化に応答して発生することを特徴とする、上記（５２）に記載のビデオＲＡＭ半導体メモリ・デバイス内での自己タイミング式リアルタイム・データ転送の方法。

【図面の簡単な説明】

【図１】本発明の好ましい実施例によるＶＲＡＭのブロック図である。

【図２】順次クロックがインアクティブの状態での通常のデータ読取り転送サイクルのタイミング図である。

【図３】順次クロックがアクティブの状態での、いわゆる「リアルタイム・データ転送」の通常のデータ読取り転送サイクルのタイミング図である。

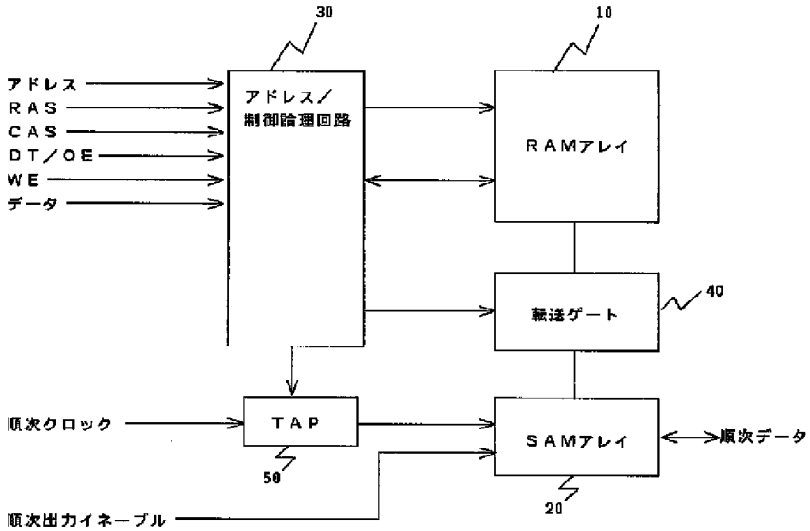
【図４】本発明の好ましい実施例による３パラメータの一般事例での自己タイミング式データ転送（ＳＴＤＴ）リアルタイム・データ読取り転送サイクルのタイミング図である。

【図５】本発明の好ましい実施例による２パラメータの事例でのＳＴＤＴリアルタイム・データ読取り転送サイクルのタイミング図である。

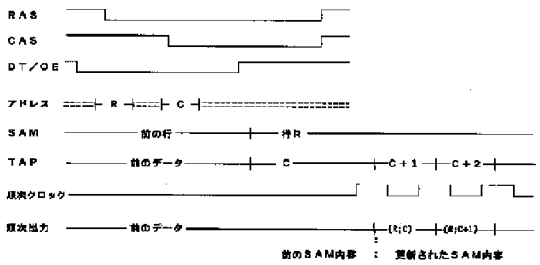
【符号の説明】

１０　ＲＡＭアレイ
２０　ＳＡＭアレイ
３０　アドレス／制御論理回路
４０　転送ゲート
５０　タップ・ポインタ（ＴＡＰ）

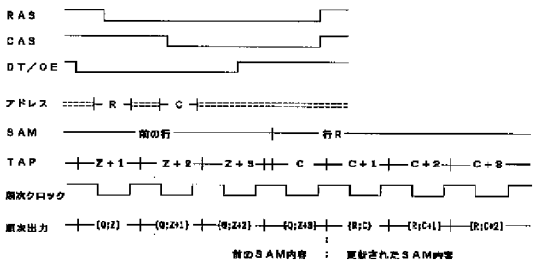
【図１】



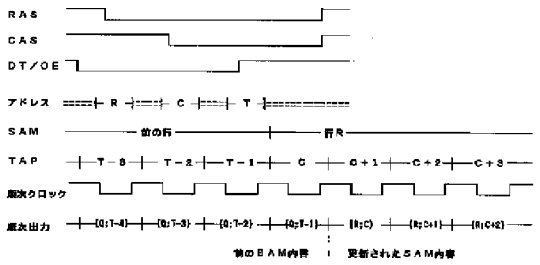
【図２】



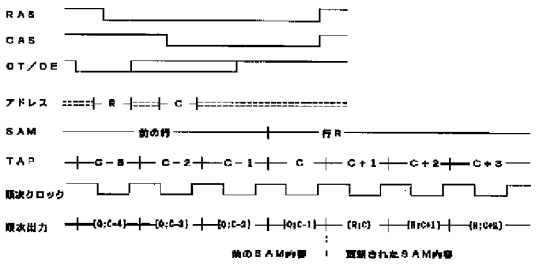
【図３】



【図４】



【図５】



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(19)日本国特許庁(JP)　(12)公開特許公報(A)　(11)特許出願公開番号
特開2005-108427
(P2005-108427A)
(43)公開日　平成17年4月21日(2005.4.21)

(51)Int.Cl.[7]	F I			テーマコード（参考）
G11B 20/14	G11B	20/14	351A	5D044
G11B 7/0045	G11B	7/0045	Z	5D090
G11B 7/005	G11B	7/005	Z	

審査請求 有　請求項の数 1　OL　（全 22 頁）

(21)出願番号　特願2004-355032(P2004-355032)
(22)出願日　平成16年12月8日(2004.12.8)
(62)分割の表示　特願平11-207997の分割
原出願日　平成11年7月22日(1999.7.22)

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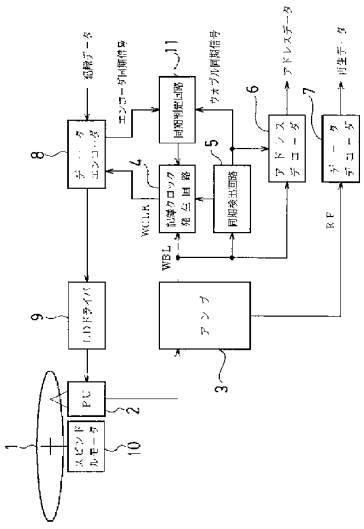
Ｆターム(参考)　5D044 BC02 CC04 DE38 GM01 GM12 GM16
5D090 AA01 BB04 CC01 CC04 DD03 FF07 GG03 GG26

(54)【発明の名称】データ記録用クロック信号発生装置

(57)【要約】
【目的】　ウォブル信号にアドレス情報などを位相変調によって重畳した光ディスクの場合でも、ウォブル信号に安定して位相同期した記録用クロックを発生させるようにする。
【構成】　この記録クロック発生回路４は、ウォブル信号を抽出し、記録用クロック信号を分周した分周クロック信号を発生し、上記ウォブル信号と上記分周クロック信号との位相を比較して位相差信号を発生し、上記位相差信号に基づく周波数制御信号を発生し、上記周波数制御信号に基づいて制御した周波数を有する上記記録用クロック信号を発生することにより、光ディスクのアドレス情報又は同期信号が位相変調された所定タイミングの近傍では位相差信号の発生を行なわせないようにする。
【選択図】　図１



【特許請求の範囲】
【請求項１】
所定の周波数成分を有し、所定タイミングでアドレス情報と同期信号とが位相変調によって重畳したウォブル信号でウォブリングされたデータ記録用トラックを有する光ディスクにデータを記録するときの前記ウォブル信号に位相同期させた記録用クロック信号を発生するデータ記録用クロック信号発生装置であって、
前記ウォブル信号を抽出するウォブル信号抽出手段と、
前記記録用クロック信号を分周した分周クロック信号を発生する記録用クロック信号分周手段と、
前記ウォブル信号と前記分周クロック信号との位相を比較して位相差信号を発生する位相差信号発生手段と、
該手段によって発生された前記位相差信号に基づく周波数制御信号を発生する周波数制御信号発生手段と、
該手段によって発生された前記周波数制御信号に基づいて制御した周波数を有する前記記録用クロック信号を発生する記録用クロック信号発生手段とを備え、
前記光ディスクの前記アドレス情報又は前記同期信号が位相変調された所定タイミングの近傍では前記位相差信号発生手段による位相差信号の発生を行なわせないようにする手段を設けたことを特徴とするデータ記録用クロック信号発生装置。
【発明の詳細な説明】
【技術分野】
【０００１】
この発明は、データ記録可能な光ディスク，ハードディスク等の記録媒体のデータ記録装置に備えるデータを記録するための記録用クロック信号を生成するデータ記録用クロック信号発生装置に関する。
【背景技術】
【０００２】
所定の周波数成分を有するウォブル信号でウォブリングされたデータ記録用トラックを有する光ディスクとして、ＣＤ－Ｒ，ＣＤ－ＲＷ，ＤＶＤ－Ｒ，及びＤＶＤ－ＲＡＭなどの記録媒体（メディア）が知られており、これらの光ディスクのウォブル信号に位相同期した記録用クロック信号を発生させるデータ記録用クロック信号発生装置（例えば、特許文献１，特許文献２参照）がある。
【０００３】
また、データ書き換え型光ディスクの性質として、同じ場所に何度も繰り返して記録すると、記録マークおよびその周辺が熱的ストレスなどによって劣化し、次に異なる信号を記録した時には、マークが正確に記録できないという性質があるが、このような問題を軽減するために、記録開始点をランダムに可変にし、同じ場所を繰り返して使用することを防ぐことによって、ディスク材料の疲労を平均化して軽減し、結果的に繰り返し使用回数を向上させる光ディスクの記録方法及び光ディスク装置（例えば、特許文献３，特許文献４参照）があった。
【０００４】
さらに、ウォブル信号にアドレス情報などを位相変調によって重畳した光ディスク（例えば、特許文献５参照）があり、光ディスクのウォブル信号に位相同期した記録用クロック信号を発生させるデータ記録用クロック信号発生装置もある。
【０００５】
図１４は、従来の光ディスク駆動装置の構成例を示すブロック図である。
まず、光ディスク１には、所定の周波数成分を有するウォブル信号でウォブリングされたデータ記録用トラックが存在する。
【０００６】
図１５は、光ディスク１上のウォブリングされたデータ記録用トラックの構造例を示す説明図である。

トラックの位置を示すグルーブ部がアドレス情報に対応してウォブリングされており、ウォブル信号にはアドレス情報と同期信号とが変調されて重畳されている。

【０００７】

図１４に示した従来の光ディスク駆動装置では、光ピックアップ（ＰＵ）２からは、光ディスク１上のデータ記録用トラックに向けて、レーザビームを照射する。

そして、光ディスク１上のトラックで反射されたレーザビームは、光ピックアップ２に戻され、光ピックアップ２内のディテクタで電気信号に変換される。

【０００８】

アンプ３は、光ピックアップ２で検出された電気信号を増幅し、光ディスク１上に記録されたデータに対応する再生信号（ＲＦ）と、トラックのウォブリングに対応したウォブル信号（ＷＢＬ）を出力する。

その再生信号（ＲＦ）は、データの再生を行なう場合に検出され、ウォブル信号（ＷＢＬ）は、データの記録及び再生双方の動作で検出される。

【０００９】

記録クロック発生回路４は、ウォブル信号（ＷＢＬ）に位相同期した記録用クロック信号（ＷＣＬＫ）を発生する。

【００１０】

図１６は、図１４に示した従来の記録クロック発生回路の構成例を示すブロック図である。

この記録クロック発生回路４は、いわゆるＰＬＬ（Ｐｈａｓｅ Ｌｏｃｋｅｄ Ｌｏｏｐ）回路で構成される。

位相比較器４１は、ウォブル信号（ＷＢＬ）と、記録用クロック信号（ＷＣＬＫ）を分周器４５で所定比に分周した信号（分周クロック）との位相差を比較する。

【００１１】

位相比較器４１からの出力は、チャージポンプ４２によって電圧信号に変換された後、フィルタ４３で平滑化され、ＶＣＯ（Ｖｏｌｔａｇｅ Ｃｏｎｔｒｏｌｌｅｄ Ｏｓｃｉｌｌａｔｏｒ）に入力される。

ＶＣＯの出力クロック、すなわち記録用クロック信号（ＷＣＬＫ）は、入力電圧によってその周波数が制御される。その結果、記録用クロック信号（ＷＣＬＫ）の位相は、ウォブル信号（ＷＢＬ）に同期したものになる。

【００１２】

図１４に戻り、従来の光ディスク駆動装置の同期検出回路５とアドレスデコーダ６は、それぞれウォブル信号に重畳された同期信号とアドレス情報を検出する。

そして、データの記録を行なう場合、データエンコーダ８は、記録用クロック信号（ＷＣＬＫ）に同期して記録データに所定の変調処理を施す。

【００１３】

ＬＤドライバ９は、変調された記録データに応じて光ピックアップ２が出射するレーザビーム強度を変調する。

この結果、データ記録用トラックのウォブル信号に同期してデータの記録が行なわれる。

【特許文献１】特開平１０－２９３９２６号公報
【特許文献２】特開平１１－６６５６３号公報
【特許文献３】特公平８　１０４８９号公報
【特許文献４】特開平１０－３６６７号公報
【特許文献５】特開平１０－６９６４６号公報

【発明の開示】

【発明が解決しようとする課題】

【００１４】

しかしながら、上述した特許文献３に記載された技術は、記録開始点をランダムに可変にし、同じ場所を繰り返して使用することを防ぐことによって、ディスク材料の疲労を平

均化して軽減し、結果的に繰り返し使用回数を向上させるものであり、そのランダムな記録開始点を得るために複数のアナログディレイ回路を使用しなければならないので装置コストが高価になるという問題があった。

【００１５】

次に、上述したような従来の記録クロック発生回路では、ウォブル信号が正常に検出されていれば、記録用クロック信号（ＷＣＬＫ）の位相は、常にウォブル信号（ＷＢＬ）に同期したものとなる。

【００１６】

しかし、光ディスク上には小さな欠陥が存在する場合もあり、また、光ディスク表面にごみなどが付着する場合もあり、このような欠陥やゴミなどが付着した部分ではウォブル信号に欠落が生じ、正常な検出がされなくなる場合がある。

【００１７】

そこで、上述したような従来のＰＬＬ回路で構成された記録クロック発生回路では、いわゆるＰＬＬのフライホイール効果があるため、ウォブル信号の小さな欠落に対しては、ウォブル信号と記録用クロック信号との位相同期は保たれる。

【００１８】

しかし、ウォブル信号の欠落が大きい場合には、欠落中にウォブル信号と記録用クロック信号との位相がずれてしまい、欠落後、記録用クロック信号がウォブル信号周期の整数倍の位相ずれを生じた状態で位相同期する、いわゆるビットスリップが生じる場合がある。

【００１９】

そして、ビットスリップが生じた場合、ウォブル信号と記録用クロックの位相ずれは回復させることができず、記録データが所定位置からずれた状態で記録されることになる。

【００２０】

また、ビットスリップが生じたまま、あるセクタまでのデータの記録を完了させた後、続くセクタから新たにデータを記録させた場合に、記録データの接続部でデータの重なりや不要な空白が生じる。

このような場合、記録データ接続部付近のデータが正しく再生できなくなるという最悪の事態を招き易くなるという問題があった。

【００２１】

次に、ウォブル信号にアドレス情報などを位相変調によって重畳した光ディスク（例えば、特許文献５参照）の場合、位相変調のためにウォブル信号位相に急な変化が生じる部分があり、従来の記録クロック発生回路では、ウォブル信号と記録用クロック信号との位相ずれが生じてしまうという問題があった。

【００２２】

この発明は上記の課題を解決するためになされたものであり、ウォブル信号にアドレス情報などを位相変調によって重畳した光ディスクの場合でも、ウォブル信号に安定して位相同期した記録用クロックを発生させる記録クロック発生回路を提供することを目的とする。

【課題を解決するための手段】

【００２３】

この発明は上記の目的を達成するため、所定の周波数成分を有し、所定タイミングでアドレス情報と同期信号とが位相変調によって重畳したウォブル信号でウォブリングされたデータ記録用トラックを有する光ディスクにデータを記録するときの上記ウォブル信号に位相同期させた記録用クロック信号を発生するデータ記録用クロック信号発生装置であって、上記ウォブル信号を抽出するウォブル信号抽出手段と、上記記録用クロック信号を分周した分周クロック信号を発生する記録用クロック信号分周手段と、上記ウォブル信号と上記分周クロック信号との位相を比較して位相差信号を発生する位相差信号発生手段と、その手段によって発生された上記位相差信号に基づく周波数制御信号を発生する周波数制御信号発生手段と、その手段によって発生された上記周波数制御信号に基づいて制御した

周波数を有する上記記録用クロック信号を発生する記録用クロック信号発生手段とを備え、上記光ディスクの上記アドレス情報又は上記同期信号が位相変調された所定タイミングの近傍では上記位相差信号発生手段による位相差信号の発生を行なわせないようにする手段を設けたデータ記録用クロック信号発生装置を提供する。

【発明の効果】

【００２４】

この発明による記録クロック発生装置は、位相変調によってウォブル信号位相に急な変化が生じる部分で位相比較器の動作をマスクするので、ウォブル信号と記録用クロック信号との位相ずれが生じることが無くなり、ウォブル信号に安定して位相同期した記録用クロックを発生させることができる。

【発明を実施するための最良の形態】

【００２５】

以下、この発明を実施するための最良の形態を図面に基づいて具体的に説明する。

図１は、この発明の参考例及びこの発明の一実施形態である光ディスク駆動装置の構成例を示すブロック図であり、図１４に示した光ディスク駆動装置と共通する部分には同一符号を付してその説明を省略する。

【００２６】

この光ディスク駆動装置の記録クロック発生回路４は、所定の周波数成分を有するウォブル信号でウォブリングされたデータ記録用トラックを有する光ディスク１にデータを記録するときの上記ウォブル信号に位相同期させた記録用クロック信号を発生するデータ記録用クロック信号発生装置であり、その記録クロック発生回路４等がこの発明及びこの発明の参考例に係る以下の各手段の機能を果たす。

【００２７】

上記ウォブル信号を抽出するウォブル信号抽出手段と、上記記録用クロック信号を分周した分周クロック信号を発生する記録用クロック信号分周手段と、上記ウォブル信号と上記分周クロック信号との位相を比較して位相差信号を発生する位相差信号発生手段と、その手段によって発生された上記位相差信号に基づく周波数制御信号を発生する周波数制御信号発生手段と、その手段によって発生された上記周波数制御信号に基づいて制御した周波数を有する上記記録用クロック信号を発生する記録用クロック信号発生手段とを備え、上記記録用クロック信号分周手段が上記記録用クロック信号を分周するときの基準分周比とその基準分周比とは異なる分周比とを所定の順序に従って設定する分周比設定手段。

【００２８】

また、上記光ディスクにデータを記録する毎に、上記記録用クロック分周手段に対して設定する基準分周比とその基準分周比とは異なる分周比の組み合わせの順序を異ならせる手段。

【００２９】

さらに、上記ウォブル信号に重畳されている同期信号を検出する同期検出手段と、その手段によって検出された上記同期信号と上記光ディスクの記録データとの同期関係を判定する同期関係判定手段と、その手段によって上記同期信号に対して上記記録データのタイミングが遅れているものと判定された場合、上記記録用クロック分周手段に設定する分周比の平均値が上記基準分周比よりも長い値になるようにし、上記同期信号に対して上記記録データのタイミングが進んでいるものと判定された場合、上記記録用クロック分周手段に設定する分周比の平均値が上記基準分周比よりも短い値になるようにする制御手段。

【００３０】

また、所定の周波数成分を有し、所定タイミングでアドレス情報と同期信号とが位相変調によって重畳したウォブル信号でウォブリングされたデータ記録用トラックを有する光ディスクにデータを記録するときの上記ウォブル信号に位相同期させた記録用クロック信号を発生するデータ記録用クロック信号発生装置であって、上記ウォブル信号を抽出するウォブル信号抽出手段と、上記記録用クロック信号を分周した分周クロック信号を発生する記録用クロック信号分周手段と、上記ウォブル信号と上記分周クロック信号との位相を

比較して位相差信号を発生する位相差信号発生手段と、その手段によって発生された上記位相差信号に基づく周波数制御信号を発生する周波数制御信号発生手段と、その手段によって発生された上記周波数制御信号に基づいて制御した周波数を有する上記記録用クロック信号を発生する記録用クロック信号発生手段とを備え、上記光ディスクの上記アドレス情報又は上記同期信号が位相変調された所定タイミングの近傍では上記位相差信号発生手段による位相差信号の発生を行なわせないようにする手段。

【００３１】

さらに、所定の周波数成分を有するウォブル信号でウォブリングされたデータ記録用トラックを有する光ディスクにデータを記録するときの上記ウォブル信号に位相同期した記録用クロック信号を発生するデータ記録用クロック信号発生装置であって、上記ウォブル信号を抽出するウォブル信号抽出手段と、上記記録用クロック信号を分周した分周クロックを発生する記録用クロック信号分周手段と、上記ウォブル信号と上記分周クロック信号との位相を比較して位相差信号を発生する位相差信号発生手段と、その手段によって発生された上記位相差信号に基づく第１の周波数制御信号を発生する第１周波数制御信号発生手段と、上記ウォブル信号を所定の分周比で分周するウォブル信号分周手段と、その手段によって分周されたウォブル信号の周期を上記記録用クロック信号の周期でカウントするウォブル信号周期カウント手段と、その手段によってカウントされた周期に基づく第２の周波数制御信号を発生する第２周波数制御信号発生手段と、上記ウォブル信号周期カウント手段によってカウントされた周期が所定の範囲内にある場合には上記第１周波数制御信号発生手段によって発生された第１の周波数制御信号によって制御した周波数を有する上記記録用クロック信号を発生し、上記周期が所定の範囲外にある場合には上記第２周波数制御信号発生手段によって発生された第２の周波数制御信号によって制御した周波数を有する上記記録用クロック信号を発生する記録用クロック信号発生手段。

【００３２】

さらにまた、所定の周波数成分を有するウォブル信号でウォブリングされたデータ記録用トラックを有する光ディスクにデータを記録するときの上記ウォブル信号に位相同期した記録用クロック信号を発生するデータ記録用クロック信号発生装置であって、上記ウォブル信号を抽出するウォブル信号抽出手段と、上記記録用クロック信号を分周した分周クロックを発生する記録用クロック信号分周手段と、上記ウォブル信号と前記分周クロック信号との位相を比較して位相差信号を発生する位相差信号発生手段と、その手段によって発生された上記位相差信号に基づく第１の周波数制御信号を発生する第１周波数制御信号発生手段と、上記ウォブル信号を所定の分周比で分周するウォブル信号分周手段と、その手段によって分周されたウォブル信号の周期を上記記録用クロック信号の周期でカウントするウォブル信号周期カウント手段と、その手段によってカウントされた周期に基づく第２の周波数制御信号を発生する第２周波数制御信号発生手段と、上記ウォブル信号周期カウント手段によってカウントされた周期が所定の範囲内にある場合には上記第１周波数制御信号発生手段によって発生された第１の周波数制御信号によって制御した周波数を有する上記記録用クロック信号を発生し、上記周期が所定の範囲外にあることが所定回数連続して検出された場合には上記第２周波数制御信号発生手段によって発生された第２の周波数制御信号によって制御した周波数を有する上記記録用クロック信号を発生する記録用クロック信号発生手段。

上記各機能については以下順に説明する。

【００３３】

まず、この発明の参考例の記録クロック発生回路について説明する。

図２は、図１に示したこの発明の参考例の記録クロック発生回路４の内部構成例を示すブロック図であり、図１６と共通する部分には同一符号を付している。

この記録クロック発生回路４は、いわゆるＰＬＬ（Ｐｈａｓｅ Ｌｏｃｋｅｄ Ｌｏｏｐ）回路で構成されており、ウォブル信号（ＷＢＬ）に位相同期した記録用クロック信号（ＷＣＬＫ）を発生する。

【００３４】

分周器４５は、分周比設定テーブル４７から出力される分周比制御信号に応じて記録用クロック信号（ＷＣＬＫ）を分周した分周クロック信号を出力する。
その分周クロック信号は、位相比較器４１にフィードバックされると共に、分周クロックカウンタ４６にも入力される。

【００３５】

分周クロックカウンタ４６は、分周クロック信号のエッジ毎にカウント値を変化させる。
分周比設定テーブル４７は、分周クロックカウンタ４６のカウント値と分周条件設定値に応じて分周器４５へ分周比制御信号を出力する。

【００３６】

図３は、上記分周器４５，分周クロックカウンタ４６，及び分周比設定テーブル４７のさらに詳細な構成例を示す図である。
この分周クロックカウンタ（２ｂｉｔ　Ｃｎｔ）４６は、２ビットカウンタで構成される。

【００３７】

また、分周器４５は、４ビットカウンタであるＡカウンタ（Ａ　Ｃｎｔ：４ｂｉｔ　Ｃｎｔ）４５１，３ビットカウンタであるＢカウンタ（Ｂ　Ｃｎｔ：３ｂｉｔ　Ｃｎｔ）４５２，同期式ＳＲＦＦ４５５，インバータ（Ｉｎｖ）４５３，及び３ｔｏ１構成のマルチプレクサ（Ｍｕｘ）４５４で構成される。

【００３８】

このＡカウンタ４５１，Ｂカウンタ４５２，及び同期式ＳＲＦＦ４５５には、図示を省略した記録用クロック信号（ＷＣＬＫ）をそれぞれ入力しており、以下の説明では、記録用クロック信号の１周期を１Ｔと表現する。

【００３９】

Ａカウンタ４５１，Ｂカウンタ４５２のカウントイネーブル入力（ＥＮ）には、それぞれ同期式ＳＲＦＦ４５５のＱｂ出力，Ｑ出力を接続している。

【００４０】

同期式ＳＲＦＦ４５５のＳ入力には、Ａカウンタ４５１のフルカウント出力（＝１５），すなわち、Ａカウンタ４５１のカウント値が最大値“１５”であることを示す信号を接続している。

【００４１】

同期式ＳＲＦＦ４５５のＲ入力には、Ｂカウンタ４５２のフルカウント出力（＝７），すなわち、Ｂカウンタ４５２のカウント値が最大値“７”であることを示す信号を接続している。

【００４２】

Ａカウンタ４５１のフルカウント出力（＝１５）は、Ｂカウンタ４５２のロード入力（ＬＤ）にも接続している。
Ｂカウンタ４５２のフルカウント出力（－７）は、Ａカウンタ４５１のロード入力（ＬＤ）にも接続している。

【００４３】

Ａカウンタ４５１のデータ入力（Ｄｉ）には、“７”，“８”，“９”の各値の中からマルチプレクサ４５４で選択された一つの値が入力され、ロード（ＬＤ）入力がアクティブになった場合には、Ａカウンタ４５１のカウント値は“７”，“８”，“９”のいずれかの値に設定される。

【００４４】

Ｂカウンタ４５２のデータ入力（Ｄｉ）には、値“０”が入力され、ロード（ＬＤ）入力がアクティブになった場合には、Ｂカウンタ４５２のカウント値は“０”に設定される。

【００４５】

次に、分周器４５の動作について説明する。

Ａカウンタ４５１とＢカウンタ４５２は、交互にカウント動作を行なう。
Ａカウンタ４５１は、マルチプレクサ４５４で選択される値によって、“７”，“８”，“９”のいずれかの初期値から、最終値“１５”までのカウント動作を行なう。
つまり、Ａカウンタ４５１は１回のカウント動作で７Ｔ分，８Ｔ分，又は９Ｔ分のカウントを行なう。

【００４６】

Ｂカウンタ４５２は、初期値“０”から最終値“７”までのカウント動作を行なう。
つまり、Ｂカウンタ４５２は１回のカウント動作で８Ｔ分のカウントを行なう。

【００４７】

また、分周クロックは、同期式ＳＲＦＦ４５５のＱ出力をインバータ４５３で反転させた信号である。
したがって、分周クロック１サイクル分の動作は、Ａカウンタ４５１の１回のカウント動作と、Ｂカウンタ４５２の１回のカウント動作とを組み合わせたものであり、その周期は１５Ｔ分，１６Ｔ分，又は１７Ｔ分になる。

【００４８】

すなわち、分周器４５の基準分周比は“１６”になり、その基準分周比に対して±１の分周比変化を可能にしている。

【００４９】

分周クロックカウンタ４６のカウントイネーブル入力（ＥＮ）には、Ｂカウンタのフルカウント出力（＝７）を接続している。
そのため、分周クロックカウンタ４６は、Ａカウンタ４５１の１回のカウント動作とＢカウンタ４５２の１回のカウント動作とを組み合わせた分周クロックの１サイクル分の動作の終了毎に、そのカウント値をアップさせる。
分周クロックカウンタ４６は、ここでは２ビットカウンタなので、カウント値は０から３までの値になる。

【００５０】

分周比設定テーブル４７には、分周クロックカウンタ４６から２ビットのカウントデータと、分周条件設定値として２ビットのデータとが入力される。
分周比設定テーブル４７は、分周クロックカウンタ４６のカウント値と分周条件設定値とに応じて、表１に示す真理値表にしたがって分周比制御信号を出力する。

【００５１】

【表１】

分周条件設定値	分周クロックカウンタ値	Sel7	Sel8	Sel9
0	0	0	1	0
	1	0	1	0
	2	0	1	0
	3	0	1	0
1	0	0	0	1
	1	0	1	0
	2	0	1	0
	3	1	0	0
2	0	0	0	1
	1	1	0	0
	2	0	0	1
	3	1	0	0
3	0	0	1	0
	1	0	1	0
	2	0	0	1
	3	1	0	0

【００５２】
分周比設定テーブル４７の分周比制御信号はマルチプレクサ４５４に接続しており、その分周比制御信号に応じてＡカウンタ４５１の初期値が選択される。
マルチプレクサ４５４は、分周比制御信号（Ｓｅｌ７）がアクティブの場合には値“７”を選択し、分周比制御信号（Ｓｅｌ８）がアクティブの場合には値“８”を選択し、分周比制御信号（Ｓｅｌ９）がアクティブの場合には値“９”を選択する。
【００５３】
図４は、分周器４５の動作の説明に供するタイミング図であり、同図に基づいて図３に示した分周器４５の動作を詳細に説明する。
図４では４段のタイミング図を同時に示しているが、１段目が分周条件設定値＝０の場合，２段目が分周条件設定値＝１の場合，３段目が分周条件設定値＝２の場合，４段目が分周条件設定値＝３の場合のそれぞれの動作タイミングである。
【００５４】
また、同図の水平方向に分周クロックカウンタの値が“０”から“３”までのタイミング図を示しているが、分周クロックカウンタの値が“３”になった後は再び“０”の動作に戻る。
【００５５】
まず、分周条件設定値＝０の場合の動作を説明する。
表１の真理値表に基づいて、分周条件設定値＝０の場合は、分周比設定テーブル４７は、分周クロックカウンタ４６からのカウント値に関わらずに分周比制御信号（Ｓｅｌ８）のみをアクティブにする。
【００５６】
したがって、Ａカウンタ４５１の初期値は、すべての分周クロックサイクルの先頭で“７”にセットされ、Ａカウンタ４５１のカウント動作は、すべての分周クロックサイクルで８Ｔ分になり、分周クロック１サイクル分の周期は１６Ｔになる。
【００５７】
次に、分周条件設定値＝１の場合の動作を説明する。
分周クロックカウンタ値が“０”になる分周クロックサイクルにおけるＡカウンタ４５

１の初期値は、その直前、すなわち、分周クロックカウンタ４６のカウント値が“４”になる分周クロックサイクル最後のマルチプレクサ４５４からの出力によって決まる。

【００５８】

表１の真理値表に基づいて、分周条件設定値＝１，分周クロックカウンタ値＝４では、分周比制御信号（Ｓｅ１７）がアクティブになっているから、分周クロックカウンタ４６のカウント値が“０”になる分周クロックサイクルにおけるＡカウンタ４５１の初期値は“７”になる。

【００５９】

そのため、分周クロックカウンタ４６のカウント値が“０”になる分周クロックサイクルにおけるＡカウンタ４５１のカウント動作は９Ｔ分になり、分周クロック１サイクル分の周期は１７Ｔになる。

【００６０】

そして、上述と同様にして、分周クロックカウンタ４６のカウント値が“１”になる分周クロックサイクル周期は１５Ｔになる。

また、分周クロックカウンタ４６のカウント値が“２”になる分周クロックサイクル周期は１６Ｔになる。

さらに、分周クロックカウンタ４６のカウント値が“３”になる分周クロックサイクル周期は１６Ｔになる。

【００６１】

すなわち、分周条件設定値＝１の場合、分周クロック１サイクル分の周期は一定ではなく、「１７Ｔ→１５Ｔ→１６Ｔ→１６Ｔ→，１７Ｔ→１５Ｔ→１６Ｔ→１６Ｔ→，…」というパターンを繰り返す。

【００６２】

そして、上述と同様にして、分周条件設定値＝２の場合、分周クロック１サイクル分の周期は、「１７Ｔ→１５Ｔ→１７Ｔ→１５Ｔ→，１７Ｔ→１５Ｔ→１７Ｔ→１５Ｔ→，…」というパターンを繰り返す。

また、分周条件設定値＝３の場合、分周クロック１サイクル分の周期は、「１７Ｔ→１６Ｔ→１６Ｔ→１５Ｔ→，１７Ｔ→１６Ｔ→１６Ｔ→１５Ｔ→…」というパターンを繰り返す。

【００６３】

このように、分周クロック１サイクル分の周期を所定のパターンで変化させた場合、分周クロックの位相がどのように変化するかを考慮する。

分周条件設定値＝０の場合、分周クロック１サイクル分の周期は常に１６Ｔであり、１６Ｔは上述のように基準分周比である。

【００６４】

以下の説明では、分周条件設定値＝０の場合の分周クロック信号の位相を基準にして分周クロック信号の位相変化を説明する。

位相比較器４１が注目する位相は、分周クロック信号に関してはその立ち上りエッジ位相とする。

【００６５】

分周クロックは同期式ＳＲＦＦ４５５のＱ出力を反転したものなので、図４では、同期式ＳＲＦＦ４５５のＱ出力の立ち下がりエッジ位相に注目する。

分周条件設定値－１の場合、分周クロックカウンタ４６のカウント値が“０”になる分周クロックサイクル周期は１７Ｔであるから、同期式ＳＲＦＦ４５５のＱ出力の立ち下がりエッジ位相は、分周クロック基準位相に対して１Ｔ分の遅れが生じる。

【００６６】

また、分周クロックカウンタ４６のカウント値が“１”になる分周クロックサイクル周期は１５Ｔであるから、直前のサイクルの立ち下がりエッジ位相遅れと差し引きして、同期式ＳＲＦＦ４５５のＱ出力の立ち下がりエッジ位相は分周クロック基準位相と一致する。

【００６７】
さらに、分周クロックカウンタ４６のカウント値が“２”，“３”になる分周クロックサイクル周期は１６Ｔであるから、同期式ＳＲＦＦ４５５のＱ出力の立ち下がりエッジ位相は分周クロック基準位相と一致する。
【００６８】
すなわち、分周条件設定値－１の場合、分周クロック位相は分周クロック基準位相に対して、「１Ｔ遅れ → 一致 → 一致 → 一致 →…」というパターンを繰り返す。
【００６９】
そして、上述と同様にして、分周条件設定値＝２の場合、分周クロック位相は分周クロック基準位相に対して、「１Ｔ遅れ → 一致 → １Ｔ遅れ → 一致 →…」というパターンを繰り返す。
【００７０】
また、分周条件設定値＝３の場合、分周クロック位相は分周クロック基準位相に対して、「１Ｔ遅れ → １Ｔ遅れ → １Ｔ遅れ → 一致 →…」というパターンを繰り返す。
【００７１】
次に、上記のように分周クロック位相が変化した場合のウォブル信号（ＷＢＬ）位相と記録用クロック信号（ＷＣＬＫ）位相の関係について説明する。
ＰＬＬの動作時定数は、一般に位相比較周期に比べて長い周期が設定される。
そのため、上記のように分周クロック位相が変化しても、記録用クロック信号周波数は略一定の値に保たれ、定常状態においては分周クロック信号の平均的位相がウォブル信号位相に一致するようなロック状態が得られる。
【００７２】
図５は、分周条件設定値＝１の場合の定常状態でロックした状態のウォブル信号（ＷＢＬ），記録用クロック信号（ＷＣＬＫ），及び分周クロック信号のタイミングを示す図である。
【００７３】
同図の上段の（ａ）～（ｄ）には、それぞれウォブル信号（ＷＢＬ），分周クロック信号，及び分周クロックカウンタ４６のカウント値の関係を示し、下段の（ｅ）～（ｇ）には、位相比較が行なわれる立ち上りエッジ部分を拡大して、それぞれウォブル信号（ＷＢＬ），記録用クロック信号（ＷＣＬＫ），及び分周クロック信号の関係を示している。
【００７４】
上述のように、定常状態でロックした状態では分周クロック信号の平均的位相がウォブル信号位相に一致する。
その結果、ウォブル信号に対する分周クロックの位相は、図５の（ｇ）に示すように「０．７５Ｔ遅れ → ０．２５Ｔ進み → ０．２５Ｔ進み → ０．２５Ｔ進み→…」という関係になる。
【００７５】
分周条件設定値＝１の場合、分周クロックカウンタ４６のカウント値が“０”の場合の分周クロック位相のみが分周クロック基準位相に対して１Ｔ遅れていることを考えると、ウォブル信号位相に対する分周クロック基準位相は、常に“０．２５Ｔ”の進みになる。
このことは、ウォブル信号位相に対する記録用クロック信号位相が、“０．２５Ｔ”の進みになることと等価である。
【００７６】
また、図示を省略するが、上述と同様にして、分周条件設定値＝２，３の場合、ウォブル信号位相に対する記録用クロック信号位相は、それぞれ“０．５Ｔ”，“０．７５Ｔ”の進みになる。
【００７７】
このようにして、この記録クロック発生回路４では、分周条件設定値が“０”から“３”の範囲で、その値に応じてウォブル信号と記録用クロック信号との位相関係を０．２５

Ｔ単位で“０Ｔ”から“０．７５Ｔ”まで変化させることができる。

【００７８】

次に、図６のタイミング図に基づいて、この記録クロック発生回路が、ウォブル信号と記録用クロック信号との位相関係をさらに大きく変化させるときの制御について説明する。

【００７９】

図６の上段には、分周条件設定値を“３”から“０”に変化させた場合の分周器４５の動作タイミングを示している。

ここでは、分周条件設定値を“３”から“０”に変化させるタイミングを、分周クロックカウンタ４６のカウント値が“３”から“０”に変化するタイミングに一致させる。

【００８０】

分周条件設定値が“３”であり、分周クロックカウンタ４６のカウント値が“３”になる分周クロックサイクル周期は、上述の説明のように１５Ｔになる。

【００８１】

また、分周条件設定値が“０”であり、分周クロックカウンタ４６のカウント値が“０”になる分周クロックサイクル周期は、Ａカウンタ４５１の初期値が分周条件設定値が“３”であり、分周クロックカウンタ４６のカウント値が“３”の段階で設定されたものになるので１７Ｔになる。

【００８２】

同様にして、分周条件設定値が“０”であり、分周クロックカウンタ４６のカウント値が“１”，“２”，“３”になる分周クロックサイクル周期は、上述の説明のように１６Ｔになる。

【００８３】

すなわち、分周条件設定値を“３”から“０”に変化させた直後の分周クロックサイクル周期は、分周条件設定値が“０”のままの分周クロックサイクル周期と異なり、丸々１Ｔ分の周期が加えられたものになり、それ以降は、その１Ｔ分の周期加算による位相ずれが累積されたままになる。

【００８４】

そのため、分周条件設定値を“３”にし、ウォブル信号に対して記録用クロック信号の位相を０．７５Ｔ進ませた状態から、分周条件設定値を“０”に変化させた場合、ウォブル信号に対する記録用クロック信号の位相は１Ｔ進んだ状態になる。

【００８５】

この状態からさらに、分周条件設定値を“１→２→３”と変化させた場合、定常状態におけるウォブル信号に対する記録用クロック信号の位相は、「１．２５Ｔ→１．５Ｔ→１．７５Ｔ進んだ」状態になる。

【００８６】

図６の下段には、分周条件設定値を“０”から“３”に変化させた場合の分周器４５の動作タイミングを示している。

ここでは、分周条件設定値を“０”から“３”に変化させるタイミングを、分周クロックカウンタ４６のカウント値が“３”から“０”に変化するタイミングに一致させるものとする。

【００８７】

分周条件設定値が“０”であり、分周クロックカウンタ４６のカウント値が“３”になる分周クロックサイクル周期は、上述した説明のように１６Ｔになる。

【００８８】

また、分周条件設定値が“３”になり、分周クロックカウンタ４６のカウント値が“０”になる分周クロックサイクル周期は、Ａカウンタ４５１の初期値が分周条件設定値が“０”であり、分周クロックカウンタ４６のカウント値が“３”の段階で設定されたものになるので１６Ｔになる。

【００８９】

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同様にして、分周条件設定値が“３”であり、分周クロックカウンタ４６のカウント値が“１”，“２”，“３”になる分周クロックサイクル周期は、上述の説明のようにそれぞれ“１６Ｔ”，“１６Ｔ”，“１５Ｔ”になる。

【００９０】

すなわち、分周条件設定値を“０”から“３”に変化させた直後の分周クロックサイクル周期は、分周条件設定値が“３”のままの分周クロックサイクル周期と異なり、丸々１Ｔ分の周期が差し引かれたものとなり、それ以降は、その１Ｔ分の周期加算による位相ずれが累積されたままになる。

【００９１】

そのため、分周条件設定値を“０”にし、ウォブル信号に対して記録用クロック信号の位相を一致させた状態から分周条件設定値を“３”に変化させた場合、ウォブル信号に対する記録用クロック信号の位相は０．２５Ｔ遅れた状態になる。

【００９２】

この状態からさらに、分周条件設定値を“２→１→０”と変化させた場合、定常状態におけるウォブル信号に対する記録用クロック信号の位相は「０．２５Ｔ→０．５Ｔ→０．７５Ｔ遅れた」状態になる。

【００９３】

このようにして、この参考例の記録クロック発生回路は、分周条件設定値が“０”から“３”の範囲で、その値に応じてウォブル信号と記録用クロック信号との位相関係を０．２５Ｔ単位で“０Ｔ”から“０．７５Ｔ”まで変化させることができるだけではなく、分周条件設定値を「３→０→１→２→３．．．」というようにバイナリカウンタ式に増加させていくか、「０→３→２→１→０．．．」というように減少させていくことにより、ウォブル信号と記録用クロック信号との位相関係を０．２５Ｔ単位で無限に変化させることができる。

【００９４】

なお、上記のこの発明の参考例の記録クロック発生回路では、分周クロックカウンタ４６のカウント長を“４”にし、分周器４５の分周比変化の繰り返しサイクルを“４”にしているので、ウォブル信号と記録用クロック信号との位相関係の設定単位が“０．２５Ｔ”になっているが、カウント長をより長くし、分周比変化の繰り返しサイクルも同じく長くすることにより、より細かい単位で位相関係の設定が可能になる。

【００９５】

次に、この発明の他の参考例の記録クロック発生回路について説明する。

この記録クロック発生回路は、図２及び図３に示したような構成と同じであり、上述と同じように図１に示した光ディスク駆動装置の記録クロック発生回路４として用いられるが、その機能が上述のものとは若干異なる。

【００９６】

この場合の記録クロック発生回路４は、図示を省略したコントローラによって光ディスク１にデータを記録する毎に記録クロック発生回路４内で設定される分周条件設定値をランダムに選択する。

【００９７】

このようにして、この記録クロック発生回路４によれば、光ディスクにデータを記録する毎に、ウォブル信号と記録用クロック信号との位相関係がランダムに変化し、光ディスクの記録領域の同じ場所を繰り返して使用することを防ぐことができ、ディスク材料の疲労を平均化して軽減し、結果的に繰り返し使用回数を向上させることができる。

【００９８】

しかも、アナログディレイ回路を使用しないで記録開始点をランダムに可変することが可能なので、装置コストを低減することができ、低価格で提供することができる。

【００９９】

次に、この発明のまた他の参考例の記録クロック発生回路について説明する。

この記録クロック発生回路は、図２及び図３に示したような構成と同じであり、上述と

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同じように図１に示した光ディスク駆動装置の記録クロック発生回路４として用いられるが、その機能が上述の２つのものとは若干異なる。

【０１００】

この記録クロック発生回路は上記他の参考例と同様に図２、図６に示すような構成のもので、図１に示す光ディスク駆動装置の記録クロック発生回路４として用いられる。

【０１０１】

この場合の記録クロック発生回路４の発生した記録クロックでデータを記録する光ディスク１には、ウォブル信号にアドレス情報と同期信号とが変調されて重畳されている。

【０１０２】

この記録クロック発生回路４の同期検出回路５は、ウォブル信号に重畳された同期信号を検出し、ウォブル同期信号を出力する。

アドレスデコーダ６は、ウォブル信号に重畳されたアドレス情報を検出する。

【０１０３】

データエンコーダ８は、記録用クロック信号（ＷＣＫ）に同期させて記録データに変調を施す他に、変調データ中に同期信号を挿入する。

また、同期信号挿入のタイミングでエンコーダ同期信号を出力する。

同期判定回路１１は、ウォブル同期信号とエンコーダ同期信号とのタイミングを監視する。

【０１０４】

通常、ウォブル信号と記録用クロック信号との位相が同期した状態では、ウォブル同期信号とエンコーダ同期信号とのタイミングは一致する。

しかし、記録クロック発生回路４にビットスリップが生じた場合、ウォブル信号と記録用クロックの位相ずれが生じるので、その生じたビットスリップ分だけウォブル同期信号とエンコーダ同期信号との間にタイミング差が生じる。

【０１０５】

そこで、同期検出回路５は、ウォブル同期信号とエンコーダ同期信号との間にタイミング差が生じた場合、この差に応じて記録クロック発生回路４に設定する分周条件設定値を変化させる。

【０１０６】

図７は、図１に示した光ディスク駆動装置においてビットスリップが生じた場合の同期検出回路５の動作の説明に供する各種信号のタイミング図である。

同図に示す例では、左から２番目と３番目の同期信号の間でビットスリップが生じており、３番目のウォブル同期信号とエンコーダ同期信号との間にタイミング差を生じている。

【０１０７】

また、ビットスリップの発生により、ウォブル信号に対して記録用クロックの位相は遅れ方向に生じているので、エンコーダ同期信号の発生位置よりも早いタイミングでウォブル同期信号が生じている。

【０１０８】

このような場合、同期検出回路５は、ビットスリップによって生じた記録用クロックの位相遅れを修正するために、記録用クロック信号の位相を進める方向に分周条件設定値を変化させる。

【０１０９】

上述のように制御すると、図２と図３に示した記録クロック発生回路４では、分周条件設定値を「０→１→２→３→０→１．．．」というようにバイナリカウンタ式に増加させることにより、ウォブル信号に対する記録用クロックの位相を０．２５Ｔ単位で進めて行くことができる。

【０１１０】

また、同期検出回路５は、ウォブル同期信号とエンコーダ同期信号との間にタイミング差がなくなるまで分周条件設定値を変化させていく。

その結果、ビットスリップによって生じた記録用クロックの位相遅れを修正することができる。

【０１１１】

このようにして、この記録クロック発生回路によれば、ウォブル信号の欠落などによって記録用クロック信号がウォブル信号に対してビットスリップを生じた場合でも、ウォブル信号と記録用クロックの位相ずれを回復させることができ、記録データを所定位置に復旧させることが可能になる。

【０１１２】

次に、この発明の一実施形態の記録クロック発生回路について説明する。

図８は、この発明の一実施形態の記録クロック発生回路の構成を示すブロック図であり、図１６に示した記録クロック発生回路の構成と略同じであるが、位相比較器４１に位相比較マスク信号を入力するようにしたところが異なる。

【０１１３】

そして、この記録クロック発生回路も、図１に示した光ディスク駆動装置の記録クロック発生回路として用いられる。

また、この場合の記録クロック発生回路の発生した記録クロックでデータを記録する光ディスク１には、ウォブル信号にアドレス情報と同期信号とが位相変調されて重畳されている。

【０１１４】

図９は、位相変調されたウォブル信号の波形例を示す説明図である。

この記録クロック発生回路を用いた図１の光ディスク駆動装置では、同期検出回路５はウォブル信号に重畳された同期信号を検出すると共に、アドレス情報と同期信号が位相変調された所定タイミングの近傍では、図８に示した位相比較器４１に対して位相差検出をマスクさせるための位相比較マスク信号を出力する。

【０１１５】

図１０は、同期検出回路５が位相比較マスク信号を出力するときのタイミング例を示す説明図である。

同図に示すように、ウォブル信号に重畳された同期信号（ウォブル同期信号）を検出し、光ディスク１上の同期信号とアドレス信号（アドレス情報の検出信号）の検出区間では位相比較マスク信号を出力する。

【０１１６】

このようにして、この記録クロック発生回路によれば、位相変調によってウォブル信号の位相に急な変化が生じる部分では位相比較器４１の動作をマスクするので、ウォブル信号と記録用クロック信号との位相ずれが生じることが無くなり、ウォブル信号に安定して位相同期させた記録用クロック信号を発生させることができる。

【０１１７】

次に、この発明のさらに他の参考例の記録クロック発生回路について説明する。

図１１は、この発明のさらに他の参考例の記録クロック発生回路の構成を示すブロック図であり、図２，図８，及び図１６に示した記録クロック発生回路と共通する部分には同一符号を付している。

【０１１８】

そして、この記録クロック発生回路も、図１に示した光ディスク駆動装置の記録クロック発生回路として用いられる。

【０１１９】

この記録クロック発生回路は、周波数比較器４０１がウォブル信号を所定比で分周し、その分周されたウォブル信号の周期を記録用クロック信号の周期でカウントし、そのカウント値に応じて周波数差信号をチャージポンプ４０２へ出力し、また、切り換え信号をマルチプレクサ４０３へ出力する。

【０１２０】

チャージポンプ４０２は、周波数差信号を電圧信号に変換する。

マルチプレクサ４０３は、周波数比較器４０１からの切り換え信号に応じて、チャージポンプ４２，チャージポンプ４０２の出力の一方を選択して出力する。

【０１２１】

図１２は、図１１に示した周波数比較器４０１の内部構成を示すブロック図である。

この周波数比較器４０１のカウンタ４０１１は、ウォブル信号（ＷＢＬ）を所定比で分周し、分周ウォブルパルスをカウンタ４０１２とレジスタ４０１３へそれぞれ出力する。

【０１２２】

カウンタ４０１２は、分周クロックの数をカウントし、分周ウォブルパルス毎にリセットされる。

レジスタ４０１３には、分周ウォブルパルス毎にリセットされる直前のカウンタ４０１２のカウント値がロードされる。

【０１２３】

その結果、レジスタ４０１３には、分周されたウォブル信号の周期を記録用クロック信号の周期でカウントした値がロードされることになり、その値はウォブル信号周波数に対して分周クロック周波数が小さい時には小さい値になり、大きい時には大きい値になり、ウォブル信号周波数に対する分周クロック周波数を示す値になる。

【０１２４】

データコンパレータ４０１４は、レジスタ４０１３の値が所定値よりも大きい場合にはＤｏｗｎ信号を、小さい場合にはＵｐ信号をそれぞれ出力する。

また、データコンパレータ４０１４は、レジスタ４０１３の値が所定の範囲内にある場合には、チャージポンプ４２の出力を選択するように切り換え信号（Ｍｕｘ）をアクティブにし、所定の範囲外の場合には、チャージポンプ４０２の出力を選択するように切り換え信号（Ｍｕｘ）をインアクティブにする。

上記所定範囲の値は、ＰＬＬ回路のキャプチャレンジに相当するように選ぶ。

【０１２５】

その結果、図１１のＶＣＯ４４は、ウォブル信号周波数と記録クロック周波数との関係がキャプチャレンジ外の場合には、周波数比較器４０１から出力されるＵｐ信号又はＤｏｗｎ信号に応じてキャプチャレンジ内に近づくように駆動し、キャプチャレンジ内に入ると位相比較器４１出力に応じて駆動する。

【０１２６】

このようにして、この記録クロック発生回路によれば、ウォブル信号周波数と記録クロック周波数との関係がキャプチャレンジ外にあっても速やかにＰＬＬのロックが可能になる。

【０１２７】

次に、この発明のさらにまた他の参考例の記録クロック発生回路について説明する。

この記録クロック発生回路は、図１１に示した記録クロック発生回路の構成と同じであるが、その周波数比較器４０１の内部構成が上述のものとは異なる。そして、図１に示した光ディスク駆動装置の記録クロック発生回路として用いられる。

【０１２８】

図１３は、この発明のさらにまた他の参考例の記録クロック発生回路の周波数比較器４０１の内部構成を示すブロック図である。

この周波数比較器４０１の構成は、図１２に示したものと同様にカウンタ４０１１，カウンタ４０１２，レジスタ４０１３，及びデータコンパレータ４０１４を備えている。さらに、新たなカウンタ４０１５とフリップフロップ４０１６を設けている。

【０１２９】

この周波数比較器４０１のデータコンパレータ４０１４は、レジスタ４０１３値が所定の範囲内にある場合には切り換え信号（Ｍｕｘ）をアクティブにする。

フリップフロップ４０１６は、その切り換え信号（Ｍｕｘ）がアクティブになるとセットされ、その出力である切り換え信号（Ｍｕｘ′）をアクティブにする。

【０１３０】

データコンパレータ４０１４は、レジスタ４０１３の値が所定の範囲外の場合には、切り換え信号（Ｍｕｘ）をインアクティブにするが、切り換え信号（Ｍｕｘ′）はすぐにはインアクティブとはならない。

【０１３１】

カウンタ４０１５は、切り換え信号（Ｍｕｘ）がインアクティブの場合、分周ウォブルパルス毎にカウント値をアップさせる。

また、カウンタ４０１５は、切り換え信号（Ｍｕｘ）がアクティブの場合、分周ウォブルパルスによってカウント値をリセットする。

そして、上記カウント値が所定値に達すると、フリップフロップ４０１６に対してリセット信号を出力し、切り換え信号（Ｍｕｘ′）をインアクティブにする。

【０１３２】

こうして、レジスタ４０１３にロードされるカウント値が所定の範囲外であることが所定回数連続して検出された場合には、切り換え信号（Ｍｕｘ′）をインアクティブにする。

【０１３３】

したがって、ウォブル信号周波数と記録クロック周波数との関係がキャプチャレンジ内にあるにもかかわらず、ウォブル信号の欠落などによって周波数比較器４０１が誤ってキャプチャレンジ外であると判定することを防ぐことができる。

【０１３４】

このようにして、この記録クロック発生回路によれば、ウォブル信号周波数と記録クロック周波数との関係がキャプチャレンジ外にあっても速やかにＰＬＬのロックを可能にすると共に、ＰＬＬのロック中にウォブル信号の欠落などによって不必要な引き込み動作が生じることを防ぐことができる。

【図面の簡単な説明】

【０１３５】

【図１】この発明の参考例及びこの発明の一実施形態である光ディスク駆動装置の構成例を示すブロック図である。

【図２】図１に示したこの発明の参考例の記録クロック発生回路の内部構成例を示すブロック図である。

【図３】図２に示した分周器，分周クロックカウンタ，及び分周比設定テーブルのさらに詳細な構成例を示す図である。

【図４】図２に示した分周器の動作の説明に供する各種信号のタイミング図である。

【０１３６】

【図５】図２に示した記録クロック発生回路における分周条件設定値＝１の場合の定常状態でロックした状態のウォブル信号，記録用クロック信号，及び分周クロック信号のタイミングを示す図である。

【図６】図２に示した記録クロック発生回路におけるウォブル信号と記録用クロック信号との位相関係をさらに大きく変化させるときの制御の説明に供する各種信号のタイミング図である。

【図７】図１に示した光ディスク駆動装置においてビットスリップが生じた場合の同期検出回路の動作の説明に供する各種信号のタイミング図である。

【０１３７】

【図８】この発明の一実施形態の記録クロック発生回路の構成を示すブロック図である。

【図９】図１に示した光ディスクの位相変調されたウォブル信号の波形例を示す説明図である。

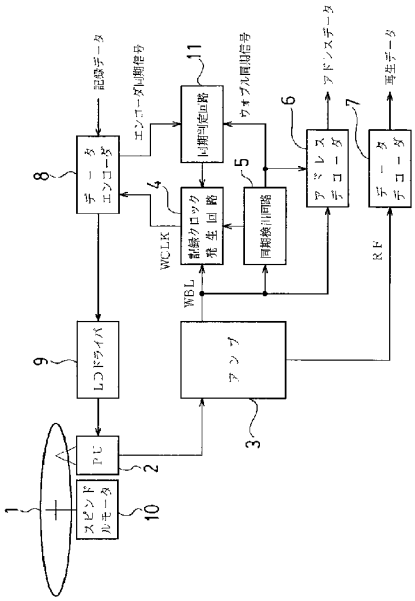
【図１０】図１に示した同期検出回路が位相比較マスク信号を出力するときのタイミング例を示す説明図である。

【図１１】この発明のさらに他の参考例の記録クロック発生回路の構成を示すブロック図である。

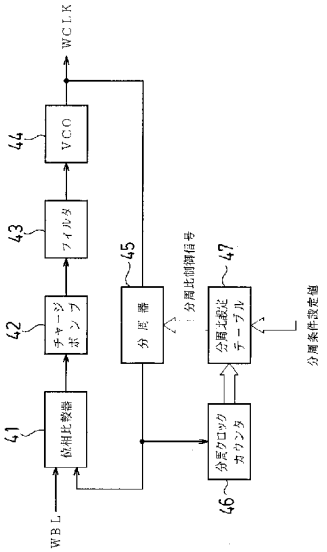
【図１２】図１１に示した周波数比較器の内部構成を示すブロック図である。

【０１３８】
【図１３】この発明のさらにまた他の参考例の周波数比較器の内部構成を示すブロック図である。
【図１４】従来の光ディスク駆動装置の構成例を示すブロック図である。
【図１５】光ディスク１上のウォブリングされたデータ記録用トラックの構造例を示す説明図である。
【図１６】図１４に示した従来の記録クロック発生回路の構成例を示すブロック図である。
【符号の説明】
【０１３９】
１：光ディスク　２：光ピックアップ（ＰＵ）　３：アンプ　４：記録クロック発生回路　５：同期検出回路　６：アドレスデコーダ　７：データデコーダ　８：データエンコーダ　９：ＬＤドライバ　１０：スピンドルモータ　１１：同期判定回路　４１：位相比較器　４２，４０２：チャージポンプ　４３：フィルタ　４４：ＶＣＯ　４５：分周器　４６：分周クロックカウンタ　４７：分周比設定テーブル　４５１：Ａカウンタ　４５２：Ｂカウンタ　４５３：インバータ　４０３，４５４：マルチプレクサ　４５５：同期式ＳＲＦＦ　４０１：周波数比較器　４０１１，４０１２，４０１５：カウンタ　４０１３：レジスタ　４０１４：データコンパレータ　４０１６：フリップフロップ

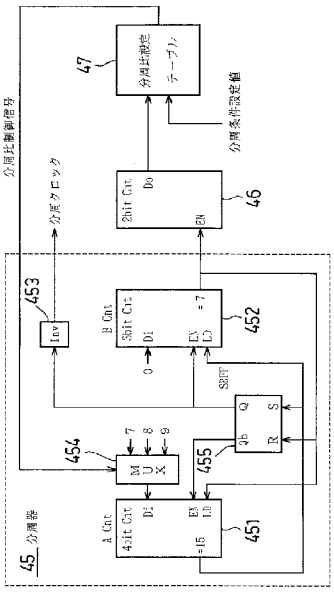
【図１】



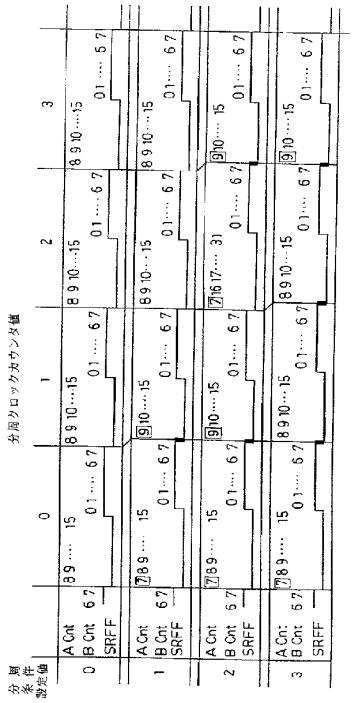
【図２】



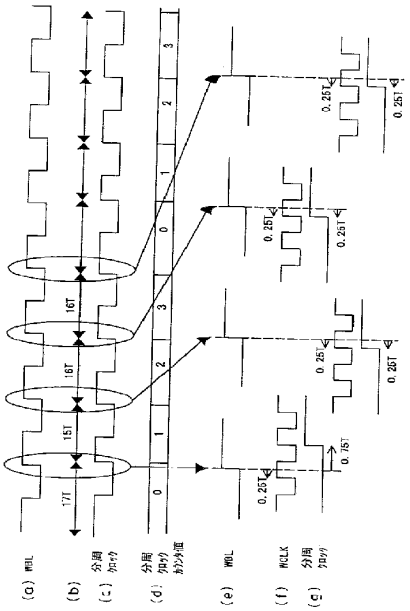
【図３】


45 分周器
A Cnt
4bit Cnt
Di
EN
LD
=15
451
454
MUX
7
8
9
455
Q
S
R
Q
SRFF
B Cnt
3bit Cnt
Di
EN
LD
=7
452
Inv
453
分周クロック
2bit Cnt
Do
EN
46
分周比制御信号
分周比設定
テーブル
47
分周条件設定値

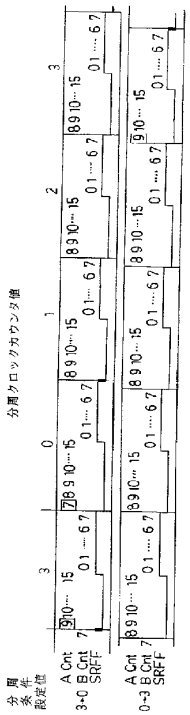
【図４】


分周クロックカウンタ値
分周条件設定値
A Cnt
B Cnt
SRFF
0
1
2
3
0 1 2 3 4 5 6 7
8 9 10 15
0 1 6 7

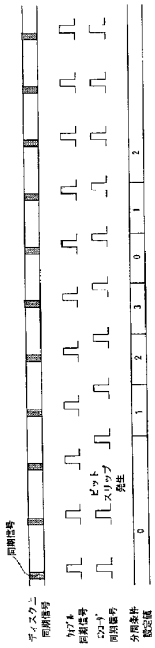
【図５】


(a) WBL
(b) 分周クロック
(c) 分周クロックカウンタ値
(d) 分周クロックカウンタ値
(e) WBL
(f) WCLK
(g) 分周クロック
17T
15T
16T
0.25T
0.75T

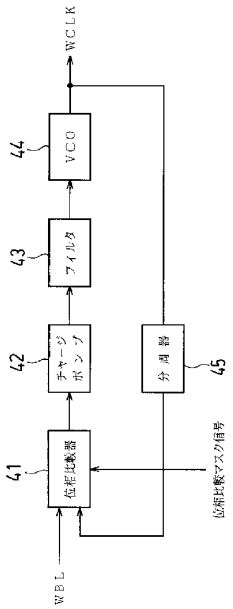
【図６】


分周クロックカウンタ値
分周条件設定値
A Cnt
B Cnt
SRFF
3-0
0-3
0
1
2
3
0 1 2 3 4 5 6 7
8 9 10 15
0 1 6 7

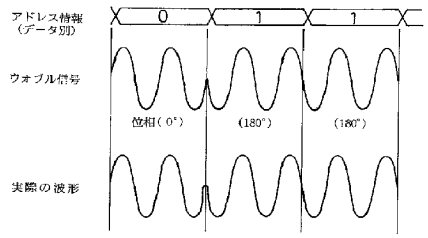
【図７】


同期信号
ビット
スリップ
発生
0
1
2
3

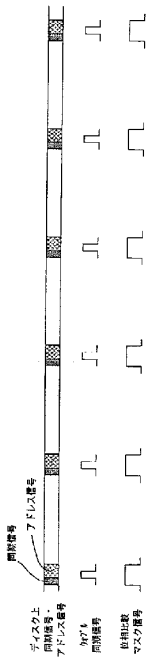
【図８】


WCLK
44
VCO
43
フィルタ
42
チャージ
ポンプ
分周器
45
41
位相比較器
WBL
位相比較マスク信号

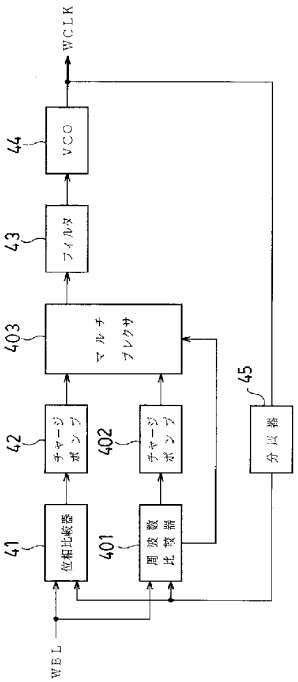
【図９】


アドレス情報
（データ別）
0
1
1
ウォブル信号
位相（0°）
（180°）
（180°）
実際の波形

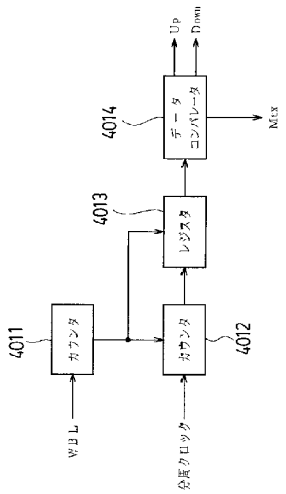
【図１０】


同期信号
アドレス信号
ディスク上
同期信号・
アドレス信号
ゲート
同期信号
位相比較
マスク信号

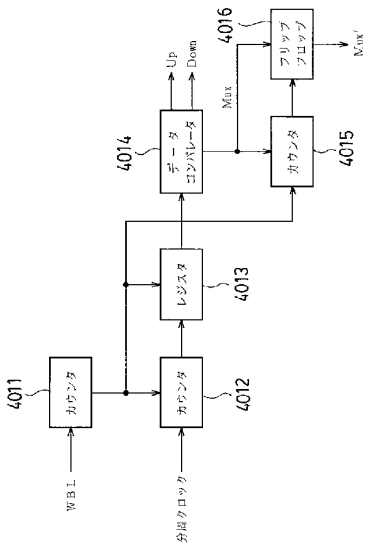
【図１１】



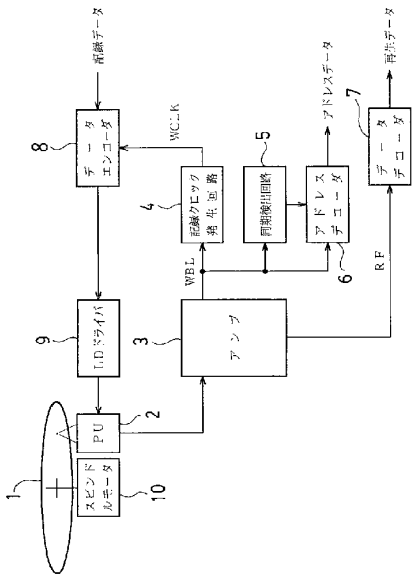
【図１２】



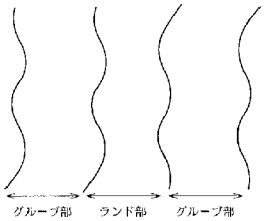
【図１３】



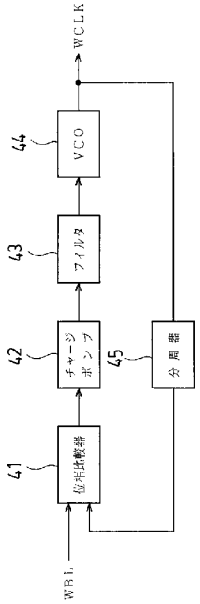
【図１４】



【図１５】


グルーブ部
ランド部
グルーブ部

【図１６】


WCLK
44
VCO
43
フィルタ
42
チャージポンプ
45
分周器
41
位相比較器
WBL

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY
(Chapter I of the Patent Cooperation Treaty)

(PCT Rule 44*bis*)

Applicant's or agent's file reference 13-0410-PCT	**FOR FURTHER ACTION**	See item 4 below
International application No. PCT/US2013/046372	International filing date *(day/month/year)* 18 June 2013 (18.06.2013)	Priority date *(day/month/year)* 26 June 2012 (26.06.2012)
International Patent Classification (8th edition unless older edition indicated) See relevant information in Form PCT/ISA/237		
Applicant SONOS, INC.		

1. This international preliminary report on patentability (Chapter I) is issued by the International Bureau on behalf of the International Searching Authority under Rule 44 *bis*.1(a).

2. This REPORT consists of a total of 5 sheets, including this cover sheet.

   In the attached sheets, any reference to the written opinion of the International Searching Authority should be read as a reference to the international preliminary report on patentability (Chapter I) instead.

3. This report contains indications relating to the following items:

☒	Box No. I	Basis of the report
☐	Box No. II	Priority
☐	Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
☐	Box No. IV	Lack of unity of invention
☒	Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
☐	Box No. VI	Certain documents cited
☐	Box No. VII	Certain defects in the international application
☐	Box No. VIII	Certain observations on the international application

4. The International Bureau will communicate this report to designated Offices in accordance with Rules 44*bis*.3(c) and 93*bis*.1 but not, except where the applicant makes an express request under Article 23(2), before the expiration of 30 months from the priority date (Rule 44*bis* .2).

	Date of issuance of this report 31 December 2014 (31.12.2014)
The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No. +41 22 338 82 70	Authorized officer Simin Baharlou e-mail: pt09.pct@wipo.int

Form PCT/IB/373 (January 2004)

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

To:
GEORGE CHRISTOPHER N.

HANLEY, FLIGHT & ZIMMERMAN, LLC 150 S.
WACKER DRIVE SUITE 2100 CHICAGO IL 60606 USA

PCT

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43bis.1)

Date of mailing *(day/month/year)*	**26 August 2013 (26.08.2013)**
Applicant's or agent's file reference 13-0410-PCT	**FOR FURTHER ACTION** See paragraph 2 below

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/US2013/046372	**18 June 2013 (18.06.2013)**	26 June 2012 (26.06.2012)

International Patent Classification (IPC) or both national classification and IPC

G06F 15/16(2006.01)i

Applicant
SONOS, INC.

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.
For further options, see Form PCT/ISA/220.

Name and mailing address of the ISA/KR	Date of completion of this opinion	Authorized officer
Korean Intellectual Property Office 189 Cheongsa-ro, Seo-gu, Daejeon Metropolitan City, 302-701, Republic of Korea Facsimile No. +82-42-472-7140	23 August 2013 (23.08.2013)	PARK, Sang Hyun Telephone No. +82-42-481-8263

Form PCT/ISA/237 (cover sheet) (July 2011)

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US2013/046372

Box No. I Basis of this opinion

1. With regard to the **language**, this opinion has been established on the basis of :

   ☒ the international application in the language in which it was filed

   ☐ a translation of the international application into _____ , which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b))

2. ☐ This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43*bis*.1(a))

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, this opinion has been established on the basis of:

   a. a sequence listing filed or furnished
      ☐ on paper
      ☐ in electronic form

   b. time of filing or furnishing
      ☐ contained in the international application as filed.
      ☐ filed together with the international application in electronic form.
      ☐ furnished subsequently to this Authority for the purposes of search.

4. ☐ In addition, in the case that more than one version or copy of a sequence listing has been filed or furnished, the required statements that the information in the subsequent or additioanl copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

5. Additional comments:

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US2013/046372

Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	2-3,12-13	YES
	Claims	1,4-11,14-20	NO
Inventive step (IS)	Claims	2-3,12-13	YES
	Claims	1,4-11,14-20	NO
Industrial applicability (IA)	Claims	1-20	YES
	Claims	NONE	NO

2. Citations and explanations :

(1) Reference is made to the following documents:

D1: US 2007-0048713 A1 (DANIEL PLASTINA et al.) 01 March 2007
D2: US 2012-0030366 A1 (COLLART TODD et al.) 02 February 2012
D3: US 2006-0143236 A1 (MICHAEL WU) 29 June 2006
D4: US 2008-0091771 A1 (JEFFREY L. ALLEN et al.) 17 April 2008

(2) Novelty & Inventive Steps

Concerning claims 1-10:
Claims 1,4-10
D1 discloses a community media playlist sharing system, wherein system users can upload media playlists which are automatically converted to a standardized format, media playlists can be shared with other users of the community media playlist sharing system, users can link to other playlists and obtain media from playlists automatically from third party points of purchase, users can provide recommendations, ratings and rankings relative to other playlists by system users and receive recommendations from other users and an editorial staff, participate in social networking functions including forums, discussions, weblogs, playlist topic groups and inter-user communications based on affinity for similar playlists, create playlists manually, automatically, or in real time, and wherein system users can obtain points for participation and popularity in the system and obtain profit by meta-affiliate sharing of profit for purchases of music made through playlists submitted by that user as well as through playlist toolbars distributed to third party websites.[paragraph 73 - paragraph 156, and figures 1-23] As all of the features of claims 1,4-10 are disclosed in D1, these claims are anticipated in D1. Therefore, claims 1,4-10 lack novelty under PCT Article 33(2) and are not considered as involving an inventive step under PCT Article 33(3).
Claims 2-3:
The subject matter of claims 2-3 is different from that of D1 in a guest mode. And it is

Continued on Supplemental Box

Supplemental Box

In case **the space in any of the preceding boxes is not sufficient.**
Continuation of : Box No. V

not obvious to a person skilled in the art by the documents, taken alone or in combination. Therefore, claims 2-3 are novel and involve an inventive step under PCT Article 33(2) and (3).

Concerning claims 11-20:
Claims 11,14-20:
D1 discloses a community media playlist sharing system, wherein system users can upload media playlists which are automatically converted to a standardized format, media playlists can be shared with other users of the community media playlist sharing system, users can link to other playlists and obtain media from playlists automatically from third party points of purchase, users can provide recommendations, ratings and rankings relative to other playlists by system users and receive recommendations from other users and an editorial staff, participate in social networking functions including forums, discussions, weblogs, playlist topic groups and inter-user communications based on affinity for similar playlists, create playlists manually, automatically, or in real time, and wherein system users can obtain points for participation and popularity in the system and obtain profit by meta-affiliate sharing of profit for purchases of music made through playlists submitted by that user as well as through playlist toolbars distributed to third party websites.[paragraph 73 - paragraph 156, and figures 1-23] As all of the features of claims 11,14-20 are disclosed in D1, these claims are anticipated in D1. Therefore, claims 11,14-20 lack novelty under PCT Article 33(2) and are not considered as involving an inventive step under PCT Article 33(3).
Claims 12-13:
The subject matter of claims 12-13 is different from that of D1 in a guest mode. And it is not obvious to a person skilled in the art by the documents, taken alone or in combination. Therefore, claims 12-13 are novel and involve an inventive step under PCT Article 33(2) and (3).

(3) Industrial Applicability

The subject matter of claims 1-20 is believed to be industrially applicable under PCT Article 33(4) because the claimed invention can be used in the computer industry.

PATENT COOPERATION TREATY

From the INTERNATIONAL BUREAU

PCT

NOTIFICATION CONCERNING TRANSMITTAL OF COPY OF INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY (CHAPTER I OF THE PATENT COOPERATION TREATY)
(PCT Rule 44bis.1(c))

To:

JASPER, Joseph, T.
Hanley, Flight & Zimmerman, LLC
150 S. Wacker Drive, Suite 2100
Chicago, Illinois 60606
ETATS-UNIS D'AMERIQUE

Date of mailing *(day/month/year)*	
08 January 2015 (08.01.2015)	
Applicant's or agent's file reference: 12-0402-PCT	**IMPORTANT NOTICE**
International application No.: PCT/US2013/046386	International filing date *(day/month/year)*: 18 June 2013 (18.06.2013)
Priority date *(day/month/year)*: 26 June 2012 (26.06.2012)	
Applicant: SONOS, INC.	

The International Bureau transmits herewith a copy of the international preliminary report on patentability (Chapter I of the Patent Cooperation Treaty)

The International Bureau of WIPO
34, chemin des Colombettes
1211 Geneva 20, Switzerland

Facsimile No. +41 22 338 82 70

Authorized officer
Philippe Bécamel

e-mail: pt03.pct@wipo.int

Form PCT/IB/326 (January 2004)

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY
(Chapter I of the Patent Cooperation Treaty)

(PCT Rule 44*bis*)

Applicant's or agent's file reference 12-0402-PCT	**FOR FURTHER ACTION**	See item 4 below
International application No. PCT/US2013/046386	International filing date *(day/month/year)* 18 June 2013 (18.06.2013)	Priority date *(day/month/year)* 26 June 2012 (26.06.2012)
International Patent Classification (8th edition unless older edition indicated) See relevant information in Form PCT/ISA/237		
Applicant SONOS, INC.		

1. This international preliminary report on patentability (Chapter I) is issued by the International Bureau on behalf of the International Searching Authority under Rule 44 *bis*.1(a).

2. This REPORT consists of a total of 7 sheets, including this cover sheet.

   In the attached sheets, any reference to the written opinion of the International Searching Authority should be read as a reference to the international preliminary report on patentability (Chapter I) instead.

3. This report contains indications relating to the following items:

☒	Box No. I	Basis of the report
☐	Box No. II	Priority
☐	Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
☐	Box No. IV	Lack of unity of invention
☒	Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
☐	Box No. VI	Certain documents cited
☐	Box No. VII	Certain defects in the international application
☐	Box No. VIII	Certain observations on the international application

4. The International Bureau will communicate this report to designated Offices in accordance with Rules 44*bis*.3(c) and 93*bis*.1 but not, except where the applicant makes an express request under Article 23(2), before the expiration of 30 months from the priority date (Rule 44*bis* .2).

	Date of issuance of this report 31 December 2014 (31.12.2014)
The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No. +41 22 338 82 70	Authorized officer Philippe Bécamel e-mail: pt03.pct@wipo.int

Form PCT/IB/373 (January 2004)

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

To:
JASPER JOSEPH T.

HANLEY, FLIGHT & ZIMMERMAN, LLC 150 S.
WACKER DRIVE, SUITE 2100 CHICAGO IL 60606 USA

PCT

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43bis.1)

Date of mailing *(day/month/year)*	**30 September 2013 (30.09.2013)**
Applicant's or agent's file reference 12-0402-PCT	**FOR FURTHER ACTION** See paragraph 2 below

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/US2013/046386	**18 June 2013 (18.06.2013)**	26 June 2012 (26.06.2012)

International Patent Classification (IPC) or both national classification and IPC

G06Q 50/10(2012.01)i

Applicant
SONOS, INC.

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.
For further options, see Form PCT/ISA/220.

Name and mailing address of the ISA/KR	Date of completion of this opinion	Authorized officer
Korean Intellectual Property Office 189 Cheongsa-ro, Seo-gu, Daejeon Metropolitan City, 302-701, Republic of Korea Facsimile No. +82-42-472-7140	27 September 2013 (27.09.2013)	KIM Sung Gon Telephone No. +82-42-481-8746

Form PCT/ISA/237 (cover sheet) (July 2011)

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US2013/046386

Box No. I Basis of this opinion

1. With regard to the **language**, this opinion has been established on the basis of :

   ☒ the international application in the language in which it was filed

   ☐ a translation of the international application into _____ , which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b))

2. ☐ This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43*bis*.1(a))

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, this opinion has been established on the basis of:

   a. a sequence listing filed or furnished
      ☐ on paper
      ☐ in electronic form

   b. time of filing or furnishing
      ☐ contained in the international application as filed.
      ☐ filed together with the international application in electronic form.
      ☐ furnished subsequently to this Authority for the purposes of search.

4. ☐ In addition, in the case that more than one version or copy of a sequence listing has been filed or furnished, the required statements that the information in the subsequent or additioanl copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

5. Additional comments:

WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY

International application No.
PCT/US2013/046386

Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	1-21	YES
	Claims	NONE	NO
Inventive step (IS)	Claims	NONE	YES
	Claims	1-21	NO
Industrial applicability (IA)	Claims	1-21	YES
	Claims	NONE	NO

2. Citations and explanations :

Reference is made to the following documents:

D1: US 7483958 B1 (TAREK Z. ELABBADY et al.) 27 January 2009
D2: US 2010-0228740 A1 (ALAN CANNISTRARO et al.) 09 September 2010

1. Novelty and Inventive Step

1.1 Claims 1-10

1.1.1 Independent claim 1

D1, which is considered to be the closest prior art to the subject matter of claim 1, discloses a method comprising: presenting media content information (e.g., music file, a play list) to the user, determining whether an original media playing license associated with the particular media contents file is available, generating a temporary media playing license from the original media playing license, the temporary media playing license specifying restrictions relating to playback of the particular media content file via the home network device; and sending the temporary media playing license to the home network device (See abstract, column 11, lines 1-20, claim 1, figure 4 in D1). Claim 1 differs from D1 in facilitating addition of content to the playlist by at least one participating user; and playback of content from the playlist in the restricted playback mode. However, D2 discloses a method comprising: receiving from at least one of the plurality of user devices a vote on a media item; and organizing the playlist based on the received votes (See abstract, paragraphs [0047]-[0057], claim 1, figure 4 in D2). Accordingly, claim 1 would have been obvious over D1 and D2. Therefore, claim 1 lacks an inventive step under PCT Article 33(3).

Continued on Supplemental Box

Supplemental Box

In case **the space in any of the preceding boxes is not sufficient.**
Continuation of : Box No. V

1.1.2 Dependent claims 2-10

The additional feature of claim 2 is identical to the feature of D1 in that media items in the playlist are automatically chosen and added to the playlist by a program on the playlist host device (See claim 6 in D1). Accordingly, claim 2 would have been obvious over D1 and D2. Therefore, claim 2 lacks an inventive step under PCT Article 33(3).

Claim 3 further specifies authenticating the at least one participating user to enable the at least one participating user to add content to the playlist in the restricted playback mode. However, the additional feature of claim 3 is virtually suggested by the feature of D2 considering that the host receives an opt-in command from an authorized user and the opt-in command instructs the host to allow remote access to the playlist (See abstract, paragraphs [0047]-[0057], figure 4 in D2). Accordingly, claim 3 would have been obvious over D1 and D2. Therefore, claim 3 lacks an inventive step under PCT Article 33(3).

The additional feature of claim 4 is identical to the feature of D2 in receiving from at least one of the plurality of user devices a vote on a media item; and organizing the playlist based on the received votes (See abstract, paragraphs [0047]-[0057], claim 1, figure 4 in D2). Accordingly, claim 4 would have been obvious over D1 and D2. Therefore, claim 4 lacks an inventive step under PCT Article 33(3).

Claims 5, 6 further specify that facilitating addition of content comprises accepting user selection of the content from a list of available content via a graphical user interface, and the list of available content includes a library of shared music available via a network. However, the additional features of claims 5, 6 are virtually suggested by the feature of D1 considering presenting media content information (e.g., metadata from the media library) to the user through a display screen, and selecting one or more music files, a play list, or other grouping of music files by the user (See abstract, column 11, lines 1-20, claim 1, figure 4 in D1). And D2 discloses a step of sending a playlist on a host device to a plurality of portable devices for display on a graphical user interface (See paragraph [0009] in D2). Accordingly, claims 5, 6 would have been obvious over D1 and D2. Therefore, claims 5, 6 lack an inventive step under PCT Article 33(3).

Claim 7 further comprises that the restricted playback mode is initiated and ended by a host user according to user authorization. However, the additional feature of claim 7 is merely a

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Supplemental Box

In case **the space in any of the preceding boxes is not sufficient.**
Continuation of : Previous Page

matter of design option when the general knowledge in relevant field of the art is used. Accordingly, claim 7 would have been obvious over D1 and D2. Therefore, claim 7 lacks an inventive step under PCT Article 33(3).

Claim 8 further specifies configuring the restricted playback mode for a fixed time interval. However, the additional feature of claim 8 is virtually suggested by the feature of D2 considering ordering changes can be postponed until the interval since the last touch event has exceeded 2 seconds (See paragraph [0089] in D2). Accordingly, claim 8 would have been obvious over D1 and D2. Therefore, claim 8 lacks an inventive step under PCT Article 33(3).

Claim 9 further specifies that a restricted playback mode includes a specified configuration of zones. However, the additional feature of claim 9 is virtually suggested by the feature of D1 considering that the media content license may be associated with a specific entity or with multiple entities (e.g., groups) (See column 7, lines 61-66 in D1). Accordingly, claim 9 would have been obvious over D1 and D2. Therefore, claim 9 lacks an inventive step under PCT Article 33(3).

Claim 10 further comprises that the subset of playback functions includes limited user interaction with at least one of zone configuration and content playback parameters. However, the additional feature of claim 10 is merely a matter of design option when the general knowledge in relevant field of the art is used. Accordingly, claim 10 would have been obvious over D1 and D2. Therefore, claim 10 lacks an inventive step under PCT Article 33(3).

1.2 Claims 11-20

1.2.1 Independent claim 11

Claim 11 relates to a tangible computer readable storage medium including instructions which, when executed by a processor, are to implement at least a method. But it shares similar technical features with claim 1. Accordingly, the same reasoning applies to claim 11. Therefore, claim 11 lacks an inventive step under PCT Article 33(3).

1.2.2 Dependent claims 12-20

Claims 12-20 share the same technical features with claims 2-10, respectively. Accordingly, the

Continued on The Next Page

Supplemental Box

In case **the space in any of the preceding boxes is not sufficient.**
Continuation of : Previous Page

same reasoning applies to claims 12-20. Therefore, claims 12-20 lack an inventive step under PCT Article 33(3).

1.3 Independent claim 21

Claim 21 relates to a media playback system, but it shares similar technical features with claim 1. Accordingly, the same reasoning applies to claim 21. Therefore, claim 21 lacks an inventive step under PCT Article 33(3).

2. Industrial Applicability

Claims 1-21 are industrially applicable under PCT Article 33(4).

Electronic Patent Application Fee Transmittal				
Application Number:	14516867			
Filing Date:	17-Oct-2014			
Title of Invention:	Obtaining Content from Remote Source for Playback			
First Named Inventor/Applicant Name:	Nicholas A.J. Millington			
Filer:	Benjamin Michael Urban			
Attorney Docket Number:	04-0401-CON1014D			
Filed as Large Entity				
Filing Fees for Utility under 35 USC 111(a)				
Description	**Fee Code**	**Quantity**	**Amount**	**Sub-Total in USD($)**
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
Submission- Information Disclosure Stmt	1806	1	180	180
		Total in USD ($)		**180**

Electronic Acknowledgement Receipt	
EFS ID:	21745971
Application Number:	14516867
International Application Number:	
Confirmation Number:	9318
Title of Invention:	Obtaining Content from Remote Source for Playback
First Named Inventor/Applicant Name:	Nicholas A.J. Millington
Customer Number:	107361
Filer:	Benjamin Michael Urban
Filer Authorized By:	
Attorney Docket Number:	04-0401-CON1014D
Receipt Date:	12-MAR-2015
Filing Date:	17-OCT-2014
Time Stamp:	19:59:44
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$180
RAM confirmation Number	5283
Deposit Account	132490
Authorized User	
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Form (SB08)	04-0401-CON1014D_IDS.pdf	707870 bac5fea1291658f7bc1de21421fcdd868f49e77f	no	6
Warnings:					
Information:					
2	Foreign Reference	GB2338374.pdf	570090 3f631e460ac8630289b34fec71d695ffa1250fe1	no	16
Warnings:					
Information:					
3	Foreign Reference	JP07210129.pdf	1047465 c0f7b2f5445519535515cb21b06d7dca1b83a6b7	no	13
Warnings:					
Information:					
4	Foreign Reference	JP2005108427.pdf	1075788 d14308cea9e61af4294aa93c28d700e7116a11a2	no	22
Warnings:					
Information:					
5	Non Patent Literature	13848932_Advisory_Action_3-2-15.pdf	129402 16d5ad67cf61562b4cc5ae8583cfe851ffc2f797	no	3
Warnings:					
Information:					
6	Non Patent Literature	14184528_Advisory_Action_2-26-15.pdf	124596 8c21acd66191f7f1e245786b35170eb0d55a30b2	no	3
Warnings:					
Information:					
7	Non Patent Literature	14184526_Final_OA_2-11-15.pdf	444504 4d2ca224f13835ab971c56f83091a5b9dc090bca	no	13
Warnings:					
Information:					

8	Non Patent Literature	14184935_Final_OA_2-11-15.pdf	597904 06df6bf664b3ebc72f1e54a3a57394b1c15d22d3	no	17
Warnings:					
Information:					
9	Non Patent Literature	14184522_Final_OA_2-12-15.pdf	706206 868a4d9bc110b9d1c8daaf1a2c50e73e2c1d165e	no	20
Warnings:					
Information:					
10	Non Patent Literature	PCTUS13046372_Intl_Preliminary_Report_12-31-14.pdf	215183 37addc80d791e2aa8c7948f7d9e827acb6c7aca0	no	5
Warnings:					
Information:					
11	Non Patent Literature	PCTUS2013046386_Intl_Preliminary_Report_1-8-15.pdf	308278 d483d48dbb01747b5d9fb4710b31c32aadf7ba53	no	8
Warnings:					
Information:					
12	Non Patent Literature	14186850_NonFinal_OA_2-26-15.pdf	880420 fa1e6f863f190c6087cde949a09e681683355aa0	no	25
Warnings:					
Information:					
13	Non Patent Literature	14504812_Non-Final_OA_1-30-15.pdf	440782 67d67d7ef53b5a9cae8379be8bad28e758ab699d	no	13
Warnings:					
Information:					
14	Non Patent Literature	14290493_NonFinal_OA_1-30-15.pdf	979987 cbc94e4d907922aec31397728bc216763c8f8d6b	no	29
Warnings:					
Information:					
15	Non Patent Literature	13864251_Final_OA_3-3-15.pdf	454610 8dbe987c5d95efb120b5e3f7b6d598ee28c4618e	no	13
Warnings:					
Information:					
16	Non Patent Literature	13848904_Final_OA_3-4-15.pdf	536473 b22879fe87ed12d1a949aa9d562d30b21e5d90f9	no	16
Warnings:					
Information:					

17	Non Patent Literature	13888203_Final_Rejection_3-5-15.pdf	452379 692bc9c4ab66f0d77f6b0b3b73ed6e3c5ac3df89	no	13
Warnings:					
Information:					
18	Non Patent Literature	13435776_Non-Final_Rejection_3-4-15.pdf	553426 95806b3a1f8d8fc4295370a99f31fbc8b521a072	no	16
Warnings:					
Information:					
19	Non Patent Literature	14505027_PreInterview_First_Office_Action_3-10-15.pdf	142373 ba1be09ea76ec4d14403ea75ad920f0b1f7493ad	no	4
Warnings:					
Information:					
20	Fee Worksheet (SB06)	fee-info.pdf	30417 e3b3382d2c854d4e556d9ff9c98aadb55845bdaa	no	2
Warnings:					
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		Total Files Size (in bytes):	10398153		

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<u>New Applications Under 35 U.S.C. 111</u>
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

<u>National Stage of an International Application under 35 U.S.C. 371</u>
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

<u>New International Application Filed with the USPTO as a Receiving Office</u>
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/516,867	10/17/2014	Nicholas A.J. Millington	04-0401-CON1014D	9318

107361 7590 03/09/2015

McDonnell Boehnen Hulbert & Berghoff LLP
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300 South Wacker Drive
Chicago, IL 60606

EXAMINER	
SURVILLO, OLEG	

ART UNIT	PAPER NUMBER
2442	

MAIL DATE	DELIVERY MODE
03/09/2015	PAPER

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

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 14/516,867	Applicant(s) MILLINGTON, NICHOLAS A.J.	
	Examiner OLEG SURVILLO	Art Unit 2442	AIA (First Inventor to File) Status No

-- 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 MONTHS 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 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 *January 19, 2015*.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ 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*

5)☒ Claim(s) *21-40* is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6)☐ Claim(s) _____ is/are allowed.

7)☒ Claim(s) *21-40* is/are rejected.

8)☐ Claim(s) _____ is/are objected to.

9)☐ Claim(s) _____ are subject to restriction and/or election requirement.

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☐ 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).

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).

Certified copies:

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)).

** 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) ☒ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date *12/17/14; 01/22/15*.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

4) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

1. Claims 21-40 remain pending in the application. Claims 21, 31-34, and 40 are currently amended. Claims 1-20 have been canceled. No new claims are currently added.

Response to Arguments

2. With regard to the Applicant's remarks dated January 19, 2015:

Regarding the rejection of claims 21-32 under 35 U.S.C. 112 (pre-AIA), second paragraph, Applicant's amendment has been fully considered and is sufficient. Therefore, the rejection has been withdrawn.

Regarding the rejection of claims 21-40 under 35 U.S.C. 103(a), Applicant's amendment and arguments have been fully considered. Applicants argue at **point 1)** at page 9 of the Remarks as filed that *"Goldberg is silent as to whether a request received by one unit from another unit includes instructions that cause both the requesting unit and the request-receiving unit to playback audio, and thus, the requests that a receive unit 730 makes to a broadcast unit 710 (or vice versa) in Goldberg do not amount to "control information comprising…one or more instructions that cause the first playback device and a second playback device to playback audio information"*. Examiner disagrees and notes that "cause" is undefined in the specification. Therefore, no specific meaning can be attributed to this word. The broadest reasonable interpretation in light of the specification would be "that enable" both the requesting unit and the request-

receiving unit to playback audio. Examiner maintains that the information exchanged between the receive unit 730 and a broadcast unit 710 in Goldberg enables both device to playback audio information in synchrony. Therefore, Applicant's argument cannot be held as persuasive. Applicants also argue that *"Alexander fails to disclose control information pertaining to a second playback device"*. Examiner agrees. Applicants further argue that *"the search requests and search results exchanged between a peer computer and the result server do not cause either device to playback audio information, and thus, the messaging exchanged between the devices in Alexander do not amount to "control information comprising...one or more instructions that cause the first playback device and a second playback device to playback audio information"*. Examiner disagrees for the same reasons as above. In particular, "cause" is undefined in the specification. Therefore, no specific meaning can be attributed to this word. The broadest reasonable interpretation in light of the specification would be "that enable" either device of Alexander to playback audio. Examiner maintains that Alexander enables peer computer to playback received audio. At **point 2)** at page 11 of the Remarks Applicants argue that "Alexander does not teach or suggest that the peer takes any action in response to receiving the search results other than perhaps displaying the received search results to a user. Alexander certainly does not teach or suggest that the peer device "(i) obtain[s]…from the audio information source..., the audio information; (ii) transmit[s], via the network interface of the first playback device to a second playback device, the audio information; and (iii) play[s] back the audio information" in response to receiving the search results from the results server".

Examiner disagrees and notes that Alexander teaches sub-steps (i) and (iii) in response to receiving search results from the results server, as disclosed in connection with Fig. 1B, par. [0033]-[0038]. It appears that Applicants rely on the claimed term “in response to” as a requirement to perform sub-steps (i)-(iii). However, receipt of the control information only enables the first device to perform sub-steps (i)-(iii), where performance of sub-steps (i)-(iii) can be voluntary in response to the receiving of the control information. Therefore, Applicant’s argument cannot be held as persuasive.

As to any arguments not specifically addressed, they are the same as those discussed above.

Comments Regarding Examination

3. As to claims 21, 33, 40, the limitation "one or more instructions that **cause** the first playback device and a second playback device to playback audio information" is interpreted more broadly than Applicants anticipate. In particular, "cause" is undefined in the specification. Therefore, no specific meaning can be attributed to this word. The broadest reasonable interpretation in light of the specification would be "that enable" the first playback device and a second playback device to playback audio information, given the one or more instructions.

Claim Rejections - 35 USC § 103

The following is a quotation of pre-AIA 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.

4. Claims 21-40 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Meade,, II (US 2003/0073432 A1) in view of Goldberg et al. (US 2007/0142944 A1).

As to claim 33, Meade teaches a method comprising:

receiving, by a first playback device [audio device 28 that is one of the appliances 13; appliance controller 50 that is one of the appliances 13; or any other appliance 13 depicted at Fig. 2] (Fig. 2; par. [0034], [0039]) from a network device [mobile device 12] configured to control the first playback device [configured to apply user preferences 18 at the selected appliances for control of the selected appliances] (par. [0039]) and communicatively coupled to the first playback device over a local area network (LAN) [network communication link 70] (par. [0042], [0047]), control information comprising (i) one or more instructions that cause the first playback device and a second playback device [another appliance 13] (Fig. 2) to playback multimedia information [mobile device 12 coordinates different media aspects of the same content or related content to be performed simultaneously on multiple appliances 13] (par. [0083]-[0084]) and (ii) an address identifying a location of the multimedia information available at an audio information source [providing selection of a TV channel identification or radio station identification as part of user preferences 18 that the user desires to be output at the selected appliances 13] (par. [0026], [0059]), wherein the audio information source is outside of the LAN [TV and radio broadcast stations are well

known in the art as being external sources outside of any local area networks formed by devices in proximity]; and

in response to receiving the control information [in response to receiving user preferences 18 at the controlled appliance] (i) obtaining, by the first playback device from the audio information source outside of the LAN, the audio information [audio device 28 receiving radio (or TV) broadcast of audio information (i.e. songs) that are preferred by the user] (par. [0057]); and (iii) playing back, by the first playback device, the audio information (par. [0062]).

Meade fails to teach that the multimedia information is specifically audio information. In Meade, video device 14 and audio device 28 playback a television broadcast and a radio broadcast of a single event, a football game, which is multimedia information, but not limited to the "audio information", as claimed. Meade further fails to expressly teach (ii) transmitting, by the first playback device to the second playback device, the audio information. However, Meade discloses having an appliance controller 50 that is one of the appliances 13 for providing local control over household appliances 42-48 of the appliance set 40 (Fig. 2; par. [0034], [0039]).

Goldberg is directed to a method, system, and apparatus for playing an audio signal synchronously on a first mobile audio player and at least a second mobile audio player (abstract). In particular, Goldberg teaches a method comprising:

obtaining, by the first playback device [DJ unit 200, broadcast unit 710] from the audio information source [distributor], the audio information [music files] (par. [0338],

Fig. 25), wherein the audio information source is outside of the LAN [distributor is an Internet device located via Internet] (par. [0350], [0351], [0357]);

transmitting, by the first playback device to a second playback device [member unit 100, receive unit 730], the audio information [step 1348] (Fig. 25, par. [0339]); and

playing back, by the first playback device, the audio information (par. [0019]).

It would have been obvious to one or ordinary skill in the art at the time of the invention to modify the method, the first playback device, and the program of Meade by having the audio information in the form of a user-preferred song being played by the at least two appliances in the group 40 of Meade, such that the radio broadcast of the football game would be played by the TV 14 (that is known to have audio output capability) and by the radio 28, in synchrony, in order to enhance the personal or social experience of the audio being played (par. [0101] in Goldberg).

As to claim 21, Meade in view of Goldberg teaches a first playback device [audio device 28 that is one of the appliances 13; appliance controller 50 that is one of the appliances 13; or any other appliance 13 depicted at Fig. 2 in Meade; DJ unit 200, broadcast unit 710 in Goldberg] comprising:

a network interface [wireless communicator 86] (Fig. 4 in Meade) [inter-unit tx/rx 110] (par. [0096] in Goldberg); and

memory comprising program instructions that, when executed by a processor, cause the playback device to perform the method steps, as discussed per claim 33, above.

As to claims 22 and 34, Meade in view of Goldberg teaches that in response to receiving the control information [application of the user preferences 18 at the controller appliance 13 in Meade], additionally:

generating, by the first playback device, timing information based on the audio information (par. [0201]-[0203] in Goldberg); and

transmitting, by the first playback device to the second playback device, the timing information (par. [0201]-[0203] in Goldberg), and

wherein playing back the audio information comprises playing back the audio information according to the timing information (par. [0201]-[0203] in Goldberg).

As to claims 23 and 35, Meade in view of Goldberg teaches causing the first playback device to:

before transmitting the audio information to the second playback device [before broadcast unit 710 of Goldberg begins broadcasting audio], receive, by the first playback device from the network device, an instruction to join a synchrony group that includes the second playback device [receiving, by the video device 14 of Meade from the mobile computing device 12, user preferences 18 instructing the video device 14 to play user-selected content simultaneously by a group of devices including the video device 14 and audio device 28, where the user preferences 18 include grouping information of appliances] (par. [0059], [0083], [0112] in Meade).

As to claims 24 and 36, Meade in view of Goldberg teaches transmitting, by the first playback device to the network device, status information that comprises a status of the synchrony group [transmitting status of the cluster broadcaster area 1174 to all members of the cluster, the status information including information about the number of members of the cluster] (par. [0029], [0187], [0224] in Goldberg).

As to claims 25 and 37, Meade in view of Goldberg teaches that the status information further comprises an identification of each playback device in the synchrony group (par. [0236], [0237], Figs. 18A and 18B in Goldberg).

As to claims 26 and 38, Meade in view of Goldberg teaches that the status information further comprises an identification of a master playback device of the synchrony group [name [ALl] indicates the name of the current broadcaster] (par. [0237] in Goldberg).

As to claims 27 and 39, Meade in view of Goldberg teaches that the first playback device is the master playback device of the synchrony group [broadcaster unit 710 of Goldberg is the master playback device] (Fig. 6 in Goldberg).

As to claim 28, Meade in view of Goldberg teaches that the status information further comprises an identification of one or more slave playback devices in the synchrony group (par. [0236], [0237], Figs. 18A and 18B in Goldberg).

As to claim 29, Meade in view of Goldberg teaches that the second playback device is one of the one or more slave playback devices in the synchrony group [receive unit 730 of Goldberg is the slave playback device] (Fig. 6 in Goldberg).

As to claim 30, Meade in view of Goldberg teaches that the audio information comprises one of audio files or packetized streaming audio information (par. [0339] in Goldberg).

As to claim 31, Meade in view of Goldberg teaches that obtaining, from the audio information source outside of the LAN, the audio information, comprises obtaining, from the audio information source via the Internet, the audio information (par. [0042] in Meade; par. [0338], [0350], [0351], [0357] in Goldberg).

As to claim 32, Meade in view of Goldberg teaches that obtaining, from the audio information source outside of the LAN, the audio information, comprises sending, to the audio information source, a request for the audio information (par. [0042] in Meade; par. [0338], [0350], [0351], [0357] in Goldberg).

As to claim 40, Meade in view of Goldberg teaches a tangible non-transitory computer-readable medium having instructions stored thereon [inventions of Meade and Goldberg are computer-implemented] that when executed cause a first playback device

[audio device 28 that is one of the appliances 13; appliance controller 50 that is one of the appliances 13; or any other appliance 13 depicted at Fig. 2 in Meade; DJ unit 200, broadcast unit 710 in Goldberg] to perform the method steps, as discussed per claim 33, above.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

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

Any inquiry concerning this communication or earlier communications from the examiner should be directed to OLEG SURVILLO whose telephone number is (571)272-9691. The examiner can normally be reached on Mon-Thu 10:00am - 7:30pm; Fri 10:00am - 6:30pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Glenton B. Burgess can be reached on 571-272-3949. 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). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/OLEG SURVILLO/
Primary Examiner, Art Unit 2442

Notice of References Cited	Application/Control No. 14/516,867	Applicant(s)/Patent Under Reexamination MILLINGTON, NICHOLAS A.J	
	Examiner OLEG SURVILLO	Art Unit 2442	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-7,711,774	05-2010	Rothschild, Leigh M.	709/205
*	B	US-2004/0098754	05-2004	Vella et al.	725/135
*	C	US-2004/0213230	10-2004	Douskalis et al.	370/390
	D	US-			
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
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FOREIGN PATENT DOCUMENTS

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NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
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	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.

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**		
	Application Number	14516867
	Filing Date	2014-10-17
	First Named Inventor	Nicholas A.J. Millington
	Art Unit	2442
	Examiner Name	Oleg Survillo
	Attorney Docket Number	04-0401-CON1014D

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
/O.S./	1	7606174		2009-10-20	OCHI; Mitsunori. et al.	
/O.S./	2	7996588		2011-08-09	SUBBIAH; Baranitharan. et al.	
/O.S./	3	8473844		2013-06-25	KREIFELDT; Richard A. et al.	

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Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
/O.S./	1	20030061428		2003-03-27	GARNEY; John I. et al.	
/O.S./	2	20030110329		2003-06-12	HIGAKI; Nobuo. et al.	
/O.S./	3	20040148237		2004-07-29	BITTMANN; Ran. et al.	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	14516867
	Filing Date	2014-10-17
	First Named Inventor	Nicholas A.J. Millington
	Art Unit	2442
	Examiner Name	Oleg Survillo
	Attorney Docket Number	04-0401-CON1014D

/O.S./	4	20050011388		2005-01-20	KOUZNETSOV; Alex A.	
/O.S./	5	20050120128		2005-06-02	WILLES; W. P. et al.	
/O.S./	6	20050195823		2005-09-08	CHEN; Jian-Rong. et al.	
/O.S./	7	20070047712		2007-03-01	GROSS; Kevin P. et al.	

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Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
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/O.S./	1	Advisory Action mailed on 12 November 2014, issued in connection with U.S. Patent Application No. 13/907666, filed on 31 May 2013, 6 pages	☐
/O.S./	2	Advisory Action mailed on 26 November 2014, issued in connection with U.S. Patent Application No. 14/186850, filed on 21 February 2014, 9 pages	☐

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	14516867
	Filing Date	2014-10-17
	First Named Inventor	Nicholas A.J. Millington
	Art Unit	2442
	Examiner Name	Oleg Survillo
	Attorney Docket Number	04-0401-CON1014D

/O.S./	3	Crown PIP Manual available for sale at least 2004, 6 pages	☐
	4	Final Office Action mailed on 3 December 2014, issued in connection with U.S. Patent Application No. 14/184528, filed on 19 February 2014, 12 pages	☐
	5	Non-Final Office Action mailed on 17 November 2014, issued in connection with U.S. Patent Application No. 13/864247, filed on 17 April 2013, 11 pages	☐
	6	Non-Final Office Action mailed on 18 November 2014, issued in connection with U.S. Patent Application No. 13/435739, filed on 30 March 2012, 10 pages	☐
	7	Non-Final Office Action mailed on 19 November 2014, issued in connection with U.S. Patent Application No. 13/848921, filed on 22 March 2013, 9 pages	☐
/O.S./	8	Renkus Heinz Manual; available for sale at least 2004, 68 pages	☐

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[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S105	2	"20070142944" and cluster with (id or identifier or identified or name)	US-PGPUB; USPAT	OR	ON	2015/02/08 16:31
S106	2	"20070142944" and button same search same broadcast	US-PGPUB; USPAT	OR	ON	2015/02/08 21:17
S107	55590126	@ad<"20040401" or @rlad<"20040401"	US-PGPUB; USPAT; FPRS; EPO; JPO	OR	ON	2015/02/08 21:55
S108	933	S107 and (controller or mobile adj1 device) with status with group	US-PGPUB; USPAT; FPRS; EPO; JPO	OR	ON	2015/02/08 21:56
S109	1	S107 and (controller or mobile adj1 device) with status with group and zone adj2 player	US-PGPUB; USPAT; FPRS; EPO; JPO	OR	ON	2015/02/08 21:57
S110	10	S107 and (controller or mobile adj1 device) with status with group same player	US-PGPUB; USPAT; FPRS; EPO; JPO	OR	ON	2015/02/08 21:58
S111	47	S107 and player near2 (zone or sound or music or audio or video) with (send$3 or sent or transmit$4) with status	US-PGPUB; USPAT; FPRS; EPO; JPO	OR	ON	2015/02/08 22:00
S112	1369	S107 and player near2 (zone or sound or music or audio or video) with (remote or remotely or network or lan or internet) near4 (control or controlling or controlled or controller)	US-PGPUB; USPAT; FPRS; EPO; JPO	OR	ON	2015/02/08 22:04
S113	1273	S107 and player near2 (zone or sound or music or audio or video) with (remote or remotely or lan or internet) near4 (control or controlling or controlled or controller)	US-PGPUB; USPAT; FPRS; EPO; JPO	OR	ON	2015/02/08 22:05
S114	563	S107 and player near1 (zone or sound or music or audio) with (remote or	US-PGPUB;	OR	ON	2015/02/08 22:05

		remotely or lan or internet) near4 (control or controlling or controlled or controller)	USPAT; FPRS; EPO; JPO			
S115	174	S107 and player near1 (zone or sound or music or audio) with (remote or remotely or lan or internet) near4 (control or controlling or controlled or controller) with (transmit$4 or send$3 or sent or receiv$3)	US-PGPUB; USPAT; FPRS; EPO; JPO	OR	ON	2015/02/08 22:06
S116	174	S107 and player near1 (zone or sound or music or audio) with (remote or remotely or lan or internet) near4 (control or controlling or controlled or controller) with (transmit$4 or send$3 or sent or receiv$3) not casino	US-PGPUB; USPAT; FPRS; EPO; JPO	OR	ON	2015/02/08 22:07
S117	2	"20020173273" and (synchrony or sync or synchronization or synchronizing or synchronous)	US-PGPUB; USPAT; FPRS; EPO; JPO	OR	ON	2015/02/08 22:18
S118	4	S107 and player near1 (zone or sound or music or audio) with (remote or remotely or lan or internet) near4 (control or controlling or controlled or controller) with (transmit$4 or send$3 or sent or receiv$3) same group$3	US-PGPUB; USPAT; FPRS; EPO; JPO	OR	ON	2015/02/08 22:30
S119	5	S107 and player near1 (zone or sound or music or audio) with (remote or remotely or lan or internet) near4 (control or controlling or controlled or controller) with (transmit$4 or send$3 or sent or receiv$3) and player near1 (zone or sound or music or audio) with group$3	US-PGPUB; USPAT; FPRS; EPO; JPO	OR	ON	2015/02/08 22:32
S120	71	S107 and (remote or remotely or lan or internet) near4 (control or controlling or controlled or controller) with (transmit$4 or send$3 or sent or receiv$3) and player near1 (zone or sound or music or audio) with group$3	US-PGPUB; USPAT; FPRS; EPO; JPO	OR	ON	2015/02/08 22:34
S121	66	S107 and (remote or remotely or lan or internet) near4 (control or controlling or controlled or controller) with (transmit$4 or send$3 or sent or receiv$3) and player near1 (zone or sound or music or audio) with group$3 not S119	US-PGPUB; USPAT; FPRS; EPO; JPO	OR	ON	2015/02/08 22:34
S122	2	"7085566".pn.	US-PGPUB; USPAT; FPRS; EPO; JPO	OR	ON	2015/02/08 22:42
S123	1	"5671267".pn.	US-PGPUB; USPAT; FPRS; EPO; JPO	OR	ON	2015/02/08 22:42

S124	4	S107 and (remote or remotely or lan or internet) near4 (control or controlling or controlled or controller) with (transmit$4 or send$3 or sent or receiv$3) and player near1 (zone or sound or music or audio) with group$3 not S119 and status near2 information	US-PGPUB; USPAT; FPRS; EPO; JPO	OR	ON	2015/02/08 22:51
S125	2	"20020173273" and link with player	US-PGPUB; USPAT; FPRS; EPO; JPO	OR	ON	2015/02/08 22:58
S126	2	"20070142944" and select$3 with (broadcast$3)	US-PGPUB; USPAT	OR	ON	2015/02/09 00:08
S127	0	"20070142944" and purchas$3 with (broadcast$3)	US-PGPUB; USPAT	OR	ON	2015/02/09 00:20
S128	2	"20070142944" and (buy or bought) with (broadcast$3)	US-PGPUB; USPAT	OR	ON	2015/02/09 00:20
S129	1	"20140173432"	US-PGPUB; USPAT	OR	ON	2015/02/20 11:03
S130	1	"20140173432" and master same become same control$4	US-PGPUB; USPAT	OR	ON	2015/02/20 11:52
S131	15090779	@ad<"20040401" or @rlad<"20040401"	US-PGPUB; USPAT; USOCR; EPO; JPO	OR	ON	2015/02/20 19:31
S132	2101	S131 and designat$3 near4 (master and slave)	US-PGPUB; USPAT; USOCR; EPO; JPO	OR	ON	2015/02/20 19:40
S133	10	S131 and designat$3 near4 (master and slave) with player	US-PGPUB; USPAT; USOCR; EPO; JPO	OR	ON	2015/02/20 19:40
S134	1	"20130226323"	US-PGPUB; USPAT	OR	ON	2015/02/22 19:25
S135	1	"20130236029"	US-PGPUB; USPAT	OR	ON	2015/02/25 20:12
S136	0	"20070142944" and address with monitor$3	US-PGPUB; USPAT	OR	ON	2015/02/25 20:16
S137	2	"20070142944" and address with socket	US-PGPUB; USPAT	OR	ON	2015/02/25 20:16
S138	0	"20070142944" and address with	US-	OR	ON	2015/02/25

		listen$3	PGPUB; USPAT			20:28
S139	0	"20070142944" and channel with listen$3	US-PGPUB; USPAT	OR	ON	2015/02/25 20:28
S140	0	"20070142944" and address with packet	US-PGPUB; USPAT	OR	ON	2015/02/25 20:39
S141	2	"20070142944" and address with (audio or broadcast or transmission or file)	US-PGPUB; USPAT	OR	ON	2015/02/25 20:39
S142	55590869	@ad<"20040401" or @rlad<"20040401"	US-PGPUB; USPAT; FPRS; EPO; JPO	OR	ON	2015/02/25 21:51
S143	101	(monitor$3 or listen$3) near4 (multicast$3 or multi-cast$3) near2 address with (instruct$3 or control$4 or direct$3)	US-PGPUB; USPAT; FPRS; EPO; JPO	OR	ON	2015/02/25 22:04
S144	34	(monitor$3 or listen$3) near4 (multicast$3 or multi-cast$3) near2 address with (instruct$3 or control$4 or direct$3) same (stream$3 or broadcast$3)	US-PGPUB; USPAT; FPRS; EPO; JPO	OR	ON	2015/02/25 22:06
S145	28	(monitor$3 or listen$3) near4 (multicast$3 or multi-cast$3) near2 address with (instruct$3 or control or controlling or controlled or direct$3) same (stream$3 or broadcast$3)	US-PGPUB; USPAT; FPRS; EPO; JPO	OR	ON	2015/02/25 22:07
S146	29	(monitor$3 or listen$3) near4 (multicast$3 or multi-cast$3) near2 address with (instruct$3 or control or controlling or controlled or direct$3 or command or commanding or commanded) same (stream$3 or broadcast$3)	US-PGPUB; USPAT; FPRS; EPO; JPO	OR	ON	2015/02/25 22:08
S147	9	S142 and (monitor$3 or listen$3) near4 (multicast$3 or multi-cast$3) near2 address with (instruct$3 or control or controlling or controlled or direct$3 or command or commanding or commanded) same (stream$3 or broadcast$3)	US-PGPUB; USPAT; FPRS; EPO; JPO	OR	ON	2015/02/25 22:11
S148	1	"6986155".pn. and (monitor$3 or listen$3) near4 (multicast$3 or multi-cast$3)	US-PGPUB; USPAT; FPRS; EPO; JPO	OR	ON	2015/02/25 22:17
S149	35	S142 and (monitor$3 or listen$3) near4 (multicast$3 or multi-cast$3) near2 address with (instruct$3 or control or controlling or controlled or direct$3 or command or commanding or	US-PGPUB; USPAT; FPRS; EPO;	OR	ON	2015/02/25 22:19

		commanded) not S147	JPO			
S150	16	S142 and (monitor$3 or listen$3) near4 (multicast$3 or multi-cast$3) near2 address with (instruct$3 or controlling or controlled or direct$3 or command or commanding or commanded) not S147	US-PGPUB; USPAT; FPRS; EPO; JPO	OR	ON	2015/02/25 22:21
S151	2	"20070142944"	US-PGPUB; USPAT	OR	ON	2015/02/25 22:47

EAST Search History (Interference)

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3/4/2015 11:09:19 PM
C:\Users\osurvillo\Documents\EAST\Workspaces\14186850.wsp

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	14516867	MILLINGTON, NICHOLAS A.J.
	Examiner	Art Unit
	OLEG SURVILLO	2442

CPC- SEARCHED		
Symbol	Date	Examiner

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner
709	219, 220, 231	3/4/2015	OS

SEARCH NOTES		
Search Notes	Date	Examiner
Updated Inventor search	3/4/2015	OS
Updated Assignee search	3/4/2015	OS
Updated EAST search in USPAT, US-PGPUB, EPO, JPO, and FPRS databases	3/4/2015	OS

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner

	/OLEG SURVILLO/ Primary Examiner.Art Unit 2442

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	14516867	MILLINGTON, NICHOLAS A.J.
	Examiner	Art Unit
	OLEG SURVILLO	2442

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

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

CLAIM		DATE								
Final	Original	03/04/2015								
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	30	✓								
	31	✓								
	32	✓								
	33	✓								
	34	✓								
	35	✓								
	36	✓								

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

CLAIM		DATE								
Final	Original	03/04/2015								
	37	✓								
	38	✓								
	39	✓								
	40	✓								

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

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(Not for submission under 37 CFR 1.99)

Application Number	14516867
Filing Date	10-17-2014
First Named Inventor	MILLINGTON; Nicholas A.J.
Art Unit	2442
Examiner Name	SURVILLO, OLEG
Attorney Docket Number	04-0401-CON1014D

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/O.S./	1	7483538		2009-01-27	MCCARTY; William A. et al.	
/O.S./	2	7519667		2009-04-14	CAPPS; Stephen P.	
/O.S./	3	7853341		2010-12-14	MCCARTY; William A. et al.	

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/O.S./	3	"Final Office Action mailed on 7 January 2015, issued in connection with U.S. Patent Application Serial No. 13/848932, filed on 22 March 2013, 14 pages".	☐

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
14/516,867	10/17/2014	Nicholas A.J. Millington	04-0401-CON1014D

CONFIRMATION NO. 9318

107361
McDonnell Boehnen Hulbert & Berghoff LLP
Sonos, Inc.
300 South Wacker Drive
Chicago, IL 60606

PUBLICATION NOTICE

OC000000073235743

Title: Obtaining Content from Remote Source for Playback

Publication No.US-2015-0039109-A1
Publication Date:02/05/2015

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The above-identified application will be electronically published as a patent application publication pursuant to 37 CFR 1.211, et seq. The patent application publication number and publication date are set forth above.

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	Filing Date	10-17-2014
	First Named Inventor	MILLINGTON; Nicholas A.J.
	Art Unit	2442
	Examiner Name	SURVILLO, OLEG
	Attorney Docket Number	04-0401-CON1014D

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☒ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☐ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Michael P. Boyea/	Date (YYYY-MM-DD)	2015-01-22
Name/Print	Michael P. Boyea	Registration Number	70248

This collection of information is required by 37 CFR 1.97 and 1.98. 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 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these record s.

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8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Electronic Patent Application Fee Transmittal					
Application Number:	14516867				
Filing Date:	17-Oct-2014				
Title of Invention:	Obtaining Content from Remote Source for Playback				
First Named Inventor/Applicant Name:	Nicholas A.J. Millington				
Filer:	Michael Paul Boyea				
Attorney Docket Number:	04-0401-CON1014D				
Filed as Large Entity					
Filing Fees for **Utility under 35 USC 111(a)**					
Description		**Fee Code**	**Quantity**	**Amount**	**Sub-Total in USD($)**
Basic Filing:					
Pages:					
Claims:					
Miscellaneous-Filing:					
Petition:					
Patent-Appeals-and-Interference:					
Post-Allowance-and-Post-Issuance:					
Extension-of-Time:					

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
Submission- Information Disclosure Stmt	1806	1	180	180
		Total in USD ($)		**180**

Electronic Acknowledgement Receipt	
EFS ID:	21267936
Application Number:	14516867
International Application Number:	
Confirmation Number:	9318
Title of Invention:	Obtaining Content from Remote Source for Playback
First Named Inventor/Applicant Name:	Nicholas A.J. Millington
Customer Number:	107361
Filer:	Michael Paul Boyea
Filer Authorized By:	
Attorney Docket Number:	04-0401-CON1014D
Receipt Date:	22-JAN-2015
Filing Date:	17-OCT-2014
Time Stamp:	09:53:08
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$180
RAM confirmation Number	9621
Deposit Account	132490
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: Charge any Additional Fees required under 37 C.F.R. Section 1.16 (National application filing, search, and examination fees) Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)	

Charge any Additional Fees required under 37 C.F.R. Section 1.19 (Document supply fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.20 (Post Issuance fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Form (SB08)	Sonos_04-0401-CON1014D_MBHB_14-1800-CON2_IDS.pdf	707055 d858f34a9dce73ea97fae3fcf4d3601727221 3fd	no	4
Warnings:					
Information:					
2	Non Patent Literature	13705176_Advisory_Action_1-8-15.pdf	147494 fae29ffd78e46c8d3b6759f16163b9f25c5e4 bee	no	4
Warnings:					
Information:					
3	Non Patent Literature	13533105_Final_OA_12-17-14.pdf	1315760 7e079cc670d11b44802ac99821e5ce2024cf 8d4b	no	36
Warnings:					
Information:					
4	Non Patent Literature	13848932_Final_OA_1-7-15.pdf	471436 487b8268cc5ecf07d340779fb29f58ec0e2b 3678	no	14
Warnings:					
Information:					
5	Fee Worksheet (SB06)	fee-info.pdf	30271 48561f673bb5442a68a3eaad38c2a70ba19 68792	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	2672016		

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If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
(Case No.: 04-0401-CON1014D)
(MBHB Docket No. 14-1800-CON2)

In the Application of:	)	
	)	
Millington	)	Art Unit: 2442
	)	
Serial No.: 14/516,867	)	Examiner: Survillo
	)	
Filed: October 17, 2014	)	Confirmation No. 9318
	)	
For: Obtaining Content from Remote Source For Playback	)	
	)	

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

RESPONSE TO NON-FINAL OFFICE ACTION MAILED DECEMBER 1, 2014

Please consider the following **AMENDMENTS** and **REMARKS** in response to the Non-Final Office Action mailed on December 1, 2014 in the above-captioned application.

AMENDMENTS TO THE CLAIMS begin on page 2.

REMARKS begin on page 7.

The Office is hereby authorized to charge any underpayment of fees or credit any overpayment of fees in connection with the prosecution of the above-captioned application to Deposit Account 13-2490.

AMENDMENTS TO THE CLAIMS

1-20 (Cancelled)

21. (Currently Amended) A first playback device comprising:

a network interface; and

memory comprising program instructions that, when executed by [[the]] a processor, cause the playback device to:

receive, via the network interface from a network device configured to control the first playback device and communicatively coupled to the first playback device over a local area network (LAN), control information comprising (i) one or more instructions that cause the first playback device and a second playback device to playback audio information and (ii) an address identifying a network location of the audio information available at an audio information source, wherein the audio information source is outside of the LAN; and

in response to receiving the control information, (i) obtain, via the network interface from the audio information source outside of the LAN, the audio information; (ii) transmit, via the network interface of the first playback device to [[a]] the second playback device, the audio information; and (iii) play back the audio information.

22. (Previously Presented) The first playback device of claim 21, wherein the program instructions, when executed by the processor, further cause the first playback device to:

generate timing information based on the audio information; and

transmit, to the second playback device, the timing information, and

wherein causing the first playback device to play back the audio information comprises causing the first playback device to play back the audio information according to the timing information.

23. (Previously Presented) The first playback device of claim 21, wherein the program instructions, when executed by the processor, further cause the first playback device to:

before transmitting the audio information to the second playback device, receive, from the network device, an instruction to join a synchrony group that includes the second playback device.

24. (Previously Presented) The first playback device of claim 23, wherein the program instructions, when executed by the processor, further cause the first playback device to:

transmit, to the network device, status information that comprises a status of the synchrony group.

25. (Previously Presented) The first playback device of claim 24, wherein the status information further comprises an identification of each playback device in the synchrony group.

26. (Previously Presented) The first playback device of claim 24, wherein the status information further comprises an identification of a master playback device of the synchrony group.

27. (Previously Presented) The first playback device of claim 26, wherein the first playback device is the master playback device of the synchrony group.

28. (Previously Presented) The first playback device of claim 24, wherein the status information further comprises an identification of one or more slave playback devices in the synchrony group.

29. (Previously Presented) The first playback device of claim 28, wherein the second playback device is one of the one or more slave playback devices in the synchrony group.

30. (Previously Presented) The playback device of claim 21, wherein the audio information comprises one of audio files or packetized streaming audio information.

31. (Currently Amended) The playback device of claim 21, wherein obtaining, from the audio information source outside of the LAN, the audio information, comprises obtaining, from the audio information source via the Internet, the audio information.

32. (Currently Amended) The playback device of claim 21, wherein obtaining, from the audio information source outside of the LAN, the audio information, comprises sending, to the audio information source, a request for the audio information.

33. (Currently Amended) A method comprising:

receiving, by a first playback device from a network device configured to control the first playback device and communicatively coupled to the first playback device over a local area network (LAN), control information comprising (i) one or more instructions that cause the first playback device and a second playback device to playback audio information and (ii) an address identifying a location of the audio information available at an audio information source, wherein the audio information source is outside of the LAN; and

in response to receiving the control information (i) obtaining, by the first playback device from the audio information source outside of the LAN, the audio information; (ii) transmitting, by the first playback device to [[a]] the second playback device, the audio information; and (iii) playing back, by the first playback device, the audio information.

34. (Currently Amended) The method of claim 33, further comprising:

in response to receiving the control information, additionally (i) generating, by the first playback device, timing information based on the audio information; and (ii) transmitting, by the first playback device to the second playback device, the timing information, and wherein playing back the audio information comprises playing back the audio information according to the timing information.

35. (Previously Presented) The method of claim 33, further comprising:

before transmitting the audio information to the second playback device, receiving, by the first playback device from the network device, an instruction to join a synchrony group that includes the second playback device.

36. (Previously Presented) The method of claim 35, further comprising:

transmitting, by the first playback device to the network device, status information that comprises a status of the synchrony group.

37. (Previously Presented) The method of claim 35, wherein the status information further comprises an identification of each playback device in the synchrony group.

38. (Previously Presented) The method of claim 37, wherein the status information further comprises an identification of a master playback device of the synchrony group.

39. (Previously Presented) The method of claim 38, wherein the first playback device is the master playback device of the synchrony group.

40. (Currently Amended) A tangible non-transitory computer-readable medium having instructions stored thereon that when executed cause a first playback device to:

receive, from a network device configured to control the first playback device and communicatively coupled to the first playback device over a local area network (LAN), control information comprising (i) one or more instructions that cause the first playback device and a second playback device to playback audio information and (ii) an address identifying a location of audio information available at an audio information source, wherein the audio information source is outside of the LAN; and

in response to receiving the control information, (i) obtain, from the audio information source outside of the LAN, the audio information; (ii) transmit, to [[a]] the second playback device, the audio information; and (iii) play back the audio information.

REMARKS

A. Status of the Claims

Claims 21-40 are pending. Claims 21, 33 and 40 are independent. In the present Response, and without conceding the merits of the rejections and in an earnest attempt to advance prosecution, Applicant has amended claims 21, 31-34, and 40 to clarify the claim language. The subject matter of the amendments can be found generally throughout Applicant's originally-filed specification, including but not limited to pages 12-14. No new matter has been added.

The present amendments are made to expedite prosecution of this application to allowance. However, Applicant does not acquiesce in the Examiner's rejection of the originally-filed claims. Applicant reserves the right to pursue the subject matter of the originally-filed claims in one or more continuation applications.

B. Summary of the Non-Final Office Action Mailed December 1, 2014

In the Non-Final Office Action mailed on December, 2014, the Examiner: (i) rejected claims 21-32 under 35 U.S.C. § 112, second paragraph, for allegedly lacking antecedent basis; (ii) rejected claims 21, 22, 30-34, and 40 under 35 U.S.C. § 103(a) as allegedly unpatentable over U.S. Pub. 2007/0142944 ("Goldberg") in view of U.S. Pub. 2005/0027821 ("Alexander"); and (iii) rejected claims 23-29 and 35-39 under 35 U.S.C. § 103(a) as allegedly unpatentable over Goldberg and Alexander in view of U.S. Pub. 2003/0073432 ("Meade").

C. Summary of the Examiner Interview on December 16, 2014

An Examiner Interview was conducted on December 16, 2014. Participants included Examiner Oleg Survillo, and Applicant's Representative Jeff Armstrong. The participants discussed claim 21 and the § 103 rejections based on the Goldberg and Alexander references. No exhibits were shown and demonstrations were conducted. During the Interview, Applicant's Representative explained the patentable distinctions between claim 21 and the teachings of Goldberg and Alexander. Participants agreed that Alexander fails to disclose control information pertaining to a second playback device. No final agreement on claim language was reached.

D. Response to the § 112 Rejections

Applicant requests withdrawal of the § 112 rejection in view of the amendment to claim 21 to correct the identified lack of antecedent basis for the claimed processor.

E. Response to the § 103 Rejections based on Goldberg and Alexander

Applicant submits that amended claims 21, 33 and 40 are allowable over Goldberg and Alexander for at least the reason that the cited references, individually or in combination, fail to teach or suggest all of the recited claim elements. For example, with reference to claim 21, Goldberg and Alexander fail to teach or suggest at least (1) "receiv[ing]…control information comprising…one or more instructions that cause the first playback device and a second playback device to playback audio information" and (2) "in response to receiving the control information, (i) obtain[ing]…from the audio information source…, the audio information; (ii) transmit[ting], via the network interface of the first playback device to a the second playback device, the audio information; and (iii) play[ing] back the audio information."

1. Goldberg and Alexander fail to teach or suggest "receiv[ing]…control information comprising…one or more instructions that cause the first playback device and a second playback device to playback audio information"

Goldberg describes a "cluster 700 of units" that includes "broadcast unit 710 [which] transmits music" and a "receive unit 730 [which] receives the broadcasted music." (Goldberg, ¶ 164) In operation, "a receive unit 730 can make song requests (e.g. 'play again', 'another by this artist') that can show on the broadcast unit 710 user interface[, or a]lternatively, the user of a receive unit 730 can request that control be switched, so that the receive unit 730 becomes the broadcast unit 710, and the broadcast unit 710 becomes a receive unit 730." (Goldberg ¶ 176) However, Goldberg is silent as to whether a request received by one unit from another unit includes instructions that cause both the requesting unit and the request-receiving unit to playback audio, and thus, the requests that a receive unit 730 makes to a broadcast unit 710 (or vice versa) in Goldberg do not amount to "control information comprising…one or more instructions that cause the first playback device and a second playback device to playback audio information," as recited in claims 21, 33 and 40.

The addition of Alexander does not overcome the deficiency of Goldberg because Alexander also fails to teach or suggest at least "receiv[ing]…control information comprising…one or more instructions that cause the first playback device and a second playback device to playback audio information." As agreed during the Examiner Interview on December 16, 2014, Alexander fails to disclose control information pertaining to a second playback device. Alexander describes a peer-to-peer music sharing system with peer computers and a results server where "[t]he Result Server 104 requests and receives information from [an] internal database 108 specific to the given search request [received from a peer in the system, and a]n

appropriate response to the search request originated by the peer 101 is generated and transmitted back [to the peer 101]. This return transmission contains a link to a media file located on the system 100 file servers." (Alexander ¶ 33) However, the search requests and the search results exchanged between a peer computer and the result server do not cause either device to playback audio information, and thus, the messaging exchanged between the devices in Alexander do not amount to "control information comprising…one or more instructions that cause the first playback device and a second playback device to playback audio information," as recited in claims 21, 33 and 40.

2. Goldberg and Alexander fail to teach or suggest "in response to receiving the control information, (i) obtain[ing]…from the audio information source…, the audio information; (ii) transmit[ting], via the network interface of the first playback device to a the second playback device, the audio information; and (iii) play[ing] back the audio information"

Goldberg does not teach or suggest "in response to receiving the control information, (i) obtain[ing]…from the audio information source…, the audio information; (ii) transmit[ting], via the network interface of the first playback device to a the second playback device, the audio information; and (iii) play[ing] back the audio information," for at least the reason that Goldberg does not "receive…control information" in the first instance as explained above. Additionally, Goldberg does not teach or suggest "obtain[ing]…from the audio information source…, the audio information" because, as acknowledged in the Office Action, "Goldberg fails to expressly teach receiving, by a first playback device…an address identifying a location of audio information available at an audio information source." (Office Action, p. 3) Because Goldberg does not receive "an address identifying a location of audio information" in the first instance, Goldberg cannot "obtain…from the audio information source…, the audio information" as recited in the claims. Therefore, Goldberg fails to teach or suggest "in response to receiving the

control information, (i) obtain[ing]…from the audio information source…, the audio information; (ii) transmit[ting], via the network interface of the first playback device to a the second playback device, the audio information; and (iii) play[ing] back the audio information," as recited in claims 21, 33 and 40.

The addition of Alexander does not overcome of the deficiency of Goldberg because Alexander also fails to teach or suggest "in response to receiving the control information, (i) obtain[ing]…from the audio information source…, the audio information; (ii) transmit[ting], via the network interface of the first playback device to a the second playback device, the audio information; and (iii) play[ing] back the audio information" for at least the reason that Alexander does not "receive…control information" in the first instance as explained above. Additionally, a peer device in Alexander's system does not perform the functions recited in the claims in response to receiving search results from the result server. Alexander explains that the "return transmission [from the results server to the requesting peer] contains a link to a media file located on the system 100 file servers." (Alexander ¶ 33) But Alexander does not teach or suggest that the peer takes any action in response to receiving the search results other than perhaps displaying the received search results to a user. Alexander certainly does not teach or suggest that the peer device "(i) obtain[s]…from the audio information source…, the audio information; (ii) transmit[s], via the network interface of the first playback device to a the second playback device, the audio information; and (iii) play[s] back the audio information" in response to receiving the search results from the results server. Thus, Alexander fails to teach or suggest "in response to receiving the control information, (i) obtain[ing]…from the audio information source…, the audio information; (ii) transmit[ting], via the network interface of the first

playback device to a the second playback device, the audio information; and (iii) play[ing] back the audio information," as recited in claims 21, 33 and 40.

3. The claims are allowable over Goldberg and Alexander

Because Goldberg and Alexander, whether considered individually or in combination, fail to teach or suggest all of the elements recited in independent claims 21, 33 and 40, Applicant submits that the independent claims are allowable over the combination of Goldberg and Alexander. Furthermore, and without conceding the merits of the other rejections set forth in the Office Action, Applicant submits that the pending dependent claims are allowable for at least the reason that they depend from allowable independent claims.

F. Conclusion

Applicant submits that the application is in condition for allowance, and Applicant respectfully requests a Notice of Allowance. If further discussion would advance the application to issuance, the Examiner is invited to telephone the undersigned at 312-913-0001.

Respectfully submitted,
McDonnell Boehnen Hulbert & Berghoff LLP

Date: January 19, 2015

By: /Jeffrey P. Armstrong/
Jeffrey P. Armstrong
Reg. No. 54,967

Electronic Acknowledgement Receipt	
EFS ID:	21243139
Application Number:	14516867
International Application Number:	
Confirmation Number:	9318
Title of Invention:	Obtaining Content from Remote Source for Playback
First Named Inventor/Applicant Name:	Nicholas A.J. Millington
Customer Number:	107361
Filer:	Jeffrey Armstrong
Filer Authorized By:	
Attorney Docket Number:	04-0401-CON1014D
Receipt Date:	19-JAN-2015
Filing Date:	17-OCT-2014
Time Stamp:	16:06:21
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		14_1800_CON2_Response.pdf	124002 0f4bb5d22fa901b7ae7b29d840af1061231c4e4f	yes	12

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Amendment/Req. Reconsideration-After Non-Final Reject	1	1
	Claims	2	6
	Applicant Arguments/Remarks Made in an Amendment	7	12
Warnings:			
Information:			
	Total Files Size (in bytes):	124002	

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New Applications Under 35 U.S.C. 111
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New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PTO/SB/06 (09-11)
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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 14/516,867	Filing Date 10/17/2014	☐ To be Mailed

ENTITY: ☒ LARGE ☐ SMALL ☐ MICRO

APPLICATION AS FILED – PART I

	(Column 1)	(Column 2)		
FOR	NUMBER FILED	NUMBER EXTRA	RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).			
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL	

APPLICATION AS AMENDED – PART II

AMENDMENT	01/19/2015	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 20	Minus	** 20	= 0	X $80 =	0
	Independent (37 CFR 1.16(h))	* 3	Minus	***3	= 0	X $420 =	0
	☐ Application Size Fee (37 CFR 1.16(s))						
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
						TOTAL ADD'L FEE	0

AMENDMENT		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =	
	☐ Application Size Fee (37 CFR 1.16(s))						
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
						TOTAL ADD'L 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.

LIE
/CORALIA BETANCOURT/

This collection of information is required by 37 CFR 1.16. 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, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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

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United States Patent and Trademark Office
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www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/516,867	10/17/2014	Nicholas A.J. Millington	04-0401-CON1014D	9318

107361 7590 12/18/2014

McDonnell Boehnen Hulbert & Berghoff LLP
Sonos, Inc.
300 South Wacker Drive
Chicago, IL 60606

EXAMINER	
SURVILLO, OLEG	

ART UNIT	PAPER NUMBER
2442	

MAIL DATE	DELIVERY MODE
12/18/2014	PAPER

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

The time period for reply, if any, is set in the attached communication.

Applicant-Initiated Interview Summary	Application No.	Applicant(s)	
	14/516,867	MILLINGTON, NICHOLAS A.J.	
	Examiner	Art Unit	
	OLEG SURVILLO	2442	

All participants (applicant, applicant's representative, PTO personnel):

(1) *Oleg Survillo, Examiner AU 2442*. (3)_____.

(2) *Jeff Armstrong, Reg. No.: 54,967*. (4)_____.

Date of Interview: *16 December 2014*.

Type: ☒ Telephonic ☐ Video Conference
☐ Personal [copy given to: ☐ applicant ☐ applicant's representative]

Exhibit shown or demonstration conducted: ☐ Yes ☒ No.
If Yes, brief description: _____.

Issues Discussed ☐101 ☐112 ☐102 ☒103 ☒Others
(For each of the checked box(es) above, please describe below the issue and detailed description of the discussion)

Claim(s) discussed: *21*.

Identification of prior art discussed: *Goldberg Alexander*.

Substance of Interview
(For each issue discussed, provide a detailed description and indicate if agreement was reached. Some topics may include: identification or clarification of a reference or a portion thereof, claim interpretation, proposed amendments, arguments of any applied references etc...)

Discussed technical distinctions between prior art and amended claim 21, as proposed. In particular, discussed whether Alexander teaches the newly added subject matter, as proposed. It was agreed that Alexander fails to disclose control information pertaining to a second playback device. Examiner suggested additional amendments to further prosecution. No agreement was reached on the final claim language to be filed in the next response.

Applicant recordation instructions: The formal written reply to the last Office action must include the substance of the interview. (See MPEP section 713.04). If a reply to the last Office action has already been filed, applicant is given a non-extendable period of the longer of one month or thirty days from this interview date, or the mailing date of this interview summary form, whichever is later, to file a statement of the substance of the interview

Examiner recordation instructions: Examiners must summarize the substance of any interview of record. A complete and proper recordation of the substance of an interview should include the items listed in MPEP 713.04 for complete and proper recordation including the identification of the general thrust of each argument or issue discussed, a general indication of any other pertinent matters discussed regarding patentability and the general results or outcome of the interview, to include an indication as to whether or not agreement was reached on the issues raised.

☒ Attachment

/OLEG SURVILLO/ Primary Examiner, Art Unit 2442	

Summary of Record of Interview Requirements

Manual of Patent Examining Procedure (MPEP), Section 713.04, Substance of Interview Must be Made of Record
A complete written statement as to the substance of any face-to-face, video conference, 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.

Title 37 Code of Federal Regulations (CFR) § 1.133 Interviews
Paragraph (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, 1.135. (35 U.S.C. 132)

37 CFR §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 an Interview Summary Form for each interview held where a matter of substance has been discussed during the interview by checking the appropriate boxes and filling in the blanks. 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, or pointing out typographical errors or unreadable script in Office actions or the like, are excluded from the interview recordation procedures below. Where the substance of an interview is completely recorded in an Examiners Amendment, no separate Interview Summary Record is required.

The Interview Summary Form shall be given an appropriate Paper No., placed in the right hand portion of the file, and listed on the "Contents" section of the file wrapper. In a personal interview, a duplicate of the Form is given to the applicant (or attorney or agent) at the conclusion of the interview. In the case of a telephone or video-conference interview, the copy is mailed to the applicant's correspondence address either with or prior to the next official communication. If additional correspondence from the examiner is not likely before an allowance or if other circumstances dictate, the Form should be mailed promptly after the interview rather than with the next official communication.

The Form provides for recordation of the following information:
- Application Number (Series Code and Serial Number)
- Name of applicant
- Name of examiner
- Date of interview
- Type of interview (telephonic, video-conference, or personal)
- Name of participant(s) (applicant, attorney or agent, examiner, other PTO personnel, etc.)
- An indication whether or not an exhibit was shown or a demonstration conducted
- 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). Note: Agreement as to allowability is tentative and does not restrict further action by the examiner to the contrary.
- The signature of the examiner who conducted the interview (if Form is not an attachment to a signed Office action)

It is desirable that the examiner orally remind the applicant of his or her obligation to record the substance of the interview of each case. It should be noted, however, that the Interview Summary Form will not normally be considered a complete and proper recordation of the interview unless it includes, or is supplemented by 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 the 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 or she 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 and accurate, the examiner will give the applicant an extendable one month time period to correct the record.

Examiner to Check for Accuracy

If the claims are allowable for other reasons of record, the examiner should send a letter setting forth the examiner's version of the statement attributed to him or her. 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.

McDonnell Boehnen Hulbert & Berghoff
Law Offices

300 South Wacker Drive
Chicago, Illinois 60606-6709
www.mbhb.com

312-913-0001 phone
312-913-0002 fax

December 15, 2014

Via Email: oleg.survillo@uspto.gov

Examiner Oleg Survillo
U.S. Patent & Trademark Office
P.O. Box 1450
Arlington, VA 22313-1450

RE: Interview Agenda for 14/516,867 (Sonos 04-0401-CON1014D; MBHB 14-1800-CON2)

Examiner Survillo:

Thank you for agreeing to interview the above-referenced application on Tuesday, December 16, 2014 at 12:00pm ET / 11:00am CT. An agenda of topics and proposed claim amendments are outlined below:

Agenda for the Examiner Interview:

- The Non-Final Office Action mailed on December 1, 2014
- Claim 21
- Cited References:
  - U.S. Pub. No. 2007/0142944 ("Goldberg")
  - U.S. Pub. No. 2003/0073432 ("Meade")
  - U.S. Pub. No. 2005/0027821 ("Alexander")
- Applicant contends that the cited references do not teach or suggest each of the recited claim elements. Nevertheless, without conceding the merits of the rejections, and in an earnest attempt to advance prosecution, Applicant proposes the draft clarifying amendments outlined below for review and consideration.

Proposed Amendments for Review:

21. (Proposed Amendment) A first playback device comprising:

a network interface; and

memory comprising program instructions that, when executed by [[the]] a processor, cause the playback device to:

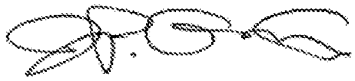
receive, via the network interface from a ~~network device~~ user interface module configured to control the first playback device and communicatively coupled to the first playback device over a

local area network (LAN), control information comprising (i) one or more instructions for the first playback device and a second playback device to play back audio information and (ii) an address identifying a network location of the audio information available at an audio information source, wherein the audio information source is outside of the LAN; and

in response to receiving the control information, (i) obtain, via the network interface from the audio information source outside of the LAN, the audio information; (ii) transmit, via the network interface of the first playback device to [[a]] the second playback device, the audio information; and (iii) play back the audio information.

If you have questions, or if you would like additional information to prepare for the interview, please feel free to call me. Otherwise, I look forward to discussing the case with you on 2014 at 12:00pm ET / 11:00am CT.

Best regards,



Jeff Armstrong
312-913-2104 (office)

PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT
(Not for submission under 37 CFR 1.99)

Application Number	14516867
Filing Date	2014-10-17
First Named Inventor	Nicholas A.J. Millington
Art Unit	2442
Examiner Name	Oleg Survillo
Attorney Docket Number	04-0401-CON1014D

U.S.PATENTS Remove

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	7606174		2009-10-20	OCHI; Mitsunori. et al.	
	2	7996588		2011-08-09	SUBBIAH; Baranitharan. et al.	
	3	8473844		2013-06-25	KREIFELDT; Richard A. et al.	

If you wish to add additional U.S. Patent citation information please click the Add button. Add

U.S.PATENT APPLICATION PUBLICATIONS Remove

Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20030061428		2003-03-27	GARNEY; John I. et al.	
	2	20030110329		2003-06-12	HIGAKI; Nobuo. et al.	
	3	20040148237		2004-07-29	BITTMANN; Ran. et al.	

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	14516867
	Filing Date	2014-10-17
	First Named Inventor	Nicholas A.J. Millington
	Art Unit	2442
	Examiner Name	Oleg Survillo
	Attorney Docket Number	04-0401-CON1014D

	4	20050011388		2005-01-20	KOUZNETSOV; Alex A.	
	5	20050120128		2005-06-02	WILLES; W. P. et al.	
	6	20050195823		2005-09-08	CHEN; Jian-Rong. et al.	
	7	20070047712		2007-03-01	GROSS; Kevin P. et al.	

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Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1							☐

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NON-PATENT LITERATURE DOCUMENTS Remove

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
	1	Advisory Action mailed on 12 November 2014, issued in connection with U.S. Patent Application No. 13/907666, filed on 31 May 2013, 6 pages	☐
	2	Advisory Action mailed on 26 November 2014, issued in connection with U.S. Patent Application No. 14/186850, filed on 21 February 2014, 9 pages	☐

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	14516867
	Filing Date	2014-10-17
	First Named Inventor	Nicholas A.J. Millington
	Art Unit	2442
	Examiner Name	Oleg Survillo
	Attorney Docket Number	04-0401-CON1014D

	3	Crown PIP Manual available for sale at least 2004, 6 pages	☐
	4	Final Office Action mailed on 3 December 2014, issued in connection with U.S. Patent Application No. 14/184528, filed on 19 February 2014, 12 pages	☐
	5	Non-Final Office Action mailed on 17 November 2014, issued in connection with U.S. Patent Application No. 13/864247, filed on 17 April 2013, 11 pages	☐
	6	Non-Final Office Action mailed on 18 November 2014, issued in connection with U.S. Patent Application No. 13/435739, filed on 30 March 2012, 10 pages	☐
	7	Non-Final Office Action mailed on 19 November 2014, issued in connection with U.S. Patent Application No. 13/848921, filed on 22 March 2013, 9 pages	☐
	8	Renkus Heinz Manual; available for sale at least 2004, 68 pages	☐

If you wish to add additional non-patent literature document citation information please click the Add button Add

EXAMINER SIGNATURE

Examiner Signature		Date Considered	

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

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**		
	Application Number	14516867
	Filing Date	2014-10-17
	First Named Inventor	Nicholas A.J. Millington
	Art Unit	2442
	Examiner Name	Oleg Survillo
	Attorney Docket Number	04-0401-CON1014D

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☒ The fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☒ A certification statement is not submitted herewith.

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	/Michael P. Boyea/	Date (YYYY-MM-DD)	2014-12-17
Name/Print	Michael P. Boyea	Registration Number	70248

This collection of information is required by 37 CFR 1.97 and 1.98. 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 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C. 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether the Freedom of Information Act requires disclosure of these record s.

2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Electronic Patent Application Fee Transmittal					
Application Number:	14516867				
Filing Date:	17-Oct-2014				
Title of Invention:	Obtaining Content from Remote Source for Playback				
First Named Inventor/Applicant Name:	Nicholas A.J. Millington				
Filer:	Michael Paul Boyea				
Attorney Docket Number:	04-0401-CON1014D				
Filed as Large Entity					
Filing Fees for **Utility under 35 USC 111(a)**					
Description		**Fee Code**	**Quantity**	**Amount**	**Sub-Total in USD($)**
Basic Filing:					
Pages:					
Claims:					
Miscellaneous-Filing:					
Petition:					
Patent-Appeals-and-Interference:					
Post-Allowance-and-Post-Issuance:					
Extension-of-Time:					

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
Submission- Information Disclosure Stmt	1806	1	180	180
		Total in USD ($)		**180**

Electronic Acknowledgement Receipt	
EFS ID:	20992654
Application Number:	14516867
International Application Number:	
Confirmation Number:	9318
Title of Invention:	Obtaining Content from Remote Source for Playback
First Named Inventor/Applicant Name:	Nicholas A.J. Millington
Customer Number:	107361
Filer:	Michael Paul Boyea
Filer Authorized By:	
Attorney Docket Number:	04-0401-CON1014D
Receipt Date:	17-DEC-2014
Filing Date:	17-OCT-2014
Time Stamp:	16:53:32
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$180
RAM confirmation Number	3429
Deposit Account	132490
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: Charge any Additional Fees required under 37 C.F.R. Section 1.16 (National application filing, search, and examination fees) Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)	

Charge any Additional Fees required under 37 C.F.R. Section 1.19 (Document supply fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.20 (Post Issuance fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Non Patent Literature	13907666_Advisory_Action_11-12-14.pdf	254022 aa1d551f2e8767f3e9e1184ed8407caec3fbc7f4	no	6
Warnings:					
Information:					
2	Non Patent Literature	14186850_Advisory_Action_11-26-14.pdf	506394 28ed162aeb999fda046f6ae425395d4aad4a9fee	no	9
Warnings:					
Information:					
3	Non Patent Literature	Crown_PIP_Manual_2004.pdf	5334400 e8c6c7ac20b1c4da24db0348b3bd52b229c54d5a	no	6
Warnings:					
Information:					
4	Non Patent Literature	14184528_Final_OA_12-3-14.pdf	410080 ef6f109bdab572de571a6beb9999ad2543d15c21	no	12
Warnings:					
Information:					
5	Non Patent Literature	13864247_Non-Final_OA_11-17-14.pdf	344920 e8940c60a00e1b96f78ba1dd9800194ca0d14a92	no	11
Warnings:					
Information:					
6	Non Patent Literature	13435739_Non-Final_OA_11-18-14.pdf	275007 3edfdcf99f809a59b2cd9083b4a324ec45e2bf42	no	10
Warnings:					
Information:					
7	Non Patent Literature	13848921_Non-Final_OA_11-19-14.pdf	271448 6aadcec7ebbb239f7aa2cb83beab4fd803caba6f	no	9
Warnings:					
Information:					

8	Non Patent Literature	Renkus_Heinz_Manual_2004.pdf	3402875 bd58fdeac41e1d1c0dc9fc8d71bfb1c31045ccb4	no	68
Warnings:					
Information:					
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Warnings:					
Information:					
10	Fee Worksheet (SB06)	fee-info.pdf	30273 5b60c942c1316a65ac74185594dbb42ec498b95c	no	2
Warnings:					
Information:					
			Total Files Size (in bytes):	11442493	

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/516,867	10/17/2014	Nicholas A.J. Millington	04-0401-CON1014D	9318

107361 7590 12/01/2014

McDonnell Boehnen Hulbert & Berghoff LLP
Sonos, Inc.
300 South Wacker Drive
Chicago, IL 60606

EXAMINER	
SURVILLO, OLEG	

ART UNIT	PAPER NUMBER
2442	

MAIL DATE	DELIVERY MODE
12/01/2014	PAPER

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

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 14/516,867	Applicant(s) MILLINGTON, NICHOLAS A.J.	
	Examiner OLEG SURVILLO	Art Unit 2442	AIA (First Inventor to File) Status No

-- 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 MONTHS 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 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 *October 17, 2014*.

☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

4)☐ 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*

5)☒ Claim(s) *21-40* is/are pending in the application.

5a) Of the above claim(s) _____ is/are withdrawn from consideration.

6)☐ Claim(s) _____ is/are allowed.

7)☒ Claim(s) *21-40* is/are rejected.

8)☐ Claim(s) _____ is/are objected to.

9)☐ Claim(s) _____ are subject to restriction and/or election requirement.

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

Application Papers

10)☐ The specification is objected to by the Examiner.

11)☒ The drawing(s) filed on *October 17, 2014* 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).

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).

Certified copies:

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)).

** 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) ☒ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date *11/14/2014; 11/14/2014*.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

4) ☐ Other: _____.

DETAILED ACTION

Response to a Preliminary Amendment

1. Claims 21-40 are pending in the application. No claims are currently amended. Claims 1-20 have been canceled. Claims 21-40 are new.

Response to Arguments

2. With regard to Applicant's remarks dated October 17, 2014:

Preliminary amendment has been fully considered and is entered.

Amendment to the specification, abstract, title, and claims has been fully considered and is entered.

Claim Rejections - 35 USC § 112

The following is a quotation of 35 U.S.C. 112 (pre-AIA), second paragraph:
The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. Claims 21-32 are rejected under 35 U.S.C. 112 (pre-AIA), second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the inventor or a joint inventor, or for pre-AIA the applicant regards as the invention.

Claim 21 recites the limitation "the processor" in line 3. There is insufficient antecedent basis for this limitation in the claim.

Claim Rejections - 35 USC § 103

The following is a quotation of pre-AIA 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.

4. Claims 21, 22, 30-34, and 40 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Goldberg et al. (US 2007/0142944 A1) in view of Alexander et al. (US 2005/0027821 A1).

As to claim 33, Goldberg teaches a method comprising:

obtaining, by the first playback device [DJ unit 200, broadcast unit 710] from the audio information source [distributor], the audio information [music files] (par. [0338], Fig. 25), wherein the audio information source is outside of the LAN [distributor is an Internet device located via Internet] (par. [0350], [0351], [0357]);

transmitting, by the first playback device to a second playback device [member unit 100, receive unit 730], the audio information [step 1348] (Fig. 25, par. [0339]); and

playing back, by the first playback device, the audio information (par. [0019]).

Goldberg fails to expressly teach receiving, by a first playback device from a network device communicatively coupled to the first playback device over a local area network (LAN), an address identifying a location of audio information available at an audio information source.

Alexander is directed to locating and serving selected files (abstract). In particular, Alexander teaches receiving, by a first playback device [requesting peer 101] (Fig. 1A) from a network device [Result server 104] (Fig. 1A) communicatively coupled

to the first playback device over a local area network (LAN) [P2P network 102] (par. [0028]), an address identifying a location of audio information [results page comprising names of files satisfying search request and a hyperlink associated with each file name] (par. [0009], [0049]) available at an audio information source [File server 118] (Fig. 1A), wherein the audio information source is outside of the LAN (par. [0026], Fig. 1A).

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the method and system of Goldberg by receiving, by the first playback device from a network device communicatively coupled to the first playback device over a local area network (LAN), an address identifying a location of audio information available at an audio information source, in order to locate music from a distributor by searching for a desired file (par. [0074] in Alexander; par. [0338] in Goldberg).

As to claim 21, Goldberg in view of Alexander teaches a first playback device [DJ unit 200, broadcast unit 710 in Goldberg] comprising:

a network interface [inter-unit tx/rx 110] (par. [0096] in Goldberg); and

memory comprising program instructions that, when executed by the processor, cause the playback device to perform the method steps, as discussed per claim 33, above.

As to claims 22 and 34, Goldberg teaches:

generating, by the first playback device, timing information based on the audio information (par. [0201]-[0203]); and

transmitting, by the first playback device to the second playback device, the timing information (par. [0201]-[0203]), and

wherein playing back the audio information comprises playing back the audio information according to the timing information (par. [0201]-[0203]).

As to claim 30, Goldberg teaches that the audio information comprises one of audio files or packetized streaming audio information (par. [0339]).

As to claim 31, Goldberg in view of Alexander teaches that obtaining, from the audio information source, the audio information, comprises obtaining, from the audio information source via the Internet, the audio information (par. [0338], [0350], [0351], [0357] in Goldberg).

As to claim 32, Goldberg in view of Alexander teaches that obtaining, from the audio information source, the audio information, comprises sending, to the audio information source, a request for the audio information (par. [0338], [0350], [0351], [0357] in Goldberg; par. [0074] in Alexander).

As to claim 40, Goldberg in view of Alexander teaches a tangible non-transitory computer-readable medium having instructions stored thereon [inventions of Goldberg

and Alexander are computer-implemented] that when executed cause a first playback device [DJ unit 200, broadcast unit 710 in Goldberg] to perform the method steps, as discussed per claim 33, above.

5. Claims 23-29 and 35-39 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over Goldberg et al. in view of Alexander et al. and in further view of Meade,, II (US 2003/0073432 A1).

As to claims 23 and 35, Goldberg in view of Alexander teaches before transmitting the audio information to the second playback device [before broadcast unit 710 of Goldberg begins broadcasting audio], exchanging instructions for the first playback device to join a synchrony group that includes the second playback device [exchanging TCP messages between broadcast unit 710 and receiver unit 730 to establish the mutual interest in audio broadcasting and reception] (par. [0181]-[0185], Figs. 14A and 14B in Goldberg).

Goldberg in view of Alexander fails to expressly teach that the instruction to join a synchrony group is received by the first playback device from the network device.

Meade is directed to wirelessly controlling a group of appliances with a mobile computing device (abstract). In particular, Meade teaches receiving, by the first playback device from the network device, an instruction to join a synchrony group that includes the second playback device [receiving, by the video device 14 from the mobile computing device 12, user preferences 18 instructing the video device 14 to play user-selected content simultaneously by a group of devices including the video device 14

and audio device 28, where the user preferences 18 include grouping information of appliances] (par. [0059], [0083], [0112]).

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the method and system of Goldberg in view of Alexander by having an instruction to join a synchrony group that includes the second playback device received by the first playback device from the network device, in order to control units 100 of Goldberg from an external device without having to manually enter grouping preferences into each unit 100 of Goldberg (par. [0006] in Meade).

As to claims 24 and 36, Goldberg in view of Alexander and Meade teaches transmitting, by the first playback device to the network device, status information that comprises a status of the synchrony group [transmitting status of the cluster broadcaster area 1174 to all members of the cluster, the status information including information about the number of members of the cluster] (par. [0029], [0187], [0224] in Goldberg).

As to claims 25 and 37, Goldberg in view of Alexander and Meade teaches that the status information further comprises an identification of each playback device in the synchrony group (par. [0236], [0237], Figs. 18A and 18B in Goldberg).

As to claims 26 and 37, Goldberg in view of Alexander and Meade teaches that the status information further comprises an identification of a master playback device of

the synchrony group [name [ALI] indicates the name of the current broadcaster] (par. [0237] in Goldberg).

As to claims 27 and 38, Goldberg in view of Alexander and Meade teaches that the first playback device is the master playback device of the synchrony group [broadcaster unit 710 of Goldberg is the master playback device] (Fig. 6 in Goldberg).

As to claim 28, Goldberg in view of Alexander and Meade teaches that the status information further comprises an identification of one or more slave playback devices in the synchrony group (par. [0236], [0237], Figs. 18A and 18B in Goldberg).

As to claim 29, Goldberg in view of Alexander and Meade teaches that the second playback device is one of the one or more slave playback devices in the synchrony group [receive unit 730 of Goldberg is the slave playback device] (Fig. 6 in Goldberg).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to OLEG SURVILLO whose telephone number is (571)272-9691. The examiner can normally be reached on Mon-Thu 10:00am - 7:30pm; Fri 10:00am - 6:30pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Glenton B. Burgess can be reached on 571-272-3949. 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). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/OLEG SURVILLO/
Primary Examiner, Art Unit 2442

Notice of References Cited	Application/Control No. 14/516,867	Applicant(s)/Patent Under Reexamination MILLINGTON, NICHOLAS A.J	
	Examiner OLEG SURVILLO	Art Unit 2442	Page 1 of 1

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*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.

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (01-10)
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**		
	Application Number	14516867
	Filing Date	10-17-2014
	First Named Inventor	MILLINGTON; Nicholas A.J.
	Art Unit	2442
	Examiner Name	SURVILLO, OLEG
	Attorney Docket Number	04-0401-CON1014D

U.S.PATENTS						Remove
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	14516867
	Filing Date	10-17-2014
	First Named Inventor	MILLINGTON; Nicholas A.J.
	Art Unit	2442
	Examiner Name	SURVILLO, OLEG
	Attorney Docket Number	04-0401-CON1014D

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	15	"European Extended Search Report for Application No. 13184747.7 mailed on 28 February 2014, 8 pages".	☐
	16	"Final Office Action mailed 05 June 2014 for U.S. Application No. 13/907666 filed 31 May 2013".	☐
	17	Final Office Action mailed 13 July 2009 for U.S. Application No. 10/816217 filed 01 April 2004.	☐
	18	"Final Office Action mailed 13 September 2012 for U.S. Application No. 13/297000", United States Patent and Trademark Office, 2012-09-13, 17 pages.	☐
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	20	"Final Office Action mailed 27 March 2014 for U.S. Application No. 13/533105 filed 26 June 2012.".	☐
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	22	"Final Office Action mailed 3 July 2012 for U.S. Patent Application No. 13/298090 filed on 16 November 2011".	☐
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/O.S./	24	"Final Office Action mailed on 22 October 2014, issued in connection with U.S. Patent Application No. 14/186850, filed on 21 February 2014, 12 pages".	☐

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/O.S./	25	"Final Office Action mailed on 23 October 2014, issued in conection with U.S. Patent Application No. 13/705176, filed on 5 December 2012, 23 pages".	☐
	26	"Final Rejection mailed on 21 January 2010 for U.S. Application No. 11/906,702 filed on 2 October 2007".	☐
	27	HUANG C.M., et al., "A Synchronization Infrastructure for Multicast Multimedia at the Presentation Layer," IEEE Transactions on Consumer Electronics, 1997, Vol. 43 (3), pp. 370-380.	☐
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	29	"INTERNATIONAL BUREAU,"Written opinion" issued in connection with International Patent application No. PCT/ US2013/046372, mailed August 26, 2013, 4 pages.".	☐
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/O.S./	36	JO J., et al., "Synchronized One-to-many Media Streaming with Adaptive Playout Control," Proceedings of SPIE, 2002, Vol. 4861, pp. 71-82.	☐
	37	"Jones, Stephen. "Dell Digital Audio Receiver: Digital upgrade for your analog stereo" Analog Stereo. 24 June 2000 < http://www.reviewsonline.com/articles/961906864.htm> retrieved 18 June 2014, 2 pages".	☐
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	45	"Non-Final Office Action mailed 01 May 2014 for U.S. Application No. 14/184522 filed 19 February 2014".	☐
/O.S./	46	"Non-Final Office Action mailed 05 December 2013 for U.S. Application No. 13/827653 filed 14 March 2013".	☐

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	Attorney Docket Number	04-0401-CON1014D

/O.S./	47	"Non-Final Office Action mailed 05 January 2012 for U.S. Patent Application No. 13/298090 filed on 16 November 2011, 40 pages".	☐
/O.S./	48	"Non-Final Office Action mailed 06 May 2014 for U.S. Application No. 13/705176 filed 05 December 2012".	☐
/O.S./	49	"Non-Final Office Action mailed 12 May 2014 for U.S. Application No. 14/184528 filed 19 February 2014".	☐
/O.S./	50	"Non-Final Office Action mailed 14 May 2014 for U.S. Application No. 13/848932 filed 22 March 2013".	☐

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EAST Search History

EAST Search History (Prior Art)

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S48	1	S46 and appliance near5 (identity or id or identification or identifying or identified)	US-PGPUB; USPAT	OR	ON	2014/10/19 00:36
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S50	833	S49 and 709/219.ccls.	US-PGPUB; USPAT	OR	ON	2014/10/19 02:12
S51	385	S49 and 709/231.ccls.	US-PGPUB; USPAT	OR	ON	2014/10/19 02:12
S52	28	S49 and sonos.as.	US-PGPUB; USPAT	OR	ON	2014/10/19 02:12
S53	24	S49 and sonos.as. and zone adj2 player	US-PGPUB; USPAT	OR	ON	2014/10/19 02:12
S54	8	S49 and sonos.as. and zone adj2 player and synchrony.clm.	US-PGPUB; USPAT	OR	ON	2014/10/19 02:12
S55	94	millington-nicholas$.in.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	ON	2014/10/19 02:16
S56	8	S49 and S55	US-PGPUB; USPAT	OR	ON	2014/10/19 02:16
S57	3	S49 and S55 and zone adj2 player.clm.	US-PGPUB; USPAT	OR	ON	2014/10/19 02:16
S58	6	S49 and S55 and synchrony.clm.	US-PGPUB; USPAT	OR	ON	2014/10/19 02:17
S59	3	S49 and S55 and synchrony.clm. not S57	US-PGPUB; USPAT	OR	ON	2014/10/19 02:17
S60	1	"20120192071"	US-PGPUB; USPAT	OR	ON	2014/10/19 08:55
S61	6	millington-nicholas$.in. and (display or displaying or displayed) near3 zone.clm.	US-PGPUB; USPAT	OR	ON	2014/10/19 09:44
S62	0	millington-nicholas$.in. and (display or displaying or displayed) near9 zone.clm. not S61	US-PGPUB; USPAT	OR	ON	2014/10/19 09:47
S63	0	millington-nicholas$.in. and (display or displaying or displayed) with zone.clm. not S61	US-PGPUB; USPAT	OR	ON	2014/10/19 09:47
S64	1	"20130232416"	US-PGPUB; USPAT	OR	ON	2014/10/19 14:40
S65	5320251	@ad<"20040401" or @rlad<"20040401"	US-PGPUB; USPAT	OR	ON	2014/10/19 17:09
S66	361	S65 and (playlist or play adj1 list) with next near3 (song or item or file)	US-PGPUB; USPAT	OR	ON	2014/10/19 17:09
S67	136	S65 and (playlist or play adj1 list) with next near3 (song or item or file) same display$3	US-PGPUB; USPAT	OR	ON	2014/10/19 17:10
S68	31	S65 and (playlist or play adj1 list) with next near3 (song or item or file)	US-PGPUB; USPAT	OR	ON	2014/10/19 17:11

		with display$3				
S69	1	"20130236029"	US-PGPUB; USPAT	OR	ON	2014/10/19 18:58
S70	1	"20130226323"	US-PGPUB; USPAT	OR	ON	2014/10/19 22:25
S71	2	"20070142944" and multicast$3 with address	US-PGPUB; USPAT	OR	ON	2014/10/20 08:18
S72	1	"20130231765"	US-PGPUB; USPAT	OR	ON	2014/11/05 16:50
S73	1	"20120191232"	US-PGPUB; USPAT	OR	ON	2014/11/12 12:33
S74	1	"8335829".pn.	US-PGPUB; USPAT	OR	ON	2014/11/12 14:44
S75	5321840	@ad<"20040401" or @rlad<"20040401"	US-PGPUB; USPAT	OR	ON	2014/11/13 09:56
S76	66137	S75 and (control or controlling or controlled) with (appliance or peripheral or player or device) with command	US-PGPUB; USPAT	OR	ON	2014/11/13 09:57
S77	1996	S75 and (control or controlling or controlled) with (appliance or peripheral or player or device) with command same master	US-PGPUB; USPAT	OR	ON	2014/11/13 09:57
S78	150	S75 and (control or controlling or controlled) with (appliance or peripheral or player or device) with command same master same (audio or music or sound)	US-PGPUB; USPAT	OR	ON	2014/11/13 09:57
S79	133	S75 and (control or controlling or controlled) with (appliance or peripheral or player or device) with command same master same (audio or music or sound) not sonos.as.	US-PGPUB; USPAT	OR	ON	2014/11/13 09:58
S80	126	S75 and (control or controlling or controlled) with (appliance or peripheral or player or device) with command same master same (audio or music or sound) not sonos.as. not millington.in.	US-PGPUB; USPAT	OR	ON	2014/11/13 09:58
S81	77	S75 and (control or controlling or controlled) with (appliance or peripheral or player or external) with command same master same (audio or music or sound) not sonos.as. not millington.in.	US-PGPUB; USPAT	OR	ON	2014/11/13 09:59
S82	6	S75 and (control or controlling or controlled) with (appliance or peripheral or player or external) with command same master same (audio or music or sound) same (group or grouping or grouped) not sonos.as. not millington.in.	US-PGPUB; USPAT	OR	ON	2014/11/13 10:00
S83	470	S75 and (control or controlling or controlled) with (appliance or peripheral or player or external) with command with (group or grouping or grouped) not sonos.as. not millington.in.	US-PGPUB; USPAT	OR	ON	2014/11/13 10:26

S84	13	S75 and (control or controlling or controlled) with (appliance or peripheral or player or external) with command with (group or grouping or grouped) near5 (creat$4 or form$3 or formation) not sonos.as. not millington.in.	US-PGPUB; USPAT	OR	ON	2014/11/13 10:27
S85	5321840	@ad<"20040401" or @rlad<"20040401"	US-PGPUB; USPAT	OR	ON	2014/11/13 11:13
S86	27	S85 and (appliance or peripheral or player or external) with command with (group or grouping or grouped) near5 (creat$4 or form$3 or formation) not sonos.as. not millington.in.	US-PGPUB; USPAT	OR	ON	2014/11/13 11:13
S87	21	S85 and (appliance or player or external) with command with (group or grouping or grouped) near5 (creat$4 or form$3 or formation) not sonos.as. not millington.in.	US-PGPUB; USPAT	OR	ON	2014/11/13 11:14
S88	31	S85 and (appliance or player or external) with instruction with (group or grouping or grouped) near5 (creat$4 or form$3 or formation) not sonos.as. not millington.in.	US-PGPUB; USPAT	OR	ON	2014/11/13 11:29
S89	38	S85 and (appliance or player or external) with (instruction or instructed or instructing) with (group or grouping or grouped) near5 (creat$4 or form$3 or formation) not sonos.as. not millington.in.	US-PGPUB; USPAT	OR	ON	2014/11/13 11:29
S90	1	"20110225013"	US-PGPUB; USPAT	OR	ON	2014/11/13 20:34
S91	1	"20030073432" and appliance near3 (control or controlling or controlled)	US-PGPUB; USPAT	OR	ON	2014/11/13 20:43
S92	1	"20130208921"	US-PGPUB; USPAT	OR	ON	2014/11/13 22:54
S93	5322428	@ad<"20040401" or @rlad<"20040401"	US-PGPUB; USPAT	OR	ON	2014/11/25 21:53
S94	0	S93 and (invite or invitation) near2 command with (identify or identifying or identification) near3 (master or slave or member)	US-PGPUB; USPAT	OR	ON	2014/11/25 22:20
S95	0	S93 and (invite or invitation) near2 command with (identify or identifying or identification) near3 (master or slave or member or leader or controller or commander)	US-PGPUB; USPAT	OR	ON	2014/11/25 22:21
S96	0	S93 and (invite or invitation) near2 (command or instruction) with (identify or identifying or identification) near3 (master or slave or member or leader or controller or commander)	US-PGPUB; USPAT	OR	ON	2014/11/25 22:21
S97	2259	S93 and (command or instruction) with (identify or identifying or identification) near3 (master or slave or member or leader or controller or commander)	US-PGPUB; USPAT	OR	ON	2014/11/25 22:21

S98	1490	S93 and (command) with (identify or identifying or identification) near3 (master or slave or member or leader or controller or commander)	US-PGPUB; USPAT	OR	ON	2014/11/25 22:22
S99	321	S93 and (command) with (identify or identifying or identification) near3 (master or slave or leader or commander)	US-PGPUB; USPAT	OR	ON	2014/11/25 22:22
S100	240	S93 and (command) with (identify or identifying or identification) near2 (master or slave or leader or commander)	US-PGPUB; USPAT	OR	ON	2014/11/25 22:22
S101	150	S93 and (command) near5 (identify or identifying or identification) near2 (master or slave or leader or commander)	US-PGPUB; USPAT	OR	ON	2014/11/25 22:22
S102	5	S93 and (command) near5 (identify or identifying or identification) near2 (master or slave or leader or commander) with (group or grouping or grouped)	US-PGPUB; USPAT	OR	ON	2014/11/25 22:25
S103	16	S93 and (command) near5 (identify or identifying or identification) near2 (master or slave or leader or commander) same network	US-PGPUB; USPAT	OR	ON	2014/11/25 22:44
S104	16	alexander-$.in. and peer and advertisement	US-PGPUB; USPAT	OR	ON	2014/11/30 13:42

EAST Search History (Interference)

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C:\Users\osurvillo\Documents\EAST\Workspaces\14186850.wsp

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	14516867	MILLINGTON, NICHOLAS A.J.
	Examiner	Art Unit
	OLEG SURVILLO	2442

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

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

CLAIM		DATE								
Final	Original	11/30/2014								
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	35	✓								
	36	✓								

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Final	Original	11/30/2014								
	37	✓								
	38	✓								
	39	✓								
	40	✓								

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CPC- SEARCHED		
Symbol	Date	Examiner

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner
709	219, 220, 231	11/30/2014	OS

SEARCH NOTES		
Search Notes	Date	Examiner
Updated Inventor search	11/30/2014	OS
Updated Assignee search	11/30/2014	OS
Updated EAST search in USPAT, US-PGPUB, EPO, JPO, and FPRS databases	11/30/2014	OS

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner

	/OLEG SURVILLO/ Primary Examiner.Art Unit 2442

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**		
	Application Number	14516867
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	First Named Inventor	MILLINGTON; Nicholas A.J.
	Art Unit	2442
	Examiner Name	SURVILLO, OLEG
	Attorney Docket Number	04-0401-CON1014D

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/O.S./	1	"Non-Final Office Action mailed 17 June 2014 for U.S. Application No. 14/176808 filed 10 February 2014".	☐
	2	"Non-Final Office Action mailed 18 December 2013 for U.S. Application No. 13/907666 filed 31 May 2013".	☐
	3	Non-Final Office Action mailed 18 January 2008 for U.S. Application No. 10/816217 filed 01 April 2004.	☐
	4	"Non-Final Office Action mailed 19 April 2010 for U.S. Application No. 11/801468 filed 09 May 2007, 16 pages".	☐
	5	"Non-Final Office Action mailed 19 March 2013 for U.S. Application No. 13/724048 filed 21 December 2012".	☐
	6	Non-Final Office Action mailed 21 June 2011 for U.S. Application No. 10/816217 filed 01 April 2004.	☐
	7	Non-Final Office Action mailed 22 January 2009 for U.S. Application No. 10/816217 filed 01 April 2004.	☐
	8	"Non-Final Office Action mailed 25 July 2014 for U.S. Application No. 14/184526 filed 19 February 2014".	☐
	9	"Non-Final Office Action mailed 25 July 2014 for U.S. Application No. 14/184935 filed 20 February 2014".	☐
	10	Non-Final Office Action mailed 25 June 2010 for U.S. Application No. 10/816217 filed 01 April 2004.	☐
/O.S./	11	"Non-Final Office Action mailed 25 November 2013 for U.S. Application No. 13/533105 filed 26 June 2012.".	☐

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/O.S./	12	"Non-Final Office Action mailed 27 May 2014 for U.S. Application No. 14/186850 filed 21 February 2014".	☐
	13	Non-Final Office Action mailed 29 February 2012 for U.S. Application No. 13/297000 filed 15 November 2011.	☐
	14	"Non-Final Office Action mailed 29 November 2010 for U.S. Application No. 11/801468 filed 09 May 2007, 17 pages".	☐
	15	"Non-Final Office Action mailed 30 April 2012 for U.S. Patent Application No. 13/204511 filed 5 August 2011".	☐
	16	"Non-Final Office Action mailed 30 July 2013 for U.S. Application No. 13/724048 filed 21 December 2012".	☐
	17	"Non-Final Office Action mailed 31 July 2014 for U.S. Application No. 13/533105 filed 26 June 2012".	☐
	18	"Non-Final Office Action mailed on 23 October 2014, issued in connection with U.S. Patent Application No. 13/848904, filed on 22 March 2013, 11 pages".	☐
	19	"Non-Final Office Action mailed on 23 October 2014, issued in connection with U.S. Patent Application No. 13/864251, filed on 17 April 2013, 11 pages".	☐
	20	"Non-Final Office Action mailed on 23 October 2014, issued in connection with U.S. Patent Application No. 13/888203, filed on 6 May 2013, 9 pages".	☐
	21	"Non-final Office Action mailed on 24 October 2014, issued in connection with U.S. Patent Application No. 13/435776, filed 30 March 2012, 14 pages".	☐
/O.S./	22	"Non-Final Rejection mailed on 20 August 2009 for U.S. Application No. 11/906,702 filed on 2 October 2007".	☐

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/O.S./	23	"Notice of Allowability in Application No. 13/619,237", 9-6-2013, 4 pages.	☐
	24	Notice of Allowance 27 December 2011 for U.S. Application No. 10/816217 filed 01 April 2004.	☐
	25	"Notice of Allowance mailed 06 March 2014 for U.S. Application No. 13/827653 filed 14 March 2013".	☐
	26	"Notice of Allowance mailed 06 May 2011 for U.S. Application No. 11/801468 filed 09 May 2007, 10 pages".	☐
	27	"Notice of Allowance mailed 10 November 2011 for U.S. Patent Application No. 11/906,702 filed on 2 October 2007".	☐
	28	"Notice of Allowance mailed 13 November 2013 for U.S. Application No. 13/724048 filed 21 December 2012".	☐
	29	"Notice of Allowance mailed 31 January 2013 for U.S. Patent Application No. 13/298090 filed on 16 November 2011".	☐
	30	"Notice of Allowance mailed 5 October 2012 for U.S. Patent Application No. 13/204511 filed 5 August 2011".	☐
	31	"Notice of Allowance mailed on 25 September 2014, issued in connection with U.S. Patent Application No. 14/176,808, filed on 10 February 2014, 5 pages".	☐
	32	"Palm, Inc. "Handbook for the Palm VII Handheld" May 2000, 311 pages".	☐
/O.S./	33	PARK S., et al., "Group Synchronization in MultiCast Media Communications," Proceedings of the 5th Research on Multicast Technology Workshop, 2003.	☐

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/O.S./	34	"Polycom Conference Composer manual: copyright 2001".	☐
	35	PRISMIQ; Inc., "PRISMIQ Media Player User Guide", 2003, 44 pages.	☐
	36	ROTHERMEL K., et al., "An Adaptive Stream Synchronization Protocol," 5th International Workshop on Network and Operating System Support for Digital Audio and Video, 1995.	☐
	37	SCHULZRINNE H., et al., "RTP: A Transport Protocol for Real-Time Applications, RFC 3550," Network Working Group, 2003, pp. 1-89.	☐
	38	The MPEG-2 Transport Stream. Retrieved from the Internet:< URL: http://www.coolstf.com/mpeg/#ts>. ; retrieved on 8/24/2006	☐
	39	"UPnP; "Universal Plug and Play Device Architecture"; 08 June 2000; version 1.0; Microsoft Corporation; pp 1-54".	☐
	40	""Welcome. You're watching Apple TV." Apple TV 1st Generation Setup Guide, 8 April 2008 <http://manuals.info.apple.com/MANUALS/0/MA403/en_US/AppleTV_SetupGuide.pdf> Retrieved 10/14/14, 40 pages".	☐
	41	""Welcome. You're watching Apple TV." Apple TV 2nd Generation Setup Guide, 10 March 2011 <http://manuals.info.apple.com/MANUALS/1000/MA1555/en_US/Apple_TV_2nd_gen_Setup_Guide.pdf> Retrieved 10/16/14, 35 pages".	☐
	42	""Welcome. You're watching Apple TV." Apple TV 3rd Generation Setup Guide, 16 March 2012 <http://http://manuals.info.apple.com/MANUALS/1000/MA1607/en_US/apple_tv_3rd_gen_setup.pdf> Retrieved 10/16/14, 35 pages".	☐
	43	"Presentations at WinHEC 2000" May 2000, 138 pages.	☐
/O.S./	44	"Written Opinion of the International Searching Authority. issued by the International Searching Authority in connection with PCT Application No. PCT/US2013/046386, on September 30, 2013, 6 pages.".	☐

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/O.S./	45	"Yamaha DME 32 manual: copyright 2001".	☐
/O.S./	46	"Yamaha DME Designer software manual: Copyright 2004, 482 pages".	☐

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Examiner Signature	/Oleg Survillo/	Date Considered	11/30/2014

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Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	4296278		1981-10-20	CULLISON; Steven B. et al.	
	2	4816989		1989-03-28	FINN; Alan M. et al.	
	3	5182552		1993-01-26	PAYNTING; Richard J.	
	4	5239458		1993-08-24	SUZUKI; Takashi	
	5	5299266		1994-03-29	LUMSDEN; John L.	
	6	5406634		1995-04-11	ANDERSON; Charles W. et al.	
	7	5440644		1995-08-08	FARINELLI; Robert et al.	
	8	5467342		1995-11-14	LOGSTON; Gary L. et al.	

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	9	5491839		1996-02-13	SCHOTZ; Larry	
	10	5553222		1996-09-03	MILNE; Steve H. et al.	
	11	5602992		1997-02-11	DANNEELS; Gunner	
	12	5668884		1997-09-16	CLAIR Jr.; Roy Barry et al.	
	13	5673323		1997-09-30	SCHOTZ; Larry et al.	
	14	5696896		1997-12-09	BADOVINATZ; Peter Richard et al.	
	15	5751819		1998-05-12	DORROUGH; Michael L.	
	16	5787249		1998-07-28	BADOVINATZ; Peter Richard et al.	
	17	5808662		1998-09-15	KINNEY; Daniel Reid et al.	
	18	5815689		1998-09-29	SHAW; George H. J. et al.	
	19	5867691		1999-02-02	SHIRAISHI; Hajime	

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	Art Unit	2442
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(11) Publication number: **0 251 584**
A2

(12) **EUROPEAN PATENT APPLICATION**

(21) Application number: 87305416.7

(22) Date of filing: 18.06.87

(51) Int. Cl.4: G06F 9/46

(30) Priority: 26.06.86 CA 512479

(43) Date of publication of application:
07.01.88 Bulletin 88/01

(84) Designated Contracting States:
AT DE FR GB IT NL SE

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(54) **A synchronization service for a distributed operating system or the like.**

(57) A synchronization service which can be incorporated into a distributed operating system as a shared service. It allows the realization of different custom-built synchronization strategies for different applications. This approach is based on defining a general set of application-independent synchronization primitives. These are provided by the distributed operating system in the form of a synchronization service. By themselves the individual primities are insuffient to provide synchronization. However, they can be combined in different ways to realize customized synchronization strategies. This leaves the ultimate responsibility for synchronization with the application, but in a much simplified form. Application programs can combine these primitives to construct the most suitable form of synchronization.

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A SYNCHRONIZATION SERVICE FOR A DISTRIBUTED OPERATING SYSTEM OR THE LIKE

This invention relates generally to the field of computers, and more specifically to a synchronization service for use with computers.

Background of the Invention

As computing tasks increase in size and complexity, one approach to speed up the execution of these tasks is to use distributed programs. A distributed program can be defined as a computer program which is partitioned into multiple concurrent components which execute on separate processing sites which do not share a common memory.

In this context, the term "program" is used to imply a global objective (i.e. common goal). Each component (or portion) of the program performs some portion of the overall activity required to attain this common goal. Thus, a distributed program represents a set of (functionally) tightly-coupled components operating in a (physically) loosely-coupled environment.

Asynchronous operation of concurrent cooperating activities results in the time-dependencies and race conditions which can lead to errors. For example, two processes attempting to simultaneously update a shared variable may interfere with each other so that an incorect value is assigned to the variable. The solution to such problems is through synchronization. Synchronization can be defined as the organization of actions and interactions of a system of concurrent asynchronous entities for the purpose of achieving some common objective.

One example of a distributed computer system is the case of a replicated database where each copy of the database is on a separate processing element. When a change is made to one copy then this change must be propagated to all the others if consistency is to be maintained. This involves synchronization. The situation may be complicated further if two or more conflicting changes are initiated simultaneously on different copies. In that case synchronization is required not only to ensure that all copies end up in the same state but also that the resulting state is valid. Other situations where synchronization is necessary include the restoration of the current state to new or recovering copies and the handling of failures.

Distributed synchronization can also be useful in standby schemes where redundant components are configured for greater system availability. In this case the compnoents have to agree as to which will be the active and which the standby components and must also arrange for proper switchover in case of failures.

The cited examples illustrate the diverse ways in which synchronization is used in distributed systems. As can be expected, different applications can have different demands on synchronization: some may require fast response while others may place more emphasis on reliability and fault tolerance. This indicates that the choice of the most suitable synchronization technique and tis implementation can only be made if the particular needs of the application are considered.

Unfortunately, in a large system supporting many different types of distributed application programs, leaving synchronization entirely to the application program could result in excessive duplication of effort, unreliable design, and suboptimal utilization of resources. Even worse, perhaps, is the possibility that the relatively complex issue of synchronization could dominate the design to such an extent that functional concerns are neglected. From that point of view a trusted, system-based, synchronization facility is preferred.

There are several important characteristics of distributed programs which make them significantly more difficult to design and implement compared to conventional non-distributed programs:

(1) Concurrent execution. This means that there is no single sequential control thread such as represented by the execution trace of a non-distributed program. Concurrency introduces timing dependencies among the system components which can lead to deadlocks or instability.

(2) Significant communication delays. The exchange of information between components of a distributed program involves non-negligible and randomly-distributed transmission delays. If these delays are comparable to the rate at which the components change state, the system may become unstable.

(3) Partial failure modes. Failures of distributed components require complex detection and recovery algorithms which are difficult to design and verify. Two types of partial failures exist:

- Communication path failures can result in the duplication, temporal reordering, or total loss of information being exchanged; and
-Processing component failures (hardware and software) lead to temporary loss of functionality.

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The recovering action for each type of failure is quite different. Unfortunately, it is often difficult to distinguish them on the basis of the observed symptoms.

From the definition of synchronization it can be seen that the need for synchronization is determined by the shared objective of the cooperating distributed entities. This common objective places interdependencies on the individual entities so that a change in the state of one necessitates appropriate changes (reactions) in others. This can be expressed as a requirement to preserve certain application-dependent state consistency constraints. The problem of maintaining consistency is further complicated by the fact that each entity, in addition to internal interactions, is also exposed to independent interactions with the environment. (The environment consists of other distributed components which do not share the same objective as the synchronized system, but which use it for their own purposes). This means that the stimulus to change state can occur simultaneously in two or more synchronized entities. The synchronization problem can then be viewed as one of ordering concurrent interdepenent activities.

The simplest form of ordering which guarantees consistency is serialization: the execution of activities one at a time. Although synchronization strategies exist which are not based on serialization, they will not be considered here due to their relative complexity.

Two basic, and not necessarily exclusive, classes of strategies exist for achieving serialization in distributed systems;

(1) Centralized strategies.

In this case, the ordering of activities is performed by a unique distinguished entity. Synchronized entities, with externally induced work requests, first approach the distinguished entity for permission. This entity resolves concurrent requests by granting a right to only one of the competing entities. When that entity completes its work, the right is granted to another entity, and so on.

A major feature of this type of scheme is that there is a single point of control. This allows the implementation of relatively complex yet reliable and efficient scheduling algorithms. Examples of centralized strategies can be found in A Decentralized Control Method in a Distributed System by J.P. Cabanel et al, Proceedings 1st Ceonference, Distributed Proc. Systems, Huntsville, Al, 1979 and in A Failure Tolerant Centralized Mutual Exclusion Algorithm by G. N. Buckley et al, Proceedings 4th Conference, Distributed Computer Systems, San Francisco, Ca. 1984.

(2) Distributed strategies.

In this case, there is no central scheduler. Instead, ordering is accomplished through distributed agreement. Key to this scheme is a shared "clock" (logical or physical). This is generally a monotonically increasing numeric variable which is maintained consistently by all the synchronized entities. Work requests are timestamped with the clock value at the time of arrival and then processed in order. However; because two or more requests can be concurrent (i.e., they have the same timestamps), ties are resolved through group negotiation: a new work request is first broadcast to all other entities which respond either with a simple acknowledgement or a work request of their own. Once an entity is aware of all concurrent work requests within the group, it orders them according to some tie-breaking rule and then processes them. Since each entity uses the same ordering algorithm each will perceive the same sequence of events as all the others.

The distinguishing feature of distributed strategies is that operation does not depend on a single critical entity at any time. This makes them very fault-tolerant. However, they are generally less efficient than centralized strategies when the number of entities to be synchronized is large. Examples of distributed strategies can be found in Time, Clocks, and the Ordering of Events in a Distributed System by L. Lamport, Comm. ACM, (21,7), July 1978, in An Algorithm for Maintaining the Consistency of Multiple Copies by D. Herman et al, Proceedings, 1st Conference Distributed Proc. Systems, Huntsville, Al., 1979 and in Synchronization in Distributed Programs by F.B. Schneider, ACM Transactions on Prog. Lang. & Syst, (4,2), April, 1982.

Combinations of these two forms, such as the circulating sequencer proposed in Algorithms for Distributed Data Sharing Systems Which Use Tickets by G. Le Lann, Proc. 3rd Berkeley Workshop on Dist. Data, Aug. 1978, are possible. In that scheme, a centralized controller is used to control the clock used for timestamping. (Although the controller function is circulated among the distributed entities, at any given time it is performed by only one entity.) The ordering of activities is then done in a distributed fashion, based on timestamp values and a tie-breaking rule.

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The following patents depict examples of distributed processing in general, and attention is directed to them: U.S. patent 3,411,139 dated November 12, 1968 by J.T. Lynch et al; U.S. patent 3,631,405 dated December 28, 1971 by G.S. Hoff et al; U.S. patent 3,771,137 dated November 6, 1973 by R.P. Barner et al; and U.S. patent 4,115,866 dated September 19, 1978 by J.L.G. Janssens et al.

Summary of the Invention

One objective of the Synchronization Service of the present invention is to provide a set of application-independent capabilities which would allow the construction of specific synchronization strategies belonging to the categories listed above. To do this it must incorporate the essential abstract features of those strategies. These are defined in the form of a general synchronization paradigm described in a following section.

Because of concurrent execution and the possibility of partial failures, it is necessary to closely synchronize the operation of the distributed components of a program. Synchronization can be defined as the ordering of actions and interactions of components in a distributed program so that the state of each component remains consistent with the common goal.

Experience with concurrent systems has shown that the synchronization problem is difficult to solve even for non-distributed situations; the number of possible component interactions is usually very large, increasing the probability of a design error.

A further difficulty is caused by the fact that no single synchronization strategy is adequate for all distributed programs. If multiple distributed programs are to be supported on a system, this means that the synchronization problem may have to be solved in many different ways.

Given the diversity of synchronization strategies and the difficulty of implementing them, is it possible to provide some assistance to designers of distributed programs to increase the reliability of their designs?

The approach to this problem, presented by the present invention, consists of providing a set of primitive synchronization operators at the level of a distributed operating system. Such operators can be used to construct more complex forms of synchronization customized to different applications. This approach has the following advantages:

-It provides a one-time trusted implementation of common mechanisms;

-It does not favour any particular synchronization strategy which would favour some applications but penalize others;

-It provides a systematic framework (programming model) for designing and implementing distributed programs.

The operating system component which implements the synchronization primitives (operators) is called the Synchronization Service.

The essential idea behind the Synchronization Service is that the synchronization problem can be tackled hierarchically. Each level in the hierarchy may have different synchronization mechanisms based on the synchronization facilities of the levels below. The lower levels of this hierarchy can be designed to be application-independent and can therefore be provided as a reliable system service. This, in turn, increases the reliability of programs and reduces development time.

This approach to distributed synchronization attempts to decompose the synchronization problem. At the lowest level of decomposition a general set of application-independent synchronization primitives is defined. These are provided by the distributed operating system in the form of a synchronization service 10. By themselves the primitives are insufficient to provide synchronization. However, they can be combined in different ways to realize customized synchronization strategies. This leaves the ultimate responsibility for synchronization with the application program, but in a much simplified form. The role of the synchronization service 10 is to hide many of the more basic housekeeping functions inherent in distributed synchronization. For instance, all fault-tolerant synchronization schemes require a monitoring function to keep track of the operational status of all relevant distributed components. The present invention consolidates such a function as a system service where it can be shared by many application programs.

Stated in other terms, the present invention is a general service, provided within a distributed operating system, which can be used by application and system programs to implement synchronization between program components that are physically distributed.

Stated in other terms, the present invention is a synchronization service for use with a computer having a distributed operation system, to allow the construction of a customized synchronization scheme, for synchronizing the constituent portions of a distributed program, the service comprising: a general set of application-independent synchronization primitives, whereby the construction of the customized synchronization scheme is achieved by the selective implementation of the application-independent synchronization primitives.

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Stated in yet other terms, the present invention is a synchronization service for use with a computer having an operating system distributed over a plurality of processing elements, to allow the construction of a customized synchronization scheme, for synchronizing the constituent components of a distributed program, the service comprising the steps of:

a) joining a program component on a fist processing element to a group of existing program components on at least a second processing element so that each of the existing components is aware of the present and location of the joining components;

b) informing each member of the group of physically distributed program components when one or more components which are members of the group, depart from it;

c) selecting, as a distinguished member, one program component from a group of distributed program components such that, within the group, there is never more than one distinguished member; and

d) providing mutually exclusive rights to the group of distributed program components such that no more than one component can appropriate a given right at any time.

Stated in still other terms the present invention is a synchronization service, for use with a computer having an operating system distributed over a plurality of processing elements, to allow the construction of customized synchronization schemes for synchronizing the constituent components of a distributed program, the service including a synchronization master control comprising: master control means for activating the synchronization service; polling means for polling the processing elements associated with the components of the distributed program so as to monitor the status of the processing elements; control means for joining new members to the group, and for handling departures of members from the group; and a database means containing information representative of the current state of the synchronization service at a given point in time.

Brief Description of the Drawings

The present invention will now be described in more detail with reference to the accompany drawings, wherein like parts in each of the several figures are identified by the same reference character, and wherein:

Figure 1 depicts a simplified block diagram of the synchronization service of the present invention;

Figure 2a is similar to Figure 1 but is for one specific embodiment thereof;

Figure 2b is a variation on the embodiment of Figure 2a;

Figure 2c is similar to Figure 2b;

Figure 3a is a chart depicting the primitives and corresponding replies employed by the invention;

Figure 3b is a symbolic representation of the constituent tasks of synchronization master control of Figure 1;

Figure 3c is a symbolic representation of the constituent tasks of member agent 11 of Figure 1;

Figure 4 is a simplified functional flow diagram for a database;

Figure 5 is a simplified functional flow diagram for a database;

Figures 6 to 8, 9a, 9b, and 10 to 13 inclusive represent action sequences helpful for understanding the operation of the present invention; and

Figure 14 is a simplified representation of the useage dependencies helpful in understanding the operation of the present invention.

Detailed Description

Synchronization service 10 is based on a general distributed program paradigm. This paradigm is represented by the concept of synchronization groups. A synchronization group is a set of distributed program components called "members", and referred to by the reference character 18, which cooperate to achieve a common objective. Note that members 18 are not a part of synchronization service 10, but they use synchronization service 10.

In other words, the distributed operating system 15, to which synchronization service 10 is applied, will support both distributed application programs and distributed system programs. Both the distributed application and system programs consist of several program components (called members 18) which in turn consist of subcomponents called tasks. In synchronization service 10 there is one synchronization group for each distributed application or system program.

A primitive synchronization operator has effect only within the domain of a particular synchronization group. Synchronization groups, therefore, encapsulate units of tightly coupled distributed functionality. Of course, synchronization service 10 allows many synchronization group to coexist on a single distributed operating system 15.

The basic construct of synchronization service 10 is the synchronization group representing a set (i.e., a system) of distributed entities which are tightly coupled to each other in some way. The

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state and action dependencies which bind these entities are not specified at this level so that synchronization groups are decoupled from application semantics.

Formally, a synchronization group is a set of components, called members 18, in which each group ideally has the following properties:

(1) Uniqueness: There can be any number of synchronization groups in a larger system but each synchronization group is distinguished from all others by a unique synchronization gruop identifier.

(2) Physical distribution: Each member of a synchronization group exists on a different processing element 12. (This is simply a matter of convenience: extending the concept of synchronization groups to logically distributed entities is possible). Note that there are no restrictions concerning the number of synchronization groups which may have members 18 on a particular processing element 12. This means that two or more synchronization groups can overlap in physical space.

(3) Reliable communication: Communication between any pair of members 18 is non-lossy, non-duplicating, and order-preserving. Furthermore, full connectivity is assumed; i.e., each member 18 can communicate directly with all other members 18. If the physical system does not have these properties then it is assumed that an underlying communication service exists which provides them. The intent here is to isolate communications issues from synchronization issues.

(4) Dynamic behavior: Members 18 can depart or join the synchronization group at any time and independently of each other. (The group exists as long as at least one member 18 exists.) Departures may be either application-driven or due to processing element 12 failure. This property captures the dynamic nature of real-world components.

(5) Mutual exclusion: Each synchronization group maintains a set of shared objects called rights, each of which can be either free or associated with at most one member 18. They are functionally equivalent to semaphores (reference: E.W. Dijkstra, Cooperating Sequential Processes, Technical Report EWD-123, Technological University, Eindhoven, 1965) but for a distributed environment. (However, a member 18 can hold more than one right at a time.) A departing member 18 cannot abscond with a right since any rights it holds are automatically freed. In essence, rights are a general mechanism for distinguishing between group members 18. The assignment of functional significance to rights is up to the application.

(6) Distinguished member: One and only one member 18 of every synchronization group is designated as its distinguished member. The appointment is made at random and is transferred to another member 18 if the current distinguished member 18 departs. This property is intended to serve those synchronization strategies which require a central coordinator although synchronization service 10 makes no assumptions regarding the functional significance of the distinguished member 18. (Note that the distinguished member feature is simply a special case of the mutual exclusion property but has been singled out purely for convenience.) Since the selection and preservation of a distinguished member 18 is by synchronization service 10, application programs need not implement their own election algorithms.

A synchronization group represents a unit of synchronization. The facilities of the synchronization service 10 (described later) are all limited in scope to the respective synchronization group.

The synchronization problem is often formulated as a problem of maintaining data consistency in a dynamic environment. From that point of view, the synchronization service 10 ensures consistency of the folowing information sent to members 18:

(1) current membership list;

(2) the identity of the distinguished member; and

(3) the status of all group rights.

This information is maintained consistently and correctly in the face of continual departures and arrivals of members 18.

The concept of synchronization groups does not encompass application program-level consistency; that is the responsibility of the application program. Instead, a synchronization group maintains a consistent view (on all its members 18) concerning the status of its objects: the list of active members 18, the status of rights, the distinguished member designation. These responsibilities are therefore removed from the view of the application program.

Figure 1 depicts a simplified block diagram of synchronization service 10 of the present invention. A distributed application program, structured as a synchronization group, typically has members 18 (i.e. distributed program components) which are physically distributed across two or more processing elements 12a....12n (referred to collectively as processing elements 12). In the implementation of Figure 1, the structure of synchronization service 10 matches the structure of the synchronization group by providing a local synchronization controller, i.e. member agent 11, for each group member 18. Thus, there is a separate implementation of synchronization service 10 for each application program; note, however, that there is only one synchronization master control 13 regardless of how

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many implementations, and only one synchronization agent 14 per processing element 12. Each implementation is functionally independent of the others.

Note that the group of processing elements 12 together with processing element 19 form part of the distributed computing environment (i.e. distributed operating system 15) which synchronization service 10 is designed to synchronize. Not also that each processing element 12 may have a plurality of member agents 11, and that processing element 19 may be combined with one of the processing elements 12.

Member agents 11 provide the main interface to the synchronization service 10. Application program components (i.e. members 18) initiate synchronization activities by invoking the desired synchronization primitives (to be described later). This is communicated to the local member agent 11 which then interacts with other member agents 11 in order to effect the specified synchronization function. The member agent 11 also informs the members 18 of synchronization requests initiated by other members 18 as well as group events such as the failure of active members 18 and the joining of new ones.

Member agents 11 are dynamic entities which follow the dynamics of the application programs they serve. A member agent 11 is created (by the local synchronization agent 14) when an application program component (i.e. member 18) requests to be synchronized with other members 18 in a synchronization group. It is destroyed when the member 18 is unsynchronized.

To ensure coherent behaviour of synchronization service 10, control of the individual implementations of the service 10 is centralized. This is done through a three-level hierarchy with a unique master controller at the top (i.e. synchronization master control 13), an intermediate layer of controllers in the middle (i.e. synchronization agents 14a to 14n, referred to collectively as synchronization agents 14), and a layer of member agents 11 at the bottom. This hierarchy allows a decomposition of the control problem into smaller more comprehensive subproblems. Note from Figure 1 that there is one synchronization agent 14 for each processing element 12, and it controls all the member agents 11 in that processing element 12.

Figure 2a is similar to Figure 1, but depicts a specific embodiment of the synchronization service, referred to by reference character 100 as applied to distributed operating system 115. In Figure 2a there is a synchronization master control 13 on processing element 119, three processing elements 112a, 112b, and 112c, three synchronization agents 14a, 14b, and 14c, along with six members 18a to 18f along with their corresponding member agents 11a to 11f respectively. In the distributed computing example of Figure 2a, processing elements 112a, 112b, 112c and 119 are each an IBM PC-AT. Note that the members 18a to 18f inclusive are not part of synchronization service 100 while everything else shown in Figure 2a is. Members 18a to 18f inclusive use the synchronization service 100. Note also that there is another synchronization master control (not shown) on standby.

Figure 2b is similar to Figure 2a, but is further simplified and depicts only those items that constitute one implementation of synchronization service 100 (i.e. implementation 100a). That is, members 18a and 18e (Figures 2a and 2b) form one synchronized group. Members 18b, 18c, 18d, and 18f (Figure 2a) form at least one other synchronized group.

Figure 2c is a simplified application to exemplify synchronization service 100a of Figure 2b. In Figure 2c the hardware implementating synchronization service 100a is a group of IBM personal computers of the AT series, linked by an IBM LAN (local area network) 226. That is, processing element 112a is an IBM PC-AT computer 212a, processing element 112b is an IBM PC-AT computer 212b, and processing element 119 is an IBM PC-AT computer 219.

In Figure 2c, computer 212a is a telephone operator's workstation as is computer 212b. The application in Figure 2c is to maintain a telephone directory and to allow the user at both computers 212a and 212b to have access to the telephone directory, to access it to determine an individual's telephone number, and to be able to update the telephone directory as changes occur. Computer 219, in this example, handles the tasks of synchronization master control 13 and database 16 (Fig. 2b)

Returning now to the general case of Figure 1, the role of synchronization master control 13 is to provide internal synchronization between the components of the local synchronization service 10. In essence, it performs those functions where a consistent (but not necessarily correct) view of the system 15 is required. More precisely, synchronization master control 13 is responsible for:

(1) Activation of synchronization service 10.

This is done by activating the synchronization agents 14 as the processing elements 12 are restarted.

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(2) Monitoring of processing elements 12.

This function involves observing (polling) the status of all processing elements 12 by communicating with local synchronization agents 14. Any changes in these states are detected by synchronization master control 13 and appropriate notifications are dispatched to the synchronization service components affected by the change.

(3) Management of synchronization groups.

synchronization master control 13 is the central arbiter for all synchronization groups in the local synchronization service 10. It is involved in handling transient conditions which occur in group operation:
-group establishment,
-joining of new members 18, and
-departures of joined members 18.
Note that synchronization master control 13 does not participate in the steady-state operation of synchronization groups and, consequently, is not normally a performance bottleneck.

Synchronization master control 13 must be highly fault-tolerant since synchronization service 10 may be used to implement standby schemes by applications. For that reason it is backed up by at least one other instance operating in standby mode. If the currently active synchronization master control 13 fails, the standby will take its place. Because this is the Synchronization Service, the selection of an active synchronization master control 13 from the set of instances must be done through an internal agreement (election). This is the only place in the entire system where the synchronization service 10 cannot be used for such a purpose. However, in this case, the problem occurs in a very specific context and can be solved in a specific way (for example, by using a bully algorithm for a distributed election as described in Elections in a Distributed Computing System by H. Garcia-Molina, IEEE Trans. on Computers, (C-31,1), Jan. 1982).

Once the active synchronization master control 13 has been selected, the standby resorts to a monitoring mode in which it periodically polls the active instance until a failure is detected.

Since a standby is used, following a failure of the synchronization master control 13, its previous state must be reconstructed on the standby, preferably without involving the application program. This can be achieved through the information kept by the synchronization agents 14. As a consequence, except for slightly extended service times due to the recovering process, application programs are unaware of synchronization master control 13 failure.

SYNC MASTER TASK

The Sync Master Task 20 is the root task (i.e. program) of the synchronization service 10 control hierarchy. It provides the central control point for all synchronization groups. It consists of four main subcomponents as depicted in Figure 3b and is located within synchronization master control 13. The four main subcomponents of the Sync Master Task 20 are as follows:

SYNC MASTER CONTROL 21 establishes and maintains the operational state of the Sync Master Task 20. This includes the Sync Master recovery algorithm. Sync Master Control 21 consists of the main procedure of the Sync Master Task 20.

POLLING CONTROL 22 is responsible for detecting failure of processing elements 12. This subcomponent sends periodic messages to all synchronization agents 14. If a reply is not received within a certain time interval (after several retries have been attempted) the corresponding processing element 12 is declared as failed and a notification is sent to all remaining synchronization agents 14. This subcomponent is implemented within the Sync Master Task 20.

SYNC AGENT CONTROL 23 deals with events which occur at the processing element 12 level. This subcomponent is responsible for activating newly-recovered synchronization agents 14 as well as for accepting notifications, from the synchronization agents 14, about the arrivals and departures of group members 18. These are then relayed to the appropriate Group Control 24. This subcomponent is also implemented within the Sync Master Task 20.

GROUP CONTROL 24 handles events which are relevant to one group. This includes the joining and departure of group members 18. The Group Control function is implemented by the Group Master Task 25. There is one such task 25 for each synchronization group. Tasks 25 are created dynamically by the Sync Master Task 20.

The tasks comprising the Sync Master Task 20 maintain a shared detabase 16 (Figure 1) which represents a snapshot of the current state of the synchronization service 10. This database is described later.

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SYNCHRONIZATION AGENT

A synchronization agent 14 resides in the control program of each processing element 12 which requires synchronization service 10 and it is the sole representative of the Sync Master Task 20 in that processing element 12. The synchronization agent 14 has the following responsibilities:
-It accepts SYNCHRONIZE directives and creates corresponding member agents 11.
-It monitors the status of all active member agents 11 on its processing element 12 and detects their disappearance (spontaneous or planned).
-It notifies the synchronization master control 13 of all changes (arrivals and departures) of Member Agents 11 on its processing element 12.
The synchronization agent 14 is implemented by the Sync Agent Task which is part of the operating system 15 on the corresponding processing element 12.

The synchronization agents 14 are permanent representatives of synchronization master control 13 within their host processing element 12. They have three main purposes:

(1) Synchronization agents 14 are a focal point for controlling all member agents 11 within a single processing element 12. This reduces the load on synchronization master control 13 which simply sends common control information to synchronization agents 14 for distribution to local member agents 11.

(2) Synchronization agents 14 isolate member agents 11 from the effects of synchronization master control 13 failures. All communication between the synchronization master control 13 and Member Agents 11 is channeled through the synchronization agents 14. If the synchronization master control 13 is temporarily unavailable (due to failure), the synchronization agents 14 will hold member agent 11 messages destined for the synchronization master control 13 until the latter is reinstated. In this way failures of the synchronization master control 13 are masked from member agents 11 and hence the applications.

(3) Synchronization agents 14 participate in the recovery of the synchronization master control 13. When a synchronization master control 13 is being reinstated it can reconstruct its operational state simply by querying all the synchronization agents 14. This is much faster and more reliable than querying the member agents 11 since these are more dynamic and more numerous.

The synchronization master control 13 maintains a database 16 (Figure 1) which represents the current state of the synchronization service 10 within the system 15. The database can be accessed through two keys:
-by group identifier --for access to the data for a particular synchronization group, and
-by processing element identifier --for access to synchronization service components located on a particular processing element 12.

The basic structure used is the linked list of dynamically allocated control blocks, each block corresopnding to some synchronization service component. This represents a trade-off between the requirement to minimize storage costs and the need for fast access to the data.

The next section describes the operation of the internal mechanisms used to achieve the synchronization functions. In the following discussion the communication between member agents 11 is assumed to be reliable; i.e., it is non-lossy, non duplicating, and order preserving. If the communication medium is unreliable an underlying reliable communication service provided within the distributed operating system can be used.

Rights are a set of shared objects within each synchronization group; each right can be free or assicated with at most one member 18. One example of a right is a database lock whereby only one user at a time can write to a database and no one else can read or write at that time. See also the "Update" right referred to later.

Rights are distributed in a centralized fashion since that minimizes overhead and complexity. In principle, this can be done by any member agent 11. For convenience, the control and distribution of rights are performed by the distinguished member (one of the members 18). The distinguished member 18 already has the uniqueness and fault-tolerant properties which are also required by the controller for rights. Thus, the Member 18 selected as the distinguished member has to perform this special function in addition to its standard synchronization functions. The selection of a distinguished member is done, by the synchronization master control 13, at the time the group is established (see below).

When a member 18 requires a right, its member agent 11 directs the request to the distinguished member 18. If the right is available, the distinguished member 18 will grant the right and inform the requesting member agent 11. If the right is already appropriated, then depending on the type of request made, the request is either queued by the distinguished member 18 or it is refused. In the first case, requests are handled on a first-come first-served basis.

Should the current distinguished member 18 fail, a new one is appointed by the synchronization master control 13 (which is also resonsible for detecting the failure). Of course, until a new distinguished member 18 is appointed, rights cannot be distributed or retrieved, but all the other synchronization services are still available. In order to mini-

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mize the effect of a distinguished member 18 failure, the state of rights is reconstructed to the point just prior to failure. Each member 18 keeps a list of all rights which it has appropriated as well as a list of all its outstanding rights requests. This information is then exchanged with the new distinguished member 18 which can then assume the same state as the previous distinguished member 18. The entire switchover process is transparent to the application program.

If a member 18 fails, the distinguished member will automatically release any rights held by that member 18 and also purge any queued requests generated by that member 18.

Member agent 11 is the main functional component of synchronization service 10 and is responsible for handling all directives initiated by the user. It performs four classes of functions as depicted in Figure 3c and as represented by the following:

The COMMUNICATIONS HANDLER 33 provides a reliable (order-preserving, non-lossy, non-duplucating) communications service between group members 18; in order to minimize deadlocks the communication mode used is asynchronous message passing. This function is required only if there is no reliable communications service present within the distributed operating system 15.

The GROUP STATE HANDLER 32 maintains a local version of the current state of all the other group members 18.

The DIRECTIVE HANDLER 31 provides the interface between user tasks (components of members 18) and the member agent 11.

The DM HANDLER 30 implements the distinguished member functionality and is active on only one member 18 of the group at a time. This member 18 is selected by the Group Master Task 25 (Figure 3b). The distinguished member 18 is responsible for allocation of rights as well as for broadcasting group status change notifications to all other members 18 of the group. (This information is received from the Group Master Task 25.)

Member agents 11 are created dynamically by the synchronization agent 14 in response to a SYNCHRONIZE directive (Primitive). They are also destroyed by the synchronization agent 14 after they have left the group or following a failure.

Broadcasts and Acknowledgements

When an application program initiates a broadcast (via the GROUP-BROADCAST primitive), its local member agent 11 distributes the information to all other active member agents 11. It then accumulates acknowledgements until all active member agents 11 have replied after which the application program is notified (via the GRP-ACK reply signal).

If an element 12 fails before its acknowledgement is dispatched, the broadcasting member agent 11 will assume an implicit acknowledgement from that member so that failures will not disrupt the application.

Group Establishment and Joining of New Members

A newly joining member 18 first informs the synchronization master control 13 (via its synchronization agent 14) of its intent to join the synchronization group. The synchronization master control 13 then determines if this is the first reported member of the group. If it is, then this Member 18 is designated as the distinguished member 18 and a notification is sent back. This establishes the group.

If the group is already established, synchronization master control 13 registers the new member 18 as being in the joining state and informs the group's distinguished member agent 11. Upon receiving this notification the distinguished member agent 11 broadcasts a join request to all member agents 11 on the list and waits for the corresponding group acknowledgement. The period between the broadcast of the join request and the full acknowledgement of that request by all joined member agents 11 is called the joining interval. During that time some member agents 11 will become aware of the new member agent 11 before others. This opens up the possibility that some messages broadcast within the group may bypass the partially synchronized member agent 11. If messages received by this member agent 11 are passed to the application program, then the application program function of this member 18 would not necessarily perceive the same sequence of group events as other members 18; it could miss some. Therefore, the new member agent 11 must acknowledge any messages received from other member agents 11 (in order to satisfy the acknowledgement requirement) but, once acknowledged, the messages are discarded; i.e. they are not passed on to the application (an exception is messages containing other joining or departure requests which are processed by the member agent 11 but still not relayed to the application). This mode of operation remains in effect until the join

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request is finally acknowledged by the entire group. At that point, the new member 18 informs its application that it is fully joined and switches to normal operation. The overall effect, as perceived by the application, is that the joining operation is atomic.

The handling of messages that were discarded during the joining interval is no different to the application program than the handling of messages missed by the member 18 while it was down; that is, once synchronized with the gruop, the application program must proceed to upgrade its functional state to be consistent with the functional states of other members 18. The best method for achieving this depends on the application program.

Departure of Members

The departure of a member 18 from a synchronization group occurs when the member 18 decides to unsynchronize or when the host processing element 12 fails. In the former case, the departing procedure is as follows: the synchronization group (i.e. agent 11) notifies the Sync Master Task 20 of its intention. This event is relayed, via the appropriate Group Master Task 25 (Figure 3b), to the distinguished member 18 of the group. The distinguished member 18 then broadcasts this information to all other group members 18. Note that there is one Group Master Task 25 for every synchronization group defined in service 10.

In the case of a processing element 12 failure, the failure is detected by the Polling Control 22 within Sync Master Task 20 (Figure 3b) and the same sequence as described above is executed.

If the departed member 18 was a distinguished member, Group Master Task 25 will first select a new distinguished member 18 and then proceed in the same manner as above.

The synchronization agents 14 are intermediaries between synchronization master control 13 and the member agents 11. Synchronization agents 14 are created and dispatched when their host processing element 12 is initialized. Upon creation they wait to be contacted by the synchronization master 13, if one exists. Any application level requests for synchronization are queued until an acknowledgement is received from synchronization master control 13.

During normal operation, the synchronization agents 14 serve as a relay point for communication between the synchronization master control 13 and the member agents 11. All communication is buffered until acknowledged by the receiver so that the Member Agents 11 are protected from temporary failures of synchronization master control 13. The synchronization agents 14 also extract and store any information relevant to the reestablishment of the synchronization master control 13.

Most of the operation of the synchronization master control 13 has already been described above. The only aspect remaining is the monitoring function.

The monitoring of the existence of processing elements 12 is done by the Polling Control 22 which polls each individual synchronization agent 14. The failure of a processing element 12 implies that the corresponding synchronization agent 14 is down as well as all member agents 11 that were present on that processing element 12. When that happens the synchronization master control 13 notifies all affected Group Master Tasks 25. These, in turn, inform their distinguished member agents 11 which then broadcast this information to other member agents 11.

Before we go any further, it may be advantageous to introduce the primitives used with synchronization service 10. The primitives can be split into two categories:

(1) Synchronous Primitives are in the form of request-reply pairs; member agents 11 submit requests for some action to be performed on their behalf and synchronization service 10 eventually matches these with appropriate replies.

(2) Asynchronous Notifications are spontaneous signals informing a member agent 11 about changes in the status of its group or conveying a message sent by some other member agent 11.

There are only two types of asynchronous notifications that can be sent to a member agent 11:
-GROUP-CHANGE (group status) is sent when a new member 18 has joined or an active member 18 has departed from the group. The status information includes the complete new membership list and the id of the new distinguished member.
-GROUP-MSG (message) signals the arrival of a message from some other member 18 (broadcast or point-to-point).

The application program must allow forms of communication (i.e. synchronous and asynchronous) although it may choose to handle asynchronous communications in a synchronous manner by ignoring them until the current activity sequence is complete.

The synchronous primitives and corresponding replies are depicted in chart form in Figure 3a, to which attention is directed.

The primitives are:

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-SYNCHRONIZE (group-id)

This is directive which is issued by a member 18 (via its member agent 11) when it wishes to become synchronized with the group specified by <group-id>. If no group exists at the time, one is established. The only signal expected in reply to this directive is the SYNCH-DONE signal.

-SYNC-DONE (group-status)

This is a signal from the synchronization service 10 (i.e. member agent 11) in response to a successful synchronization of a member 18 following the invocation of the SYNCHRONIZE directive. The return parameter, <group status>, contains the same information about the status of the group as the GROUP-CHANGE primitive described below. It includes a <dm-flag> parameter which informs the member 18 if it is the bearer of the distinguished member status.

- UNSYNC

This directive is used when a member 18 decides to depart from its group. It ensures orderly deactivation.

-UNSYNC-DONE

This signal is a confirmation that the member 18 has been removed from its synchronization group.

-GROUP-CHANGE (group-status)

This is an asynchronous signal which is generated by the member agent 11 whenever a new member 18 joins the group or when a member 18 departs from the group. If this mmeber 18 is the new distinguished member as a result of the change, a <dm-flag> parameter in the <group-status> data record will be set appropriately. The treatment of this situation is left to the application program. The new status of the group is also returned.

-REQ-RIGHT (right-id, mode)

This directive is issued when a member 18 needs exclusive access to a group right. If the right is available, it is guaranteed to be granted to only one requesting member 18 (there may be multiple simultaneous requests for the same right). If the right is not available, then if the <mode> parameter specifie a "queued" request, it is queued until it can be serviced. Alternatively, if the <mode> parameter specifies "immediate" the request is refused since the right has already been appropriated by another member 18 of the group.

- R-GRANTED (right-id)

This signal informs a member 18 that it has been granted the required right.

-R-REFUSED (right-id)

This signal informs a member 18 which has requested a right, with the "immediate reply" mode specified in the request, that the right is not available. (If a queued request was made then this signal will never be generated.)

-REL-RIGHT (right-id)

This directive is used to release an appropriated right.

-R-RELEASED (right-id)

This signal is the reply to the REL-RIGHT directive.

-QRY-RIGHTS

This is a directive which is used to obtain a snapshot of the distribution of group rights among group members.

-R-STATUS (rights-status)

This is a reply signal to the QRY-RIGHTS directive. The <rights-status> parameter lists, for each group right, the member-id of the member which owns it, it any.

Note that service 10 cannot guarantee the currency of the returned information since changes in the distribution of rights can occur at any time.

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-GRP-BRDCST (message)

This directive is used to broadcast a synchronization event (message) to all synchronized members 18. It is the responsibility of the synchronization service 10 (via member agent 11) to ensure that all members 18 receive the message. The <message> parameter can be used to timestamp the synchronization event. The higher level software is responsible for supplying this parameter as well as interpreting its functional significance.

-GROUP-ACK

This is an acknowledgement signal for the GRP-BRDCST directive. It signifies that all members 11 have received the latest broadcast message.

-SND-TO-MEM (message)

This directive is used to send a point-to-point message to another group member 18.

-MSG-ACK

This is an acknowledgement that the latest point-to-point message has been received by the destination member 18.

Before the invention is described further, it may be of value to give some brief examples of the application of the primitives.

The first example is the control of a standby configuration. In this configuration there are two or more distributed program components (i.e. members 18) each on a different processing element 12, each of which is equally capable of providing the necessary function. Only one should be active at any given time while the others are standing by, ready to be activated should the active one fail. Assuming that they are all part of the same synchronization group that the algorithm which each member 18 executes is the same (the synchronization service primitives are highlighted in capitals):

SYNCHRONIZE;
Wait for SYNC-DONE signal;
If not selected as the distinguished member then
Repeat
Listen for SYNC-CHANGE signals;
until selected as the distinguished member;
Execute funciton;

If a member 18 is not selected as the distinguished member following synchronization with the group, then it simply waits until it is designated as the distinguished member.

The next exampled concerns the updating of a replicated database, i.e. the same example mentioned in the Background of the Invention. In this case there are multiple instances of a database, each of which can initiate an update request as a result of external activity. Such requests will be called external to distinguish them from "shadow requests". Shadow request are copies of an external request which a member 18 sends to all other members 18 so that they can make the appropriate changes to their copies of the database. For brevity, the handling of any other requests except update requests is ignored.

The solution shown below uses the mutual exclusion feature of the synchronization group. A right, called the Update right, is defined. The holder of this right is the member 18 whose request will be honored; all other members 18 must withhold their requests and perform the shadow request sent by the holder of the right:

Solution A

Repeat
Wait for next request;
If external request then
begin
REQ-RIGHT (update);
While waiting for R-GRANTED
Handle any incoming shadow requests;
GRP-BRDCST (external request);
Handle external request;
REL-RIGHT (Update);
end
else
Handle shadow request;
until termination;

Note that the application program need not be concerned with spontaneous failures of other members 18 since that is handled by the synchronization service 10.

An important problem which must be handled by this application (i.e. Solution A, above) is the addition of new or recovering instances. These will not necessarily have the same state as the others and therefore must be brought to the same functional level. The situation is complicated by the possibility that updates may be initiated at other instances whil the new instance is being upgraded. One method of dealing with this is for the new instance to appropriate the Update right to ensure that the state remains unchanged while it is being upgraded. The algorithm performed by a restarting instance is then:

SYNCHRONIZE;
Wait for SYNC-DONE signal;
REQ-RIGHT (Update);

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While waiting for R-GRANTED
Discard any shadow requests received;
Obtain current copy of database;
REL-RIGHT (Update);

Following this, the normal request-processing algorithm described above (i.e. Solution A) is executed.

The current copy of the database is obtained from any other member 18 through an internal protocol using point-to-point messages (i.e. SND-TO-MEM directives). Instead of a copy of the entire database it may be more convenient to request an update log and then perform the updates missed while the member 18 instance was down.

Figure 4 is a functional flow diagram representing the synchronization service 10 database 16 when accessed through the processing element 12 identifier.

The head and tail pointers (AGT-LST-HD and AGT-LST-TL) respectively, point to a linked list of synchronization agent control blocks (tAGT-CB) for those synchronization agents 14 involved.

There is one synchronization agent control block tAGT-CB for each processing element 12 which requires synchronization service 10. It contains a link (AGT-LST-LNK) to other synchronization agent control blocks tAGT-CB. This chain enables quick scanning of affected processing elements 12 when an entire block of processing elements 12 fails. Each synchronization agent control block tAGT-CB also contains a pointer (MMCB-LST-HD) to a chain of member agent control blocks (tMEM-CB) which reside on that processing element 12. Through this chain it is possible to detect quickly all synchronization groups which are affected by the failure of a processing element 12. Whereas all other chains in the synchronization service database 16 remain unchanged once they are established, this chain follows the dynamics of member 18 joinings and departures.

In order to simplify searching and list maintenance, the last Sync Agent control block tAGT-CB in the list is a dummy block.

Each member agent control block tMEM-CB corresponds to one member 18 of one synchronization group. Among other data, this control block contains a pointer (not shown in the diagram) to the corresponding synchronization agent control block tAGT-CB. This link allows quick reconfiguring of the processing element-Member Agent chain when necessary.

Figure 5 is a functional flow diagram representing the synchronization service database 16 when accessed through the unique group identifier.

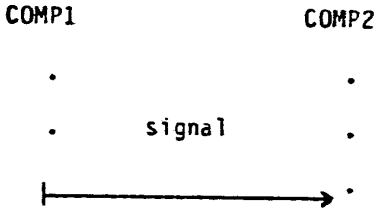
GRP-HDR [gropu id] is a static array of pointers. Each item of the array points to a circular list of member agent control blocks (tMEM-CB of which belong to the same synchronization group.

The member agent control blocks tMEM-CB are linked into a circular list to facilitate selection of a distinguished member. This list grows as members 18 are added to the synchronization group, each successive block identified by the next available positive integer (MEM-ID). This integer corresponds to the member 18 identifier.

ACTION SEQUENCES

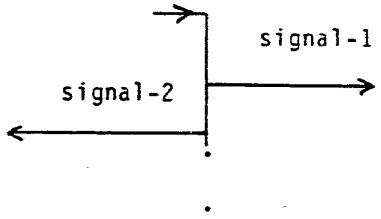
This section describes various action sequences within synchronization service 10. A diagrammatic representation is used to show these sequences. The following conventions are used.

- A full horizontal line indicates a message or rendezvous between two components (i.e. programs or tasks):



where signal is the name of the entry procedure in component COMP2 which accepts the signal. COMP1 is the component which sent the signal.

- a vertical line (1) following the reception of a signal indicates processing within the appropriate component which received the signal. This processing results in one or more signals being dispatched to other components:



- If an asterisk (*) appears next to a signal it implies that the signal may be repeated (to different destinations).
- A signal which is enclosed in braces (e.g.,<signal> indicates that the signal is not mandatory and may be omitted depending on circumstances.

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• Bracketed numbers in the Figures (e.g. (1)) designate explanatory notes which contain textual descriptions pertaining to various signals. The notes are given in the text relating to the relevant Figure. As it is believed that the Figures are self-explanatory, only brief comments will be made regarding the figures.

Joining of New Members

An "empty" synchronization group is one in which no members 18 are active. When the first member 18 joins, it is designated as the distinguished member by default. Figure 6 depicts a member 18 joining an empty group. The sequence of events is as depicted in Figure 6, to which attention is directed. The abbreviations used in the Figures are as follows: APPL means an application task; SNYC AGT means the synchronization agent task; MEM AGT means the member agent task; SYNC MST menas the synchronization master task 20; GRP MST means the Group Master Tast 25; MEM AGT (DM) means the distinguished member agent task; APPL (DM) means the application task which corresponds to the distinguished member agent.

The following notes refer to the bracketed numbers in Figure 6.

Notes:

(1) The Sync Agent will create a member agent task only if it had not existed previously, otherwise it will REINIT a previously created task instance. The START-AGT signal which follows initialization is used to pass initial data to the member agent 11.

(2) The AGT-MST-MSG signal to the sync master 13 contains the complete information about all member agents 11 on this processing element 12, including the newly-created member 18. (This ensures state convergence even in the presence of design faults.) The MST-REPLY message is used for positive acknowledgement so that the Sync Agent can send the next message to the Sync Master if it has one. (Only one outstanding message is allowed between the Sync Master and a Sync Agent.)

(3) If this group has not previously existed, a new Group Master is created. In that case a STARTUP signal follows to pass initial data to the Group Master Task, and an ACTIVATE signal is used to force it into an operational mode. If the group had existed previously (but had lost all its members) the existing Group Master Task is used.

(4) Once the Group Master has been activated, a GRP-EVENT signal is sent by the Sync Master informing it of the joining of the first member.

(5) Upon receipt of the GRP-EVENT signal, the Group Master selects the newly-created member agent 11 as the distinguished member and sends it a GRP-STATE signal. This signal establishes a connection between the Group Master and the Distinguished Member. All subsequent GRP-STATE signals are sequenced to ensure proper event ordering as well as to guard against communication failures. The GRP-REPLY signal is used to acknowledge one or more GRP-STATE signals and provides reliable communication.

The GRP-STATE signal contains the complete new state of the group rather than just information about the changes. This ensures that the system will converge to the true state even in the presence of design faults.

(6) The CHECK-FAIL signal is used to poll the application task to detect unexpected failures of the application. The application task never receives this signal; however, should the task fail, the member agent task will be notified by the underlying operating system kernel.

(7) The SYNC-REPLY signal contains a reply code of SYNC-DONE.

Figure 7 depicts the sequence for joining an existing synchronization group; the Group Master Task already exists, and the distinguished member is used to notify (broadcast) the other members 18 of the presence of a new member 18.

Notes:

(8) If the application has so requested, a GROUP-CHANGE signal is sent by each member agent 11 to the application whenever it detects a change in status of the group. In the case of the distinguished member the status change is gleaned from the GRP-STATE signal.

(9) When the distinguished member receives a GRP-STATE signal which indicates a group change (not all do), it broadcasts the new state to all other group members 18 using a MEM-MSG signal. Each member 18 acknowledges such messages with an ACK signal to provide reliable communication.

(10) When the newly-joining member 18 receives its MEM-MSG from the distinguished member it will send a SYNC-REPLY signal to the application (instead of a GROUP-CHANGE signal).

The control flow for the departure of a member 18 is shown in Figure 8. Note that the case of a processing element 12 failure is not shown here but is instead treated separately.

Notes:

(11) The sequence shown here corresponds to a voluntary departure initiated by the application program issuing an UNSYNC directive. This results in the member agent task terminating which, in turn, sends a COMPLETE signal to the parent task, the Sync Agent. The sequence is similar in situ-

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ations where the departure is not voluntary:
-When the application task fails, the member agent 11 is notified (through the failure of the CHECK-FAIL message) which results in the termination of the member agent task (and consequently, raising of the COMPLETE signal).
-If the member agent task itself fails, the Sync Agent is notified by the operating system kernel with a COMPLETE signal.

(12) Indicates a <GROUP-CHANGE> signal to an application task not shown in the Figure.

Figures 9a and 9b together depict the recovery of the synchronization master control 13 (i.e. Sync Master). The most general case is considered, i.e. the case of a running synchronization service 10 with active synchronization groups. This includes, as a subset, the case of a "cold" start.

Notes:

(13) Upon activation, Sync Master sends an ACTIVATE signal to each configured Sync Agent. The Sync Agent, whether they are already active or not, will respond with an AGT-REPLY message which includes a list of all member agents supported on that processing element. (The MST-REPLY signal is used for acknowledgement: refer to Figure 6.)

(14) Following activation of the Sync Agent, the Polling Control subcomponent 22 of Sync Master Control sends a POLL-AGT message to which the Sync Agent responds with an AGT-REPLY message. This exchange is repeated periodically to detect outages of the processing element.

(15) A Group Master is initiated only the first time a group is encountered. Refer to Figure 6 for further details on Group Master initiation.

(16) Before activating a Group Master, it is provided with data regarding the status of its members through GRP-DATA signals. Each signal contains the information for one member agent of one group. (This info is obtained from the AGT-REPLY messages.) In this way, the Group Master reconstructs the status of its group.

(17) After all Sync Agents have responded, the reconstruction is complete and an ACTIVATE signal is sent to all Group Masters. The Group Masters respond by sending a GRP-STATE signal to all distinguished members. Since this signal contains the complete group state, any group changes that might have occurred while the Sync Master was down are detected.

Figure 10 depicts the procedure for handling the failure of a processing element 12 which contains a synchronization agent 14 (Sync Agent).

Notes:

(18) The Sync Master detects a failure of a processing element when a TIME_OUT event is received. This means that a Sync Agent has not responded to a poll.

(19) For each group affected by the processing element failure, the Sync Master will send a GRP-EVENT signal to the respective Group Master.

Figure 11 depicts the procedure for the recovery of a processing element 12 which is part of synchronization service 10. Note that the recovery of processing element 12 does not extend to recovering member agent 11 tasks. It is assumed that these will be recovered when the application tasks (i.e. programs) which use them are restarted. Thus, the only action to recover a process element 12 is to integrate the sync agent 14 with the rest of synchronization service 10.

Notes:

(20) When a previously failed Sync Agent finally responds to a POLL_AGT signal, the Sync Master initiates the recovery procedure.

(21) The Sync Master registers the new processing element 12 and sends an ACTIVATE signal to the Sync Agent on that processing element 12 (Refer to Figure 9a for a more detailed description of the activation sequence).

Figure 12 depicts the procedure for member 18 to member 18 messages. This procedure (protocol) is used both for group broadcasts and point-to-point messages between members 18.

Notes:

(22) In case of a broadcast, a copy of the message is sent to each member 18. If the member 18 is not active, the message is not sent.

(23) Upon receiving a MEM-MSG signal which indicates an application-level message the message is relayed to the application task responsible for receiving asynchronous messages.

(24) A SYNC-REPLY (codes: GRP-ACK or MSG_ACK) signal is sent back to the originator.

Figure 1 depicts the procedure employed in the processing of all directives which require distinguished member intervention (rights handling directives).

Notes:

(25) If the request is made on the distinguished member site, then no message is sent.

(26) A reply signal (MEM-MSG followed by a SYNC-REPLY to the application).

In one implementation made by the inventors, the code for synchronization service 10 was contained in ten files which were distributed into six units, the useage dependencies (and compilation order) of which are shown in Figure 14.

Notes:

SYNCCTRL contains the stub of the Sync Master unit and directives to include three files (SYNCMST, SYNCGMST, and SYNCPOLL) which implement the Sync Master function. It also contains the definitions required for the master database 16. SYNCMST is an "include" file which

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contains the code for the Sync Master Task.
SYNCGMST is an "include" file which contains the code for the Group Master Task.
SYNCPOLL contains the Polling Control 22.
SYNCLOCL contains the stub of the Sync Agent unit as well as a definition of data and procedure objects shared by the Sync Agent Task and the Member Agent Tasks. It also contains directives to include two files (SYNCAGT, SYNCMAGT).
SYNCRESX contains the definition of the SYNCHRONIZE primitive. This unit must be loaded with the application code which uses the synchronization service.
SYNCDEFI contains a set of internal compile-object definitions for the synchronization service. This includes the definition of all entries used for communication between synchronization service components which are hidden from user programs. Since this file contains only compile objects it is not loaded.
SYNCDEFX contains a definition of all compile-objects which are exported by the synchronization servie to its users. Since this file contains only compile objects it is not loaded.
Application tasks which use the synchronization service need to include SYNCRESX and SYNCDEFX in their useage lists.

Note that SYNCCTRI implements the function of synchronization master control 13 (Fig. 1), and that SYNCLOCL and SYNCRESX together implement the functions of member agent 11 and synchronization agent 14 (Fig. 1). The files SYNCDEFI and SYNCDEFX are not resident in the service; they can be thought of as tools used in the construction of the synchronization service but they are not themselves a part of it.

Simplified pseudocode listings for the main constituents of the invention follow as appendix I. They are believed to be self-explanatory. Any elaboration of the material is accomplished through the use of appended notes, to which attention is directed.

As a further aid to the understanding and to the use of the present invention the following (a copy of a "User's Reference" to the synchronization service of the present invention, as prepared by one of the inventors) is included as Appendix II. It will expand on the use of the present invention.

Claims

1. A synchronization service [10] for use with a computer having a distributed operating system, to allow the construction of a customized synchronization scheme, for synchronizing the constituent portions of a distributed program, said service comprising:

a general set of application-independent synchronization primitives, whereby the construction of said customized synchronization scheme is achieved by the selective implementation of said application-independent synchronization primitives.

2. The synchronization service of claim 1 wherein said application-independent primitives comprise the following functions: synchronize; synchronize done; and unsynchronize.

3. The synchronization service of claim 2 wherein said primitives further comprise the following functions: request right; right granted; right refused; release right; group broadcast; and group acknowledge.

4. The synchronization service of claim 3 wherein said primitives further comprise the following functions: unsynchronize done; send to member; and message acknowledge.

5. A synchronization service [10] for use with a computer having an operating system [15] distributed over a plurality of processing elements [12], to allow the construction of a customized synchronization scheme, for synchronizing the constituent portions [18] of a distributed program, said service comprising:
a common synchronization master control means [13];
a synchronization agent means [14] for each processing element;
a plurality of application program components [18], each component located on a different processing element, each said component having associated therewith a member agent [11], said member agent being a program for interfacing with said synchronization agent means, and said synchronization agent means interfacing between said master control means and said member agent, whereby a customized synchronization scheme can be constructed based upon a general set of application-independent synchronization primitives contained in both said synchronization agent means [14] and said member agent [11] and accessed via said synchronization agent means.

6. The synchronization service of claim 5 wherein said application-independent primitives comprise the following functions: synchronize; synchronize done; and unsynchronize.

7. The synchronization service of claim 6 wherein said application-independent primitives further comprise the following functions: request right; right granted; right refused; release right; group broadcast; and group acknowledge.

8. A synchronization service [10] for use with a computer having an operating system [15] distributed over a plurality of processing elements, to allow the construction of a customized synchroniza-

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tion scheme, for synchronizing the constituent component of a distributed program, said service [10] comprising the steps of:

a) joining a program component [18] on a first processing element [12] to a group of existing program components [18] on at least a second processing element [12] so that each of the existing components is aware of the presence and location of the joining components;

b) informing each member of a group of physically distributed program components when one or more components which are members of said group, depart from it;

c) selecting, as a distinguished member, one program component from a group of distributed program components such that, within said group, there is never more than one said distinguished member; and

d) providing mutually exclusive rights to said group of distributed program components such that no more than one said component can appropriate a given right at any time.

9. The synchronization service of claim 8 further including the step of providing reliable point-to-point communication between said distributed program components on the basis of their internal group identifiers.

10. The synchronization service of claim 9 further including the step of providing a broadcast mechanism from any one program component to all other program components which are currently declared as being in the same group as the broadcasting component.

11. The synchronization service of claim 10 wherein said program components are components of an application program.

12. The synchronization service of claim 10 wherein said program components are components of an operating system program.

13. The synchronization service of claim 8 wherein said physical processing elements are logically distributed entities at one physical location.

14. A synchronization service [10], for use with a computer having an operating system [15] distributed over a plurality of processing elements [12], to allow the construction of customized synchronization schemes for synchronizing the constituent components [18] of a distributed program, said service comprising, as required, the steps of:

a) establishing a synchronization group for said distributed program, said group comprising at least one distributed program component [18];

b) joining a program component [18] to said group of existing program components so that each of the components is aware of the presence and the location of all the other components in said group;

c) informing each member of said group of distributed program components when one or more components which are members of said group, depart from it;

d) selecting, as a distinguished member for said group, one program component from said group of distributed program components such that, within said group, there is never more than one said distinguished member; and

e) providing mutually exclusive rights to said group of distributed program components such that no more than one said component can appropriate a given right at any time.

15. The synchronization service of claim 14 further including the step of providing full connectivity between all said distributed program components of said group.

16. The synchronization service of claim 15 wherein said distributed program is an application program.

17. The synchronization service of claim 15 wherein said distributed program is an operating system program.

18. The synchronization service of claim 15 wherein each said program component [18] is on a different processing element [12].

19. A synchronization service [10], for use with a computer having an operating system [15] distributed over a plurality of processing elements [12], to allow the construction of customized synchronization schemes for synchronizing the constituent components [18] of a distributed program, said service including a synchronization master control [13] comprising:

master control means [21] for activating said synchronization service;

polling means [22] for polling the processing elements [12] associated with said components of said distributed program so as to monitor the status of said processing element;

control means [24] for joining new members [18] to said group, and for handling departures of members [18] from said group; and

a database means [16] containing information representative of the current state of said synchronization service at a given point in time.

20. The synchronization service of claim 19 further including, at each said processing element, a synchronization agent [14] comprising:

means for accepting synchronization directives and for creating corresponding member agents; and

means for monitoring the status of all active member agents on said processing element and reporting same to said synchronization master control [13].

21. The synchronization service of claim 20 further including at each said processing element [12], a member agent [11] each synchronization

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group, comprising:
communications means [33] for providing a reliable communications service between program components [18];
storage means [32] for maintaining a local version of the current state of all other program components [18];
handler means [31] for providing the interface between user tasks and said member agent [11]; and
distinguished member means [30] for implementing the distinguished member function on only one program component [18] at any given time.

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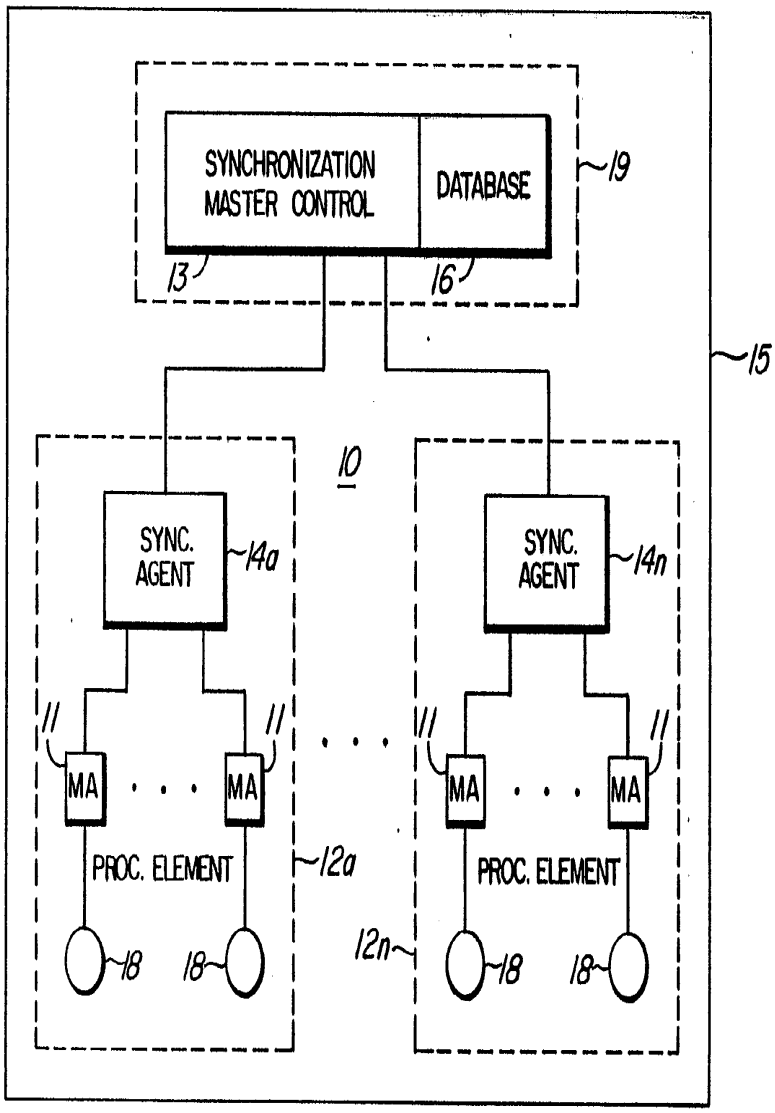


FIG. 1

0 251 584

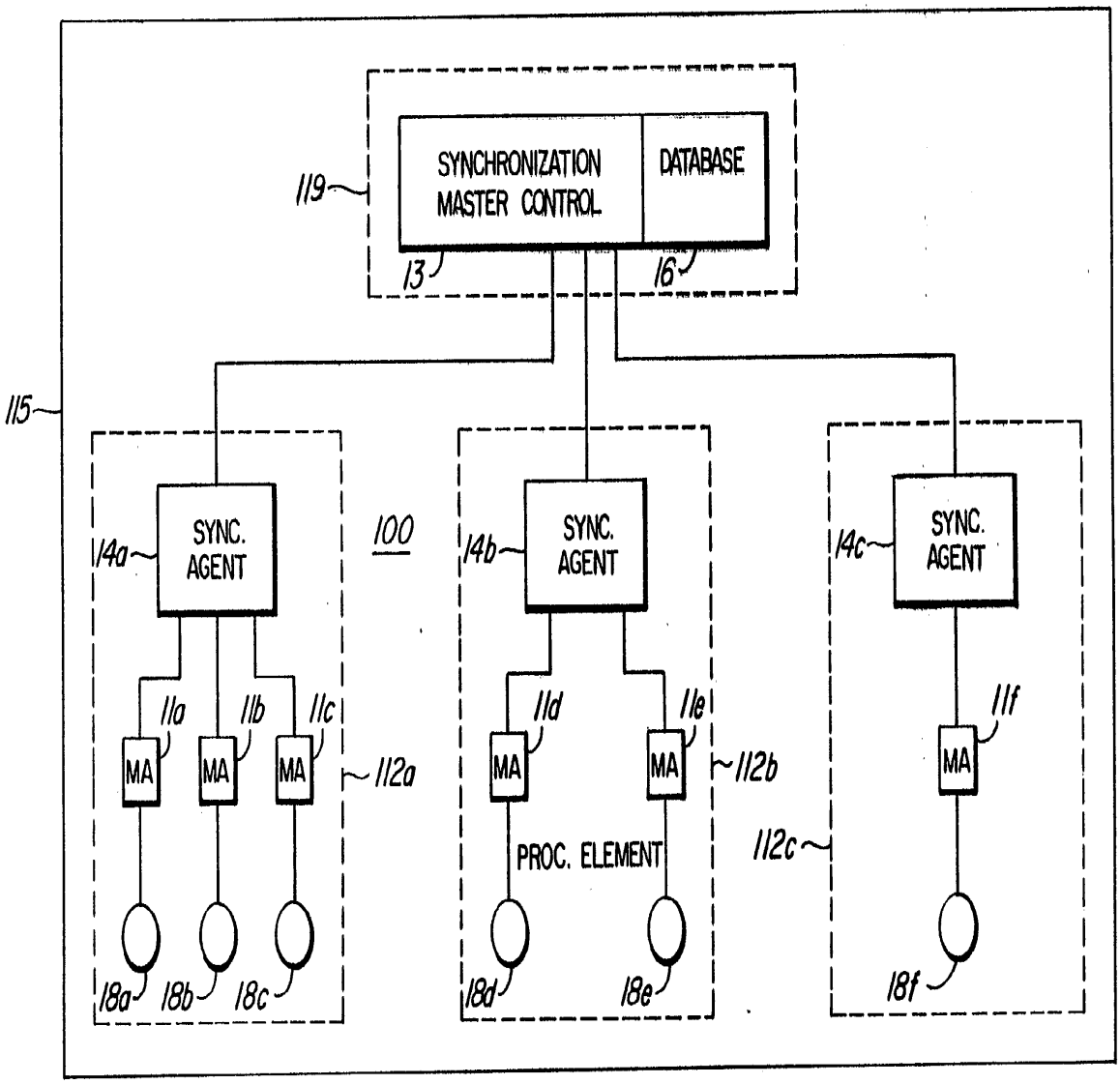


FIG. 2a

0 251 584

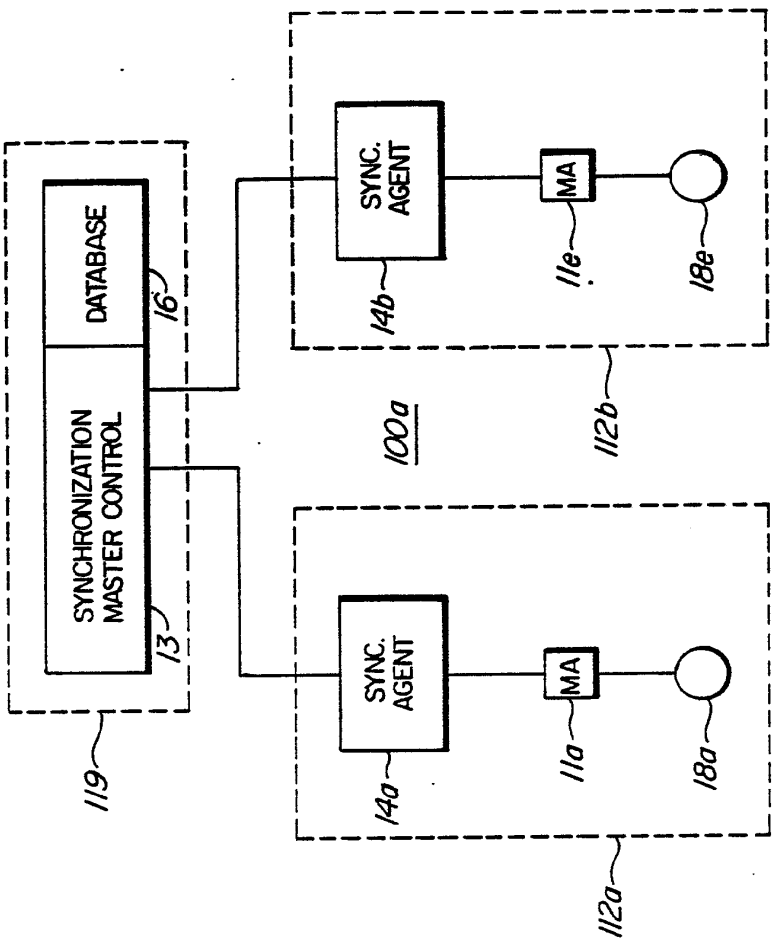

SYNCHRONIZATION MASTER CONTROL
DATABASE
13
16
119
SYNC. AGENT
14a
MA
11a
18a
112a
100a
SYNC. AGENT
14b
MA
11e
18e
112b

FIG. 2b

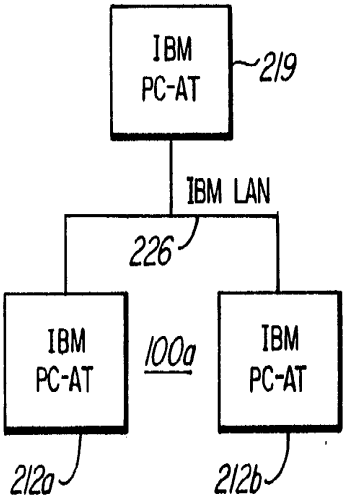


FIG. 2c

SYNCHRONOUS PRIMITIVES

REQUEST	REPLY
SYNCHRONIZE (group-Id)	SYNC_DONE (group-status)
UNSYNC	UNSYNC_DONE
REQ_RIGHT (right-id, Immed)	R_GRANTED
	R_REFUSED
REQ_RIGHT (right-id, Queued)	R:GRANTED
REL_RIGHT (right-id)	R_RELEASED
QRY_RIGHTS	R_STATUS (rights-status)
GRP_BRDCST (message)	GRP_ACK
SND_TO_MEM (message)	MSG_ACK

ASYNCHRONOUS NOTIFICATIONS

GROUP-CHANGE (group-status)
GROUP-MSG (message)

FIG. 3a

0 251 584

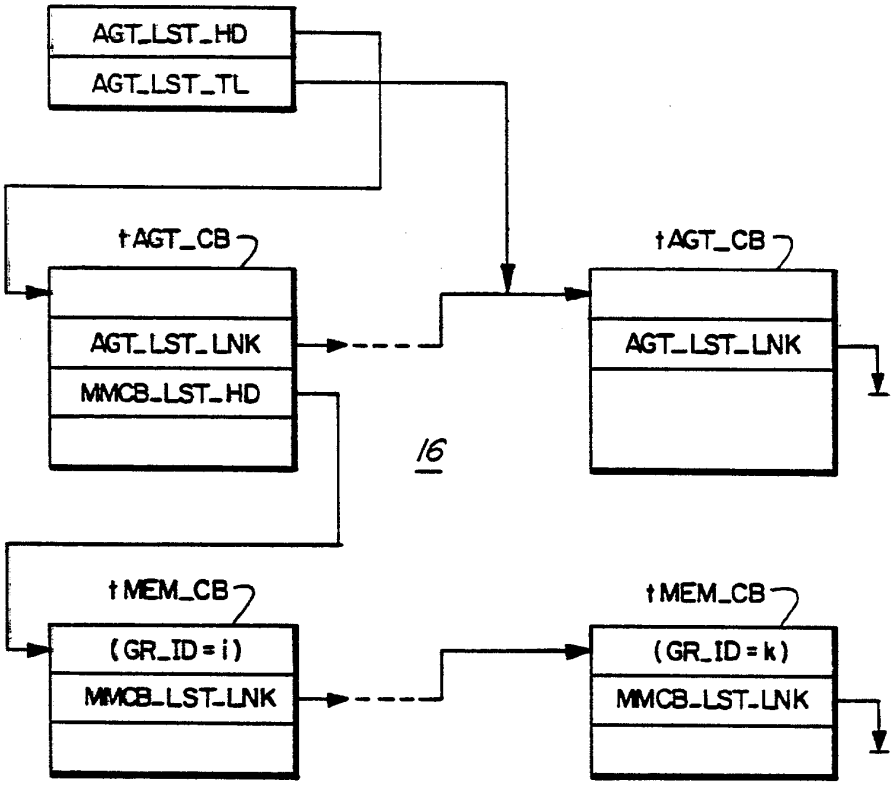

AGT_LST_HD
AGT_LST_TL
tAGT_CB
AGT_LST_LNK
MMCB_LST_HD
tAGT_CB
AGT_LST_LNK
16
tMEM_CB
(GR_ID = i)
MMCB_LST_LNK
tMEM_CB
(GR_ID = k)
MMCB_LST_LNK

FIG. 4

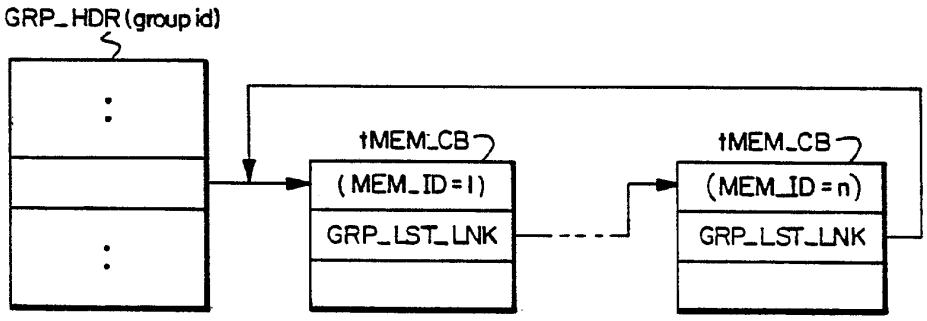

GRP_HDR (group id)
tMEM_CB
(MEM_ID = 1)
GRP_LST_LNK
tMEM_CB
(MEM_ID = n)
GRP_LST_LNK

FIG. 5

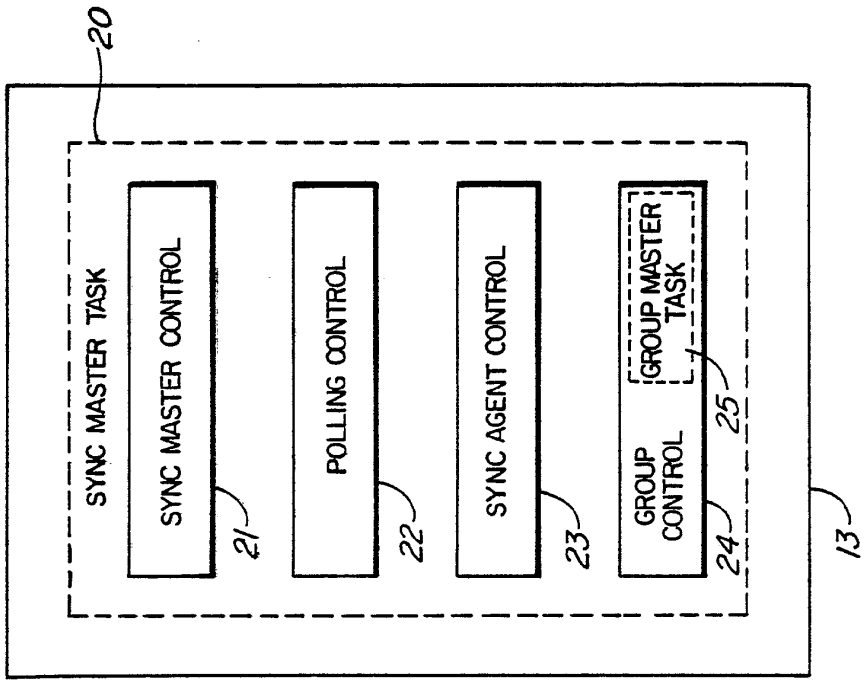

20
SYNC MASTER TASK
SYNC MASTER CONTROL
21
POLLING CONTROL
22
SYNC AGENT CONTROL
23
GROUP CONTROL
GROUP MASTER TASK
24
25
13

FIG. 3b

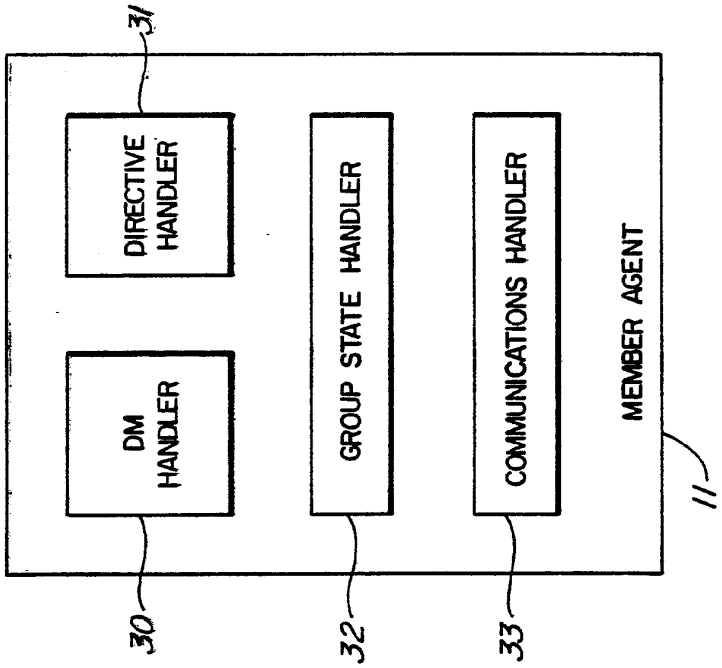
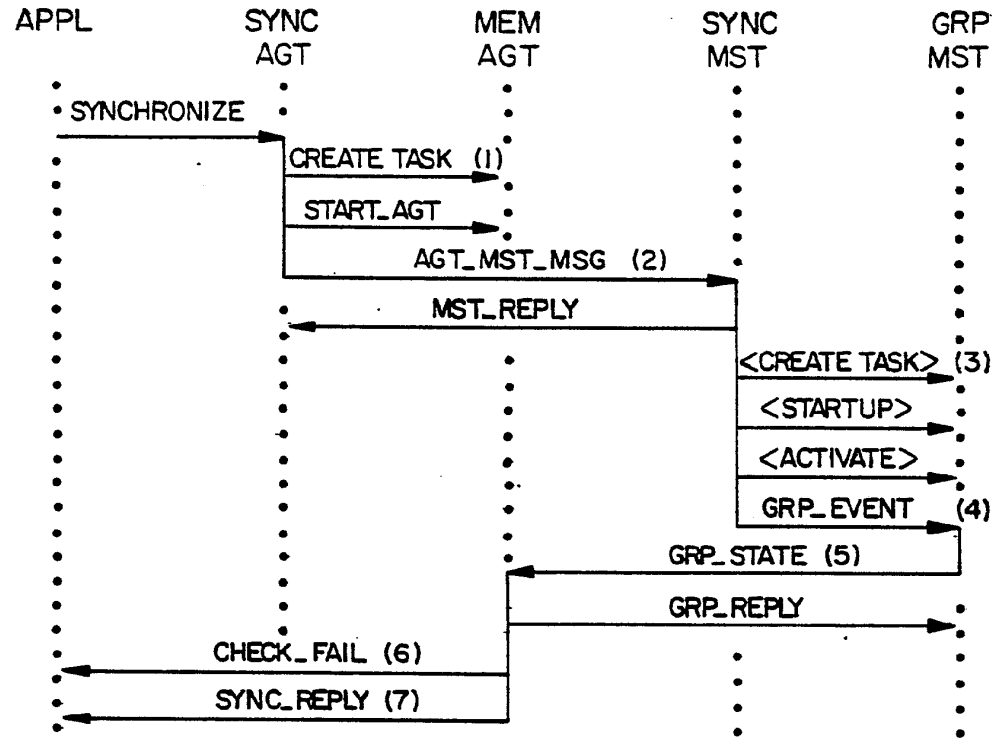

31
DIRECTIVE HANDLER
DM HANDLER
GROUP STATE HANDLER
COMMUNICATIONS HANDLER
MEMBER AGENT
11
30
32
33

FIG. 3c



LEGEND
APPL = MEMBER 18
SYNC AGT = SYNCHRONIZATION AGENT 14
MEM AGT = MEMBER AGENT 11
SYNC MST = SYNCHRONIZATION MASTER 13
GRP MST = GROUP MASTER 25

FIG. 6

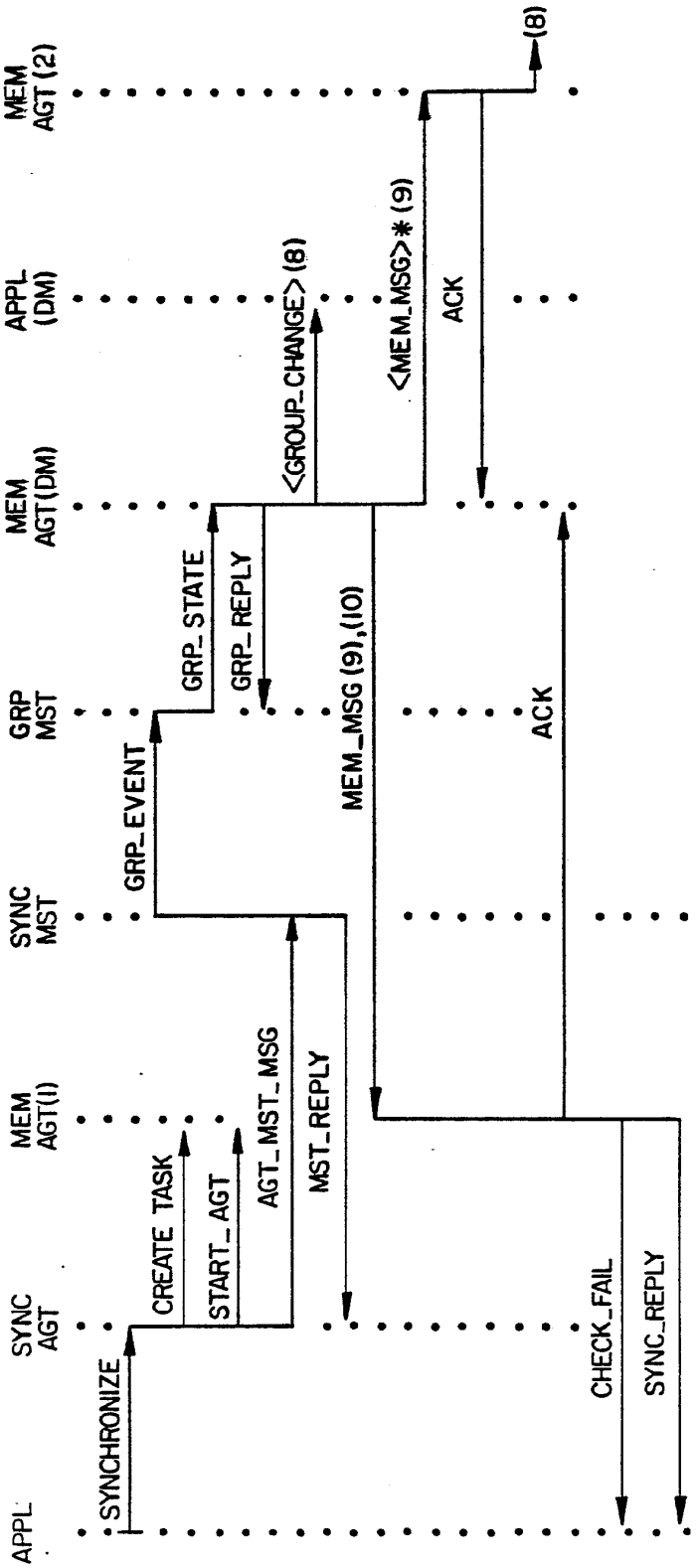

APPL
SYNC AGT
MEM AGT(1)
SYNC MST
GRP MST
MEM AGT(DM)
APPL (DM)
MEM AGT(2)
SYNCHRONIZE
CREATE TASK
START_AGT
AGT_MST_MSG
MST_REPLY
GRP_EVENT
GRP_STATE
GRP_REPLY
<GROUP_CHANGE> (8)
MEM_MSG (9),(10)
<MEM_MSG>* (9)
ACK
ACK
(8)
CHECK_FAIL
SYNC_REPLY

FIG. 7

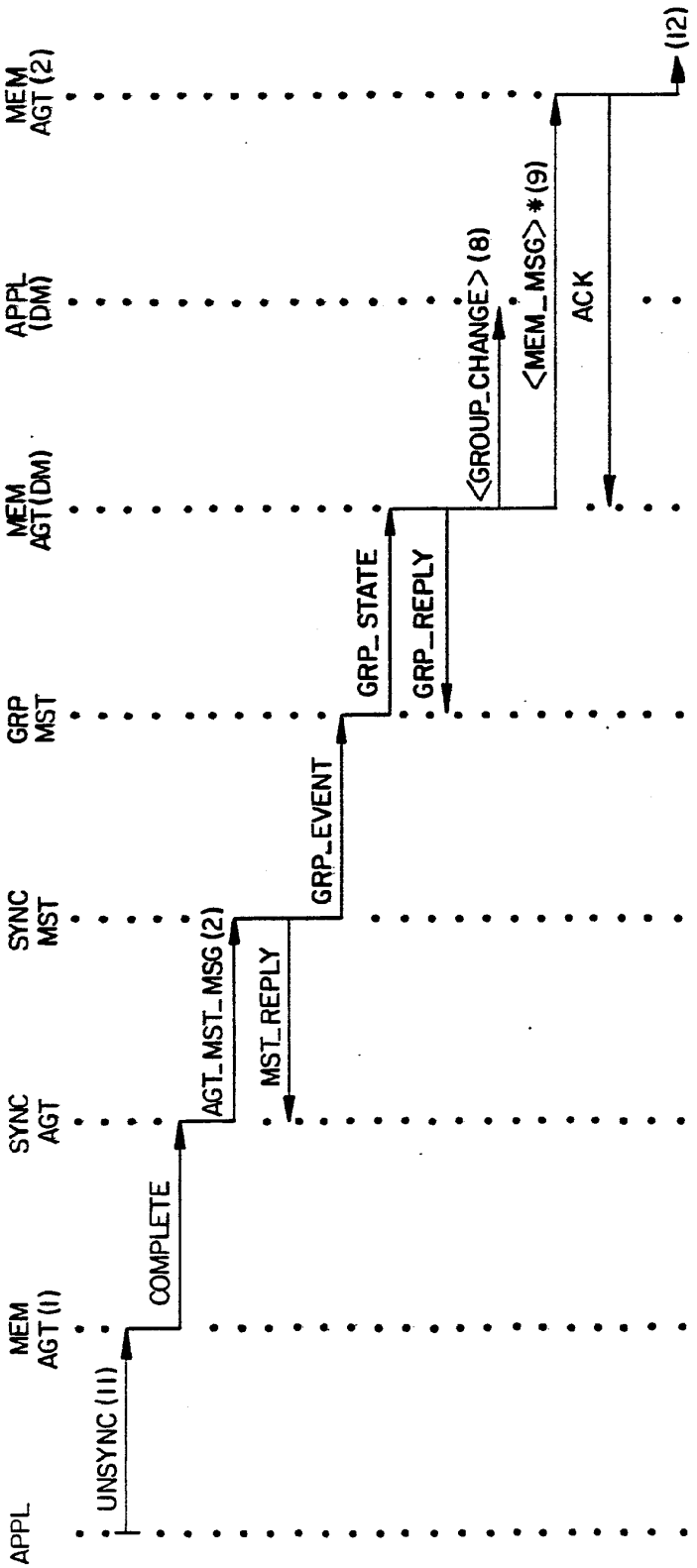

APPL
MEM AGT (1)
SYNC AGT
SYNC MST
GRP MST
MEM AGT(DM)
APPL (DM)
MEM AGT (2)
UNSYNC (11)
COMPLETE
AGT_MST_MSG (2)
MST_REPLY
GRP_EVENT
GRP_STATE
GRP_REPLY
<GROUP_CHANGE> (8)
<MEM_MSG> *(9)
ACK
(12)

FIG. 8

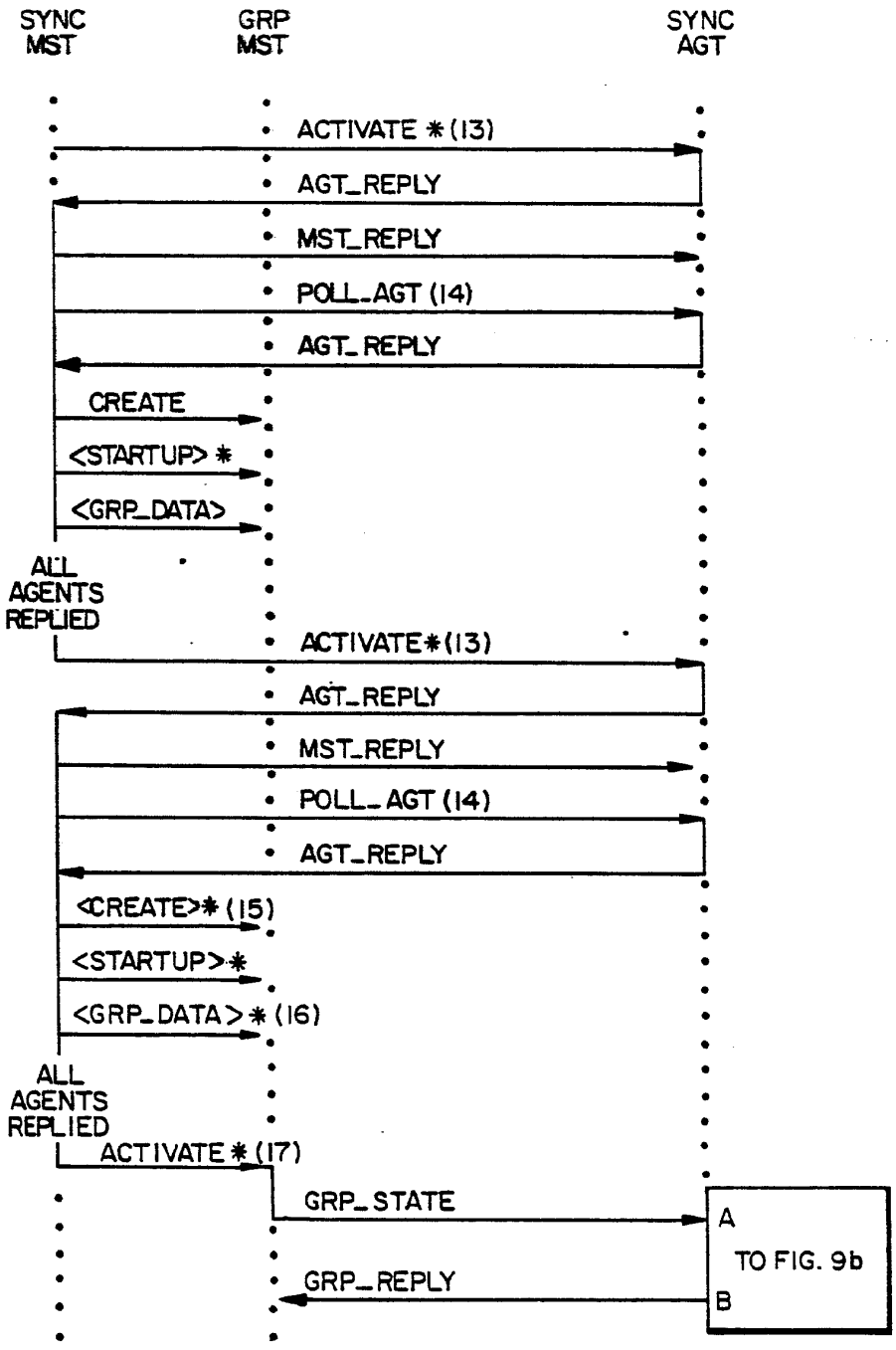

SYNC MST
GRP MST
SYNC AGT
ACTIVATE * (13)
AGT_REPLY
MST_REPLY
POLL_AGT (14)
AGT_REPLY
CREATE
<STARTUP> *
<GRP_DATA>
ALL AGENTS REPLIED
ACTIVATE*(13)
AGT_REPLY
MST_REPLY
POLL_AGT (14)
AGT_REPLY
<CREATE>* (15)
<STARTUP>*
<GRP_DATA>* (16)
ALL AGENTS REPLIED
ACTIVATE * (17)
GRP_STATE
GRP_REPLY
A
TO FIG. 9b
B

FIG. 9a

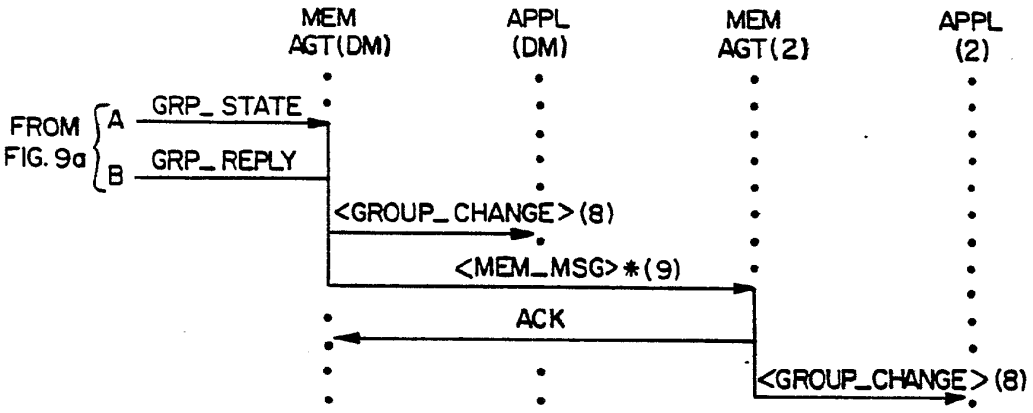

MEM AGT(DM)
APPL (DM)
MEM AGT(2)
APPL (2)
FROM FIG. 9a
A
B
GRP_ STATE
GRP_ REPLY
<GROUP_ CHANGE> (8)
<MEM_MSG>*(9)
ACK
<GROUP_CHANGE> (8)

FIG. 9b

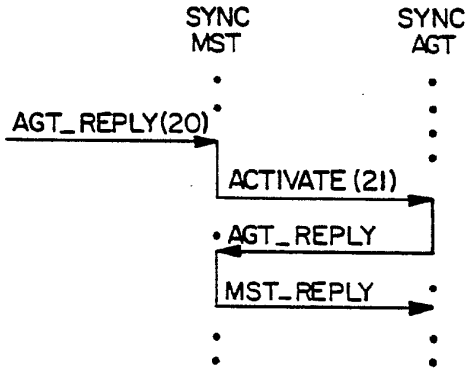

SYNC MST
SYNC AGT
AGT_REPLY(20)
ACTIVATE (21)
AGT_REPLY
MST_REPLY

FIG. 11

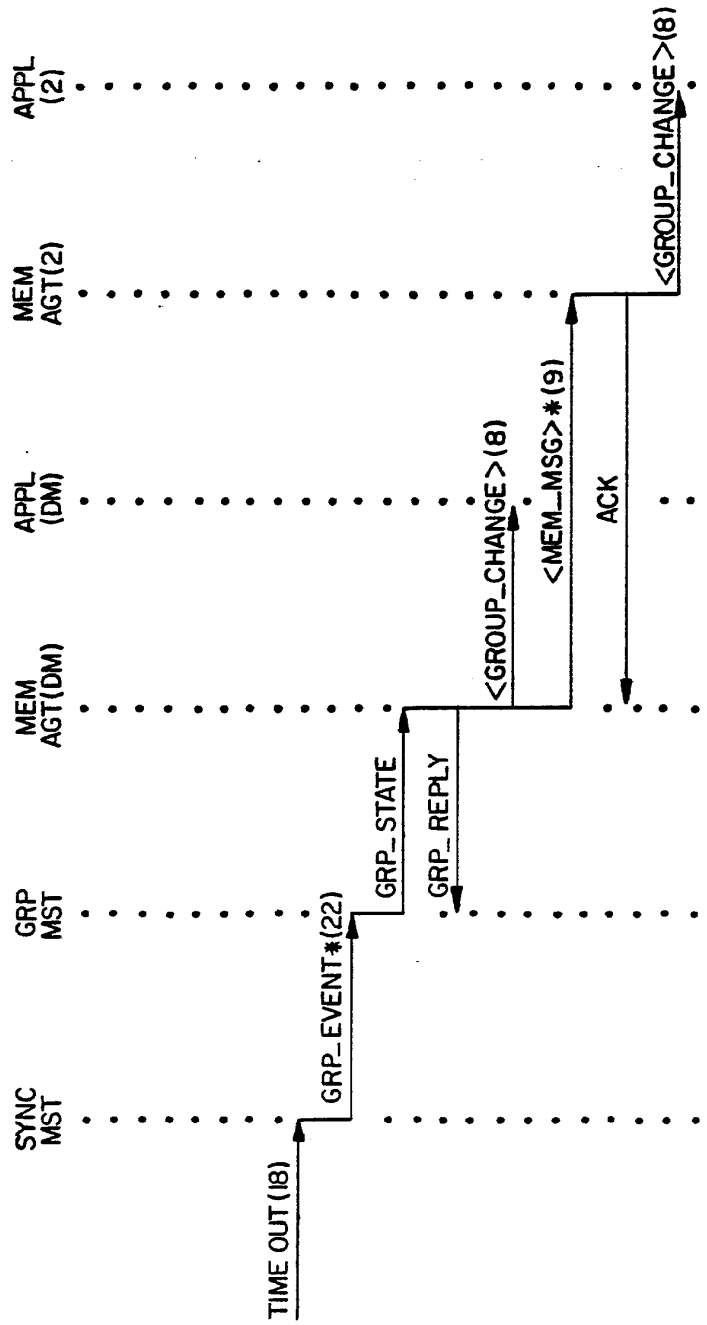

SYNC MST
GRP MST
MEM AGT(DM)
APPL (DM)
MEM AGT(2)
APPL (2)
TIME OUT (18)
GRP_EVENT*(22)
GRP_STATE
GRP_REPLY
<GROUP_CHANGE>(8)
<MEM_MSG>*(9)
ACK
<GROUP_CHANGE>(8)

FIG. 10

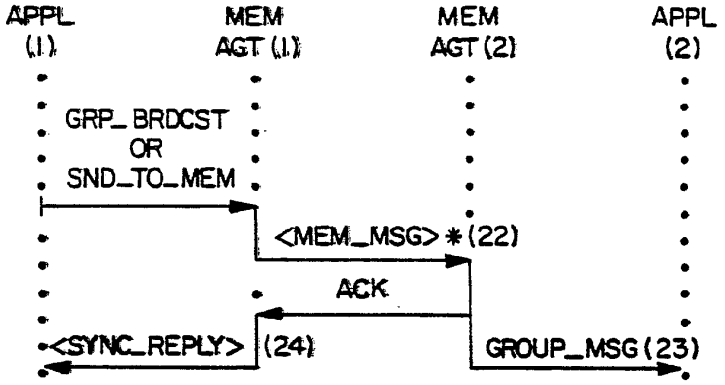

APPL (1)
MEM AGT (1)
MEM AGT (2)
APPL (2)
GRP_BRDCST OR SND_TO_MEM
<MEM_MSG> * (22)
ACK
<SYNC_REPLY> (24)
GROUP_MSG (23)

FIG. 12

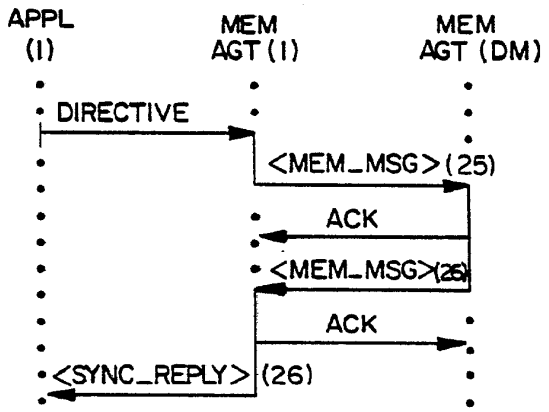

APPL (1)
MEM AGT (1)
MEM AGT (DM)
DIRECTIVE
<MEM_MSG> (25)
ACK
<MEM_MSG> (26)
ACK
<SYNC_REPLY> (26)

FIG. 13

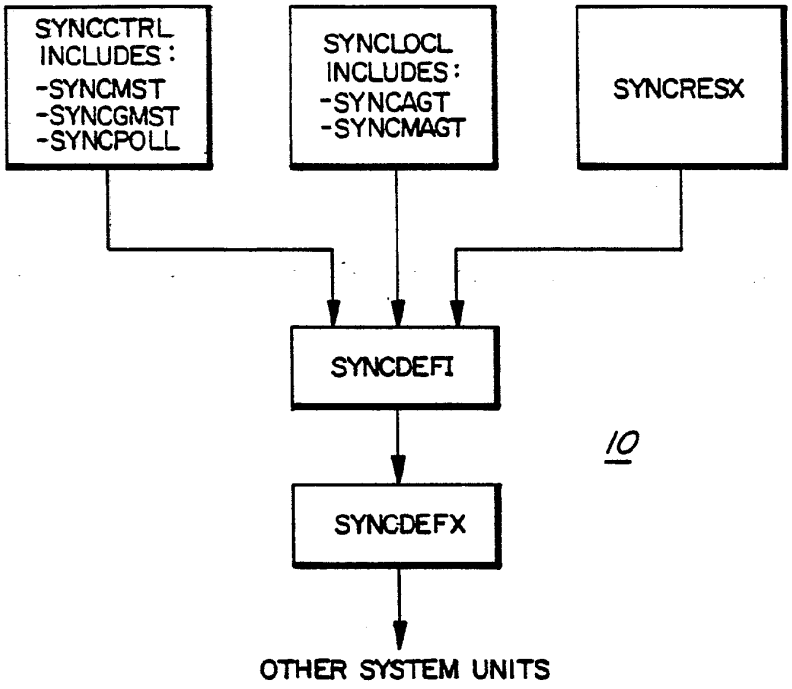

SYNCCTRL
INCLUDES:
-SYNCMST
-SYNCGMST
-SYNCPOLL
SYNCLOCL
INCLUDES:
-SYNCAGT
-SYNCMAGT
SYNCRESX
SYNCDEFI
10
SYNCDEFX
OTHER SYSTEM UNITS

FIG. 14

(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 672 985 B1

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
27.05.1998 Bulletin 1998/22

(51) Int Cl.[6]: **G06F 11/14**, G06F 11/20

(21) Application number: **95300753.1**

(22) Date of filing: **07.02.1995**

(54) **Asynchronous remote data duplexing**

Asynchrone Datenfernduplizierung

Téléduplication asynchrone de données

(84) Designated Contracting States:
DE FR GB

(30) Priority: **22.02.1994 US 199444**

(43) Date of publication of application:
20.09.1995 Bulletin 1995/38

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(56) References cited:
WO-A-91/20034

- **PROCEEDINGS OF THE ACM SIGMOD INTERNATIONAL CONFERENCE ON MANAGEMENT OF DATA, SAN DIEGO, JUNE 2 - 5, 1992 STONEBRAKER M, XP000393592 ANUPAM BHIDE ET AL 'An Efficient Scheme for Providing High Availability'**

Note: Within nine months from the publication of the mention of the grant of the European patent, any person may give notice to the European Patent Office of opposition to the European patent granted. Notice of opposition shall be filed in a written reasoned statement. It shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).

Printed by Jouve, 75001 PARIS (FR)

EP 0 672 985 B1

Description

The present invention relates generally to disaster recovery techniques in data processing systems, and more particularly, to a system for real-time remote copying of data.

Data processing systems, in conjunction with processing data, typically are required to store large amounts of data (or records), which data can be efficiently accessed, modified, and re-stored. Data storage is typically separated into several different levels, or hierarchically, in order to provide efficient and cost effective data storage. A first, or highest level of data storage involves electronic memory, usually dynamic or static random access memory (DRAM or SRAM). Electronic memories take the form of semiconductor integrated circuits wherein millions of bytes of data can be stored on each circuit, with access to such bytes of data measured in nano-seconds. The electronic memory provides the fastest access to data since access is entirely electronic.

A second level of data storage usually involves direct access storage devices (DASD). DASD storage, for example, can comprise magnetic and/or optical disks, which store bits of data as micrometer sized magnetic or optical altered spots on a disk surface for representing the "ones" and "zeros" that make up those bits of the data. Magnetic DASD, includes one or more disks that are coated with remnant magnetic material. The disks are rotatably mounted within a protected environment. Each disk is divided into many concentric tracks, or closely spaced circles. The data is stored serially, bit by bit, along each track. An access mechanism, known as a head disk assembly (HDA), typically includes one or more read/write heads, and is provided in each DASD for moving across the tracks to transfer the data to and from the surface of the disks as the disks are rotated past the read/write heads. DASDs can store giga-bytes of data with the access to such data typically measured in milli-seconds (orders of magnitudes slower than electronic memory). Access to data stored on DASD is slower due to the need to physically position the disk and HDA to the desired data storage location.

A third or lower level of data storage includes tape and/or tape and DASD libraries. At this storage level, access to data is much slower in a library since a robot is necessary to select and load the needed data storage medium. The advantage is reduced cost for very large data storage capabilities, for example, tera-bytes of data storage. Tape storage is often used for back-up purposes, that is, data stored at the second level of the hierarchy is reproduced for safe keeping on magnetic tape. Access to data stored on tape and/or in a library is presently of the order of seconds.

Having a back-up data copy is mandatory for many businesses as data loss could be catastrophic to the business. The time required to recover data lost at the primary storage level is also an important recovery consideration. An improvement in speed over tape or library back-up, includes dual copy. An example of dual copy involves providing additional DASD's so that data is written to the additional DASDs (sometimes referred to as mirroring). Then if the primary DASDs fail, the secondary DASDs can be depended upon for data. A drawback to this approach is that the number of required DASDs is doubled.

Another data back-up alternative that overcomes the need to provide double the storage devices involves writing data to a redundant array of inexpensive devices (RAID) configuration. In this instance, the data is written such that the data is apportioned amongst many DASDs. If a single DASD fails, then the lost data can be recovered by using the remaining data and error correction procedures. Currently there are several different RAID configurations available.

The aforementioned back-up solutions are generally sufficient to recover data in the event that a storage device or medium fails. These back-up methods are useful only for device failures since the secondary data is a mirror of the primary data, that is, the secondary data has the same volume serial numbers (VOLSERs) and DASD addresses as the primary data. System failure recovery, on the other hand, is not available using mirrored secondary data. Hence still further protection is required for recovering data if a disaster occurs destroying the entire system or even the site, for example, earthquakes, fires, explosions, hurricanes, etc. Disaster recovery requires that the secondary copy of data be stored at a location remote from the primary data. A known method of providing disaster protection is to back-up data to tape, on a daily or weekly basis, etc. The tape is then picked up by a vehicle and taken to a secure storage area usually some kilometers away from the primary data location. A problem is presented in this back-up plan in that it could take days to retrieve the back-up data, and meanwhile several hours or even days of data could be lost, or worst, the storage location could be destroyed by the same disaster. A somewhat improved back-up method would be to transmit data to a back-up location each night. This allows the data to be stored at a more remote location. Again, some data may be lost between back-ups since back-up does not occur continuously, as in the dual copy solution. Hence, a substantial data amount could be lost which may be unacceptable to some users.

More recently introduced data disaster recovery solutions include remote dual copy wherein data is backed-up not only remotely, but also continuously. In order to communicate duplexed data from one host processor to another host processor, or from one storage controller to another storage controller, or some combination thereof, a substantial amount of control data is required for realizing the process. A high overhead, however, can interfere with a secondary site's ability to keep up with a primary site's processing, thus threatening the ability of the secondary site to be able to recover the primary in the event a disaster occurs.

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Accordingly it is desired to provide a method and apparatus for providing a real time update of data consistent with the data at a primary processing location using minimal control data, wherein the method and apparatus operates independently of a particular application data being recovered, that is, generic storage media based rather than specific application data based.

An aim of the present invention is to provide an improved system and method for shadowing DASD data to a secondary site for disaster recovery.

According to a first aspect of the present invention, a method for forming consistency groups provides for disaster recovery capability from a remote site. Data updates generated by one or more applications running in a primary processor are received by a primary storage subsystem, wherein the primary storage subsystem causes I/O write operations to write each data update therein. The primary storage subsystem is synchronized by a common timer, and a secondary system, remote from the primary processor, shadows the data updates in sequence consistent order such that the secondary site is available for disaster recovery purposes. Thee method comprising steps of: (a) time stamping each write I/O operation occurring in the primary storage subsystem; (b) capturing write I/O operation record set information from the primary storage subsystem for each data update; (c) generating self describing record sets from the data updates and the respective record set information, such that the self describing record sets are sufficient to re-create a sequence of the write I/O operations; (d) grouping the self describing record sets into interval groups based upon a predetermined interval threshold; and (e) selecting a first consistency group as that interval group of self describing record sets having an earliest operational time stamp, the individual data updates being ordered within the first consistency group based upon time sequences of the I/O write operations in the primary storage subsystem.

In another aspect of the present invention, a primary system has a primary processor running one or more applications, wherein the applications generating record updates, and the primary processor generating self describing record sets therefrom. Each self describing record set is sent to a secondary system remote from the primary system, wherein the secondary system shadows the record updates in sequence consistent order based upon the self describing record sets for real time disaster recovery purposes. The primary processor is coupled to a primary storage subsystem wherein the primary storage subsystem receives the record updates and causes I/O write operations for storing each record update therein. The primary processor comprises a sysplex timer for providing a common time source to the applications and to the primary storage subsystem for synchronization purposes, and a primary data mover, synchronized by the sysplex timer, prompts the primary storage subsystem for providing record set information to the primary data mover for each record update. The primary data mover groups a plurality of record updates and each corresponding record set information into time interval groups, and inserts a prefix header thereto. Each time interval group forms the self describing record sets.

A preferred embodiment of the invention will now be described, by way of example only, with reference to the accompanying drawings in which:

FIG. 1 is a block diagram of a disaster recovery system having synchronous remote data shadowing capabilities.

FIG. 2 is a flow diagram of a method for providing synchronous remote copy according to the disaster recovery system of FIG. 1.

FIG. 3 is a flow diagram of a method of an I/O error recovery program (I/O ERP) operation.

FIG. 4 is a block diagram of a disaster recovery system having asynchronous remote data shadowing capabilities.

FIG. 5 is a data format diagram showing a prefix header that prefixes read record sets from the primary site of FIG. 4.

FIG. 6 is a data format diagram describing fields making up a read record set.

FIG. 7 is a state table identifying volume configuration information.

FIG. 8 is a master journal as used by the secondary site of FIG. 4.

FIG. 9 is an example sequence for forming a consistency group.

FIG. 10 is a flow diagram showing a method of collecting information and read record sets for forming consistency groups.

FIG. 11 is a flow diagram showing a method of forming consistency groups.

FIG. 12 is a table indicating full consistency group recovery rules application for an ECKD architecture device for a given sequence of I/O operations to a DASD track.

FIG. 13 is a description of the rules to be used in the table of FIG. 12.

FIG. 14 is a flow diagram of a method of writing read record set copies to a secondary site with full consistency group recovery capability.

A typical data processing system may take the form of a host processor, such as an IBM System/360 or IBM System/370 processor for computing and manipulating data, and running, for example, data facility storage management subsystem/multiple virtual systems (DFSMS/MVS) software, having at least one IBM 3990 storage controller attached thereto, the storage controller comprising a memory controller and one or more cache memory types incorporated therein. The storage controller is further connected to a group of direct access storage devices (DASDs) such as IBM 3380 or 3390 DASDs. While the host processor provides substantial computing power, the storage controller provides the necessary functions to efficiently transfer, stage/

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destage, convert and generally access large databases.

Disaster recovery protection for the typical data processing system requires that primary data stored on primary DASDs be backed-up at a secondary or remote location. The distance separating the primary and secondary locations depends upon the level of risk acceptable to the user, and can vary from several kilometers to thousands of kilometers. The secondary or remote location, in addition to providing a back-up data copy, must also have enough system information to take over processing for the primary system should the primary system become disabled. This is due in part because a single storage controller does not write data to both primary and secondary DASD strings at the primary and secondary sites. Instead, the primary data is stored on a primary DASD string attached to a primary storage controller while the secondary data is stored on a secondary DASD string attached to a secondary storage controller.

The secondary site must not only be sufficiently remote from the primary site, but must also be able to back-up primary data in real time. The secondary site needs to back-up primary data as the primary data is updated with some minimal delay. Additionally, the secondary site has to back-up the primary data regardless of the application program (e.g., IMS, DB2) running at the primary site and generating the data and/or updates. A difficult task required of the secondary site is that the secondary data must be order consistent, that is, secondary data is copied in the same sequential order as the primary data (sequential consistency) which requires substantial systems considerations. Sequential consistency is complicated by the existence of multiple storage controllers each controlling multiple DASDs in a data processing system. Without sequential consistency, secondary data inconsistent with primary data would result, thus corrupting disaster recovery.

Remote data duplexing falls into two general categories, synchronous and asynchronous. Synchronous remote copy involves sending primary data to the secondary location and confirming the reception of such data before ending a primary DASD input/output (I/O) operation (providing a channel end (CE) and device end (DE) to the primary host). Synchronous copy, therefore, slows the primary DASD I/O response time while waiting for secondary confirmation. Primary I/O response delay is increased proportionately with the distance between the primary and secondary systems - a factor that limits the remote distance to tens of kilometers. Synchronous copy, however, provides sequentially consistent data at the secondary site with relatively little system overhead.

Asynchronous remote copy provides better primary application system performance because the primary DASD I/O operation is completed (providing a channel end (CE) and device end (DE) to the primary host) before data is confirmed at the secondary site. Therefore, the primary DASD I/O response time is not dependent upon the distance to the secondary site and the secondary site could be thousands of kilometers remote from the primary site. A greater amount of system overhead is required, however, for ensuring data sequence consistency since data received at the secondary site will often not be in order of the primary updates. A failure at the primary site could result in some data being lost that was in transit between the primary and secondary locations.

Synchronous real time remote copy for disaster recovery requires that copied DASD volumes form a set. Forming such a set further requires that a sufficient amount of system information be provided to the secondary site for identifying those volumes (VOLSERs) comprising each set and the primary site equivalents. Importantly, the secondary site forms a "duplex pair" with the primary site and the secondary site must recognize when one or more volumes are out of sync with the set, that is, "failed duplex" has occurred. Connect failures are more visible in synchronous remote copy than in asynchronous remote copy because the primary DASD I/O is delayed while alternate paths are retried. The primary site can abort or suspend copy to allow the primary site to continue while updates for the secondary site are queued, the primary site marking such updates to show the secondary site is out of sync. Recognizing exception conditions that may cause the secondary site to fall out of sync with the primary site is needed in order that the secondary site be available at any time for disaster recovery. Error conditions and recovery actions must not make the secondary site inconsistent with the primary site.

Maintaining a connection between the secondary site and the primary site with secondary DASD present and accessible, however, does not ensure content synchronism. The secondary site may lose synchronism with the primary site for a number of reasons. The secondary site is initially out of sync when the duplex pair is being formed and reaches sync when an initial data copy is completed. The primary site may break the duplex pair if the primary site is unable to write updated data to the secondary site in which case the primary site writes updates to the primary DASD under suspended duplex pair conditions so that the updating application can continue. The primary site is thus running exposed, that is, without current disaster protection copy until the duplex pair is restored. Upon restoring the duplex pair, the secondary site is not immediately in sync. After applying now pending updates, the secondary site returns to sync. The primary site can also cause the secondary site to lose sync by issuing a suspend command for that volume to the primary DASD. The secondary site re-syncs with the primary site after the suspend command is ended, duplex pair is re-established, and pending updates are copied. On-line maintenance can also cause synchronization to be lost.

When a secondary volume is out of sync with a primary volume, the secondary volume is not useable for secondary system recovery and resumption of primary

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applications. An out-of-sync volume at the secondary site must be identified as such and secondary site recovery-takeover procedures need to identify the out-of-sync volumes for denying application access (forcing the volumes off-line or changing their VOLSERs). The secondary site may be called upon to recover the primary site at any instant wherein the primary site host is inaccessible - thus the secondary site requires all pertinent information about a sync state of all volumes. The secondary storage subsystem, that is the secondary storage controllers and DASD, is unable to determine all conditions causing the primary site to break synchronism due to primary site-encountered exceptions. For example, the primary site may break a duplex pair if the primary site is unable to access the secondary peer due to a primary I/O path or link failure that the secondary site is unaware of. In this case the secondary site shows in-sync state while the primary site indicates the duplex pair is broken.

External communication may notify the secondary site that an out-of-sync duplex pair volume exists. This is realizable by employing a user systems management function. Primary I/O operations end with channel end/device end/unit check (CE/DE/UC) status and sense data indicates the nature of the error. With this form of I/O configuration an error recovery program (ERP) processes the error and send an appropriate message to the secondary processor before posting the primary application that I/O is complete. The user is then responsible to recognize the ERP suspend duplex pair message and secure that information at the secondary location. When the secondary site is depended upon to become operational in place of the primary site, a start-up procedure brings the secondary DASD on-line to the secondary host wherein sync status stored in the secondary DASD subsystem is retrieved for ensuring that out-of-sync volumes are not brought on-line for application allocation. This sync status merged with all ERP suspend duplex pair messages gives a complete picture of the secondary out-of-sync volumes.

Referring now to FIG. 1, a disaster recovery system 10 is shown having a primary site 14 and a secondary site 15, wherein the secondary site 15 is located, for example, 20 kilo-meters remote from the primary site 14. The primary site 14 includes a host processor or primary processor 1 having an application and system I/O and Error Recovery Program 2 running therein (hereinafter referred to as I/O ERP 2). The primary processor 1 could be, for example, an IBM Enterprise Systems/9000 (ES/9000) processor running DFSMS/MVS operating software and further may have several application programs running thereon. A primary storage controller 3, for example, an IBM 3990 Model 6 storage controller, is connected to the primary processor 1 via a channel 12. As is known in the art, several such primary storage controllers 3 can be connected to the primary processor 1, or alternately, several primary processors 1 can be attached to the primary storage controllers 3. A primary DASD 4, for example, an IBM 3390 DASD, is connected to the primary storage controller 3. Several primary DASDs 4 can be connected to the primary storage controller 3. The primary storage controller 3 and attached primary DASD 4 form a primary substorage system. Further, the primary storage controller 3 and the primary DASD 4 could be single integral units.

The secondary site 15 includes a secondary processor 5, for example, an IBM ES/9000, connected to a secondary storage controller 6, for example an IBM 3990 Model 3, via a channel 13. A DASD 7 is further connected to the secondary storage controller 6. The primary processor 1 is connected to the secondary processor 5 by at least one host-to-host communication link 11, for example, channel links or telephone T1/T3 line links, etc. The primary processor 1 may also have direct connectivity with the secondary storage controller 6 by, for example, multiple Enterprise Systems Connection (ESCON) links 9. As a result, the I/O ERP 2 can communicate, if required, with the secondary storage controller 6. The primary storage controller 3 communicates with the secondary storage controller 6 via multiple peer-to-peer links 8, for example, multiple ESCON links.

When a write I/O operation is executed by an application program running in the primary processor 1, a hardware status channel end/device end (CE/DE) is provided indicating the I/O operation completed successfully. Primary processor 1 operating system software marks the application write I/O successful upon successful completion of the I/O operation, thus permitting the application program to continue to a next write I/O operation which may be dependent upon the first or previous write I/O operation having successfully completed. On the other hand, if the write I/O operation was unsuccessful, the I/O status of channel end/device end/unit check (hereinafter referred to as CE/DE/UC) is presented to the primary processor 1 operating system software. Having presented unit check, the I/O ERP 2 takes control obtaining specific sense information from the primary storage controller 3 regarding the nature of the failed write I/O operation. If a unique error to a volume occurs then a unique status related to that error is provided to the I/O ERP 2. The I/O ERP 2 can thereafter perform new peer-to-peer synchronization error recovery for maintaining data integrity between the primary storage controller 3 and the secondary storage controller 6, or in the worst case, between the primary processor 1 and the secondary processor 5.

Referring to FIGs 2 and 3, the error recovery procedure is set forth. In FIG. 2, a step 201 includes an application program running in the primary processor 1 sending a data update to the primary storage controller 3. At step 203 the data update is written to the primary DASD 4, and the data update is shadowed to the secondary storage controller 6. At step 205 the duplex pair status is checked to determine whether the primary and secondary sites are synchronized. If the duplex pair status is in a synchronized state, then the data update is

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written to the secondary DASD 7 at step 207 while processing then continues at the primary processor 1 via application programs running thereat.

In the case that the duplex pair is in a "failed" state, then at step 209 the primary storage controller 3 notifies the primary processor 1 that duplex pair has suspended or failed. The duplex pair can become "failed" due to communication failure between the primary storage controller 3 and the secondary storage controller 6 via communication links 8. Alternatively, duplex pair can become "failed" due to errors in either the primary or secondary subsystem. If the failure is in the communication links 8, then the primary storage controller 3 is unable to communicate the failure directly to the secondary storage controller 6. At step 211 the primary storage controller 3 returns I/O status CE/DE/UC to the primary processor 1. The I/O ERP 2 quiesces the application programs hence taking control of the primary processor 1 at step 213 for error recovery and data integrity before returning control to the application requesting the write I/O operation.

FIG. 3 represents steps performed by the I/O ERP 2. The I/O ERP 2 issues a sense I/O to the primary storage controller 3 at step 221. The sense I/O operation returns information describing the cause of the I/O error, that is, the data description information is unique to the storage controllers or duplex pair operation regarding specific errors. In the event that the data description information indicates that the peer-to-peer communication links 8 have failed between the primary storage controller 1 and the secondary storage controller 6, then at step 223 the I/O ERP 2 issues a storage controller level I/O operation against the primary storage controller 3 and the secondary storage controller 6 indicating that the affected volume is to be placed in failed synchronous remote copy state. This secondary storage controller 6 is able to receive the state of the affected volume from the I/O ERP 2 via the - multiple ESCON links 9 or the host-to-host communication link 11. Consequently, the current status of the duplex pair operation is maintained at both the primary processor 1 and the secondary processor 5 in conjunction with applications running in the primary processor 1. Consoles 18 and 19 are provided for communicating information from the primary processor 1 and secondary processor 4, respectively, wherein the I/O ERP posts status information to both consoles 18 and 19.

Data integrity has been maintained at step 225 upon successful completion of the failed synchronous remote copy I/O operation to the primary storage controller 3 and the secondary storage controller 6. Therefore, if a recovery is attempted at the secondary site 15 the secondary storage controller 6 identifies the volume marked "failed synchronous remote copy" as not being useable until data on that volume are synchronized with other data in that synchronization group by data recovery means (conventional data base logs and/or journals for determining the state of that data on the volume).

Step 227 tests to determine whether the I/O ERP 2 received successful completion of the I/O operations at the primary storage controller 3 and the secondary storage controller 6 on the failed synchronous remote copy status update. Upon successful completion, the I/O ERP 2 returns control to the Primary processor 1 at step 229. Otherwise step 231 performs a next level recovery notification which involves notifying an operator, via the console 18, of the failed volume and that a status of that volume at either the primary storage controller 3 or the secondary storage controller 6 may not be correct. The notification is shadowed to the secondary site 15, via the console 19 or a shared DASD data set, for indicating the specific volume status there.

An error log recording data set is updated at step 233. This update is written to either the primary DASD 4 or some other storage location and is shadowed to the secondary site 15. Having completed the error recovery actions, the I/O ERP 2, at step 235, posts to the primary application write I/O operation a "permanent error" for causing the primary application an error normal "permanent error" recovery for the failed write I/O operation. Once the error is corrected, the volume states can be recovered, first to pending (recopy changed data) and then back to full duplex. The data may later be re-applied to the secondary DASD 7 once duplex pair is re-established.

When establishing a duplex pair a volume can be identified as CRITICAL according to a customer's needs. For a CRITICAL volume, when an operation results in failing a duplex pair, a permanent error failure of the primary volume is reported irrespective of the actual error's location. With CRIT=Y, all subsequent attempts to write to the primary DASD 405 of the failed pair will receive a permanent error, ensuring that no data is written to that primary volume that cannot also be shadowed to the paired secondary volume. This permits complete synchronization with the primary application actions and the I/O data operations when required.

Consequently, the disaster recovery system 10 described herein, introduces outboard synchronous remote copy such that a primary host process error recovery procedure having an I/O order (channel command word (CCW)) may change a status of a primary and secondary synchronous remote copy volume from duplex pair to failed duplex thereby maintaining data integrity for several types of primary and secondary subsystem errors. Storage based back-up, rather than application based back-up, wherein data updates are duplicated in real time has been provided. The disaster recovery system 10 also attempts several levels of primary/secondary status updates, including: (1) primary and secondary storage controller volume status updates; (2) primary and secondary host processor notification on specific volume update status via operator messages or error log recording common data sets; and (3) CRITICAL volume indication, future updates to the primary volume can be prevented if the volume pair goes failed duplex.

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Hence, real time, full error disaster recovery is accomplished.

Asynchronous remote data shadowing is used when it is necessary to further increase a distance between primary and secondary sites for reducing the probability that a single disaster will corrupt both primary and secondary sites, or when primary application performance impact needs to be minimized. While the distance between primary and secondary sites can now stretch across the earth or beyond, the synchronization of write updates across multiple DASD volumes behind multiple primary subsystems to multiple secondary subsystems is substantially more complicated. Record write updates can be shipped from a primary storage controller via a primary data mover to a secondary data mover for shadowing on a secondary storage subsystem, but the amount of control data passed therebetween must be minimized while still being able to re-construct an exact order of the record write updates on the secondary system across several storage controllers as occurred on the primary system across multiple DASD volumes behind several storage controllers.

FIG. 4 depicts an asynchronous disaster recovery system 400 including a primary site 421 and a remote or secondary site 431. The primary site 421 includes a primary processor 401, for example, an IBM ES/9000 running DFSMS/MVS host software. The primary processor 401 further includes application programs 402 and 403, for example, IMS and DB2 applications, and a primary data mover (PDM) 404. A common sysplex clock 407 is included in the primary processor 401 for providing a common reference to all applications (402, 403) running therein, wherein all system clocks or time sources (not shown) synchronize to the sysplex clock 407 ensuring all time dependent processes are properly timed relative to one another. The primary storage controllers 406, for example, synchronize to a resolution appropriate to ensure differentiation between record write update times, such that no two consecutive write I/O operations to a single primary storage controller 404 can exhibit the same time stamp value. The resolution, and not the accuracy, of the sysplex timer 407 is critical. The PDM 404, though shown connected to the sysplex timer 407, is not required to synchronize to the sysplex timer 407 since write I/O operations are not generated therein. A sysplex timer 407 is not required if the primary processor 401 has a single time reference (for example, a single multi-processor ES/9000 system).

A plurality of primary storage controllers 405, for example, IBM 3990 Model 6 storage controllers, are connected to the primary processor 401 via a plurality of channels, for example, fiber optic channels. Connected to each primary storage controller 405 is at least one string of primary DASDs 406, for example, IBM 3390 DASDs. The primary storage controllers 405 and the primary DASDs 406 form a primary storage subsystem. Each storage controller 405 and primary DASD 406 need not be separate units, but may be combined into a single drawer.

The secondary site 431, located for example, some thousands of kilometers remote from the primary site 421, similar to the primary site 421, includes a secondary processor 411 having a secondary data mover (SDM) 414 operating therein. Alternatively, the primary and secondary sites can be the same location, and further, the primary and secondary data movers can reside on a single host processor (secondary DASDs may be just over a fire-wall). A plurality of secondary storage controllers 415 are connected to the secondary processor 411 via channels, for example, fiber optic channels, as is known in the art. Connected to the storage controllers 415 are a plurality of secondary DASDs 416 and a control information DASD(s) 417. The storage controllers 415 and DASDs 416 and 417 comprise a secondary storage subsystem.

The primary site 421 communicates with the secondary site 431 via a communication link 408. More specifically, the primary processor 401 transfers data and control information to the secondary processor 411 by a communications protocol, for example, a virtual telecommunications access method (VTAM) communication link 408. The communication link 408 can be realized by several suitable communication methods, including telephone (T1, T3 lines), radio, radio/telephone, microwave, satellite, etc.

The asynchronous data shadowing system 400 encompasses collecting control data from the primary storage controllers 405 so that an order of all data writes to the primary DASDs 406 is preserved and applied to the secondary DASDs 416 (preserving the data write order across all primary storage subsystems). The data and control information transmitted to the secondary site 431, must be sufficient such that the presence of the primary site 421 is no longer required to preserve data integrity.

The applications 402, 403 generate data or record updates, which record updates are collected by the primary storage controllers 405 and read by the PDM 404. The primary storage controllers 405 each grouped its respective record updates for an asynchronous remote data shadowing session and provides those record updates to the PDM 404 via non-specific primary DASD 406 READ requests. Transferring record updates from the primary storage controllers 405 to the PDM 404 is controlled and optimized by the PDM 404 for minimizing a number of START I/O operations and time delay between each read, yet maximizing an amount of data transferred between each primary storage controller 405 and the primary processor 401. The PDM 404 can vary a time interval between non-specific READs to control this primary storage controller-host optimization as well as a currency of the record updates for the secondary DASDs 416.

Collecting record updates by the PDM 404, and transmitting those record updates to the SDM 414, while maintaining data integrity, requires the record updates

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to be transmitted for specific time intervals and in appropriate multiple time intervals with enough control data to reconstruct the primary DASDs 406 record WRITE sequence across all primary storage subsystems to the secondary DASDs 416. Re-constructing the primary DASDs 406 record WRITE sequences is accomplished by passing self describing records from the PDM 404 to the SDM 414. The SDM 414 inspects the self describing records for determining whether any records for a given time interval have been lost or are incomplete.

FIGs 5 and 6 show a journal record format created by the PDM 404 for each self describing record, including a prefix header 500 (FIG. 5), and a record set information 600 (FIG. 6) as generated by the primary storage controller 405. Each self describing record is further journaled by the SDM 414 for each time interval so that each self describing record can be applied in time sequence for each time interval to the secondary DASDs 416.

Referring now to FIG. 5, the prefix header 500, which is inserted at the front of each record set, includes a total data length 501 for describing the total length of the prefix header 500 and actual primary record set information 600 that is transmitted to the SDM 414 for each record set. An operational time stamp 502 is a time stamp indicating a start time for the operational set that the PDM 404 is currently processing. The operational time stamp 502 is generated by the PDM 404 (according to the sysplex timer 407) when performing a READ RECORD SET function to a set of the primary storage controllers 405. An I/O time 610 (FIG. 6) of the primary DASDs 406 write is unique for each primary storage controller 405 READ RECORD SET. The operational time stamp 502 is common across all storage controllers.

A READ RECORD SET command is issued by the PDM 404 and can be predicated upon one of the following conditions:

(1) Primary storage controller 405 attention interrupt based upon that primary storage controller predetermined threshold;

(2) Primary processor 401 timer interrupt based upon a predetermined time interval; or

(3) Record set information indicates additional information on outstanding record sets available but not yet read.

Condition (2) uses a timer interval to control how far behind the secondary system 431 executes during periods of low activity. Condition (3) occurs when the PDM 404 fails to drain all record sets during a processing interval which drives further activity for ensuring that the PDM 404 keeps up with primary storage controller 405 activity.

A time interval group number 503 is supplied by the PDM 404 to identify a time interval (bounded by operational time stamp 502 and a records read time 507) for which the current record sets belong (sets of records across all primary storage controllers 405 for a given time interval group form consistency groups). A sequence number within group 504 is derived based upon a hardware provided identification (to the PDM 404) of a write sequence order of application WRITE I/Os for primary storage controller 405 for each record set within a given time interval group 503. A primary SSID (substorage identification) 505 uniquely identifies the specific primary storage controller of the primary storage controllers 405 for each record set. A secondary target volume 506 is assigned by either the PDM 404 or the SDM 414 depending upon performance considerations. A records read time 507 supplies an operational time stamp that is common to all primary storage controllers 405 indicating an end time for the PDM 404 read record set process current interval.

The operational time stamp 502 and the records read time 507 are used by the PDM 404 to group sets of read record sets from each of the primary storage controllers 405. Time synchronization for grouping sets of read record sets is key only to the PDM 404 and as such, the PDM 404 could be synchronized to a central processing unit (CPU) clock running only the PDM 404 not attached to the syspelx timer 407. The PDM 404 does not write record updates, but the record updates, as stated previously, must be synchronized to a common time source.

Referring now to FIG. 6, the record set information 600 is generated by the primary storage controllers 405 and collected by the PDM 404. Update Specific Information 601-610, includes a primary device unit address 601 of each record indicating the actual primary DASD 406 that the record update occurred on. A cylinder number/head number (CCHH) 602 indicates a location on primary DASD 406 for each record update. Primary SSID 603, the primary storage controller session identifier is the same as primary SSID 505. Status flags 604 provide status information regarding whether specific data records 620 follow. Sequence numbers 605 and 630 assign a number to each record for indicating whether the entire record set has been read (all data transferred to the PDM 404). Primary DASD write I/O type 606 is an operation indicator identifying the type of write operation performed on each record, the operation indicators including: update write; format write; partial track records follow; full track data follows; erase command performed; or write any performed. Search argument 607 indicates initial positioning information for the first read record set data record 620. A sector number 608 identifies that sector that the record was updated at. Count field 609 describes a number of specific record data fields 620 that follow. A host application time when the primary DASD 406 write update occurred is recorded in time of updates 610. Specific record data 620 provides a count/key/data (CKD) field of each record up-

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date. Lastly, the sequence number 630 is compared to the sequence number 605 for indicating whether the entire read record set was transferred to the PDM 404.

The update records are handled in software groups called consistency groups so that the SDM 414 can copy the record updates in the same order they were written at the primary DASDs 406. The information used for creating the consistency groups (across all record sets collected from all storage controllers 405) includes the: operational time stamp 502; time interval group number 503; sequence number within group 504; primary controller SSID 505; records read time 507; primary device address 601; the primary SSID 603; and the status flags 604. The information used for determining whether all records for a time interval group have been received for each storage controller 405 at the SDM 414 includes the: time interval group number 503; sequence number within group 504; physical controller ID 505; the primary SSID 603; and a total number of read record sets returned from each primary storage controller 405 for each operational time interval. The information necessary to place record updates on the secondary DASDs 416 equivalently to the primary DASDs 406 record updates with full recover possible includes the: secondary target volume 506; CCHH 602; primary DASD write I/O type 606; search argument 607; sector number 608; count 609; time of updates 610; and the specific record data 620.

FIGs 7 and 8 show a state table 700 and a master journal 800, respectively, for describing a current journal contents, which simplifies recovery time and journal transfer time. The state table 700 provides configuration information, collected by and common to the PDM 404 and SDM 414, and includes primary storage controller session identifiers (SSID numbers) and the volumes therein, and the corresponding secondary storage controller session identifiers and the corresponding volumes. Thus the configuration information tracks which primary volumes 710 or primary DASD extents map to secondary volumes 711 or secondary DASD extents. With a simple extension to the state table 700 indicating partial volume extents 712 (CCHH to CCHH), partial volume remote copy can be accomplished using the same asynchronous remote copy methods described herein, but for a finer granularity (track or extent) than full volume.

The master journal 800 includes: consistency group number; location on journal volumes; and operational time stamp. The master journal 800 further maintains specific record updates as grouped in consistency groups. The state table 700 and master journal 800 support disaster recovery, and hence must be able to operate in a stand-alone environment wherein the primary system 401 no longer exists.

A time stamp control is placed at the front and back of each master journal 800 to ensure that the entire control entry was successfully written. The time stamp control is further written to the secondary DASDs 417. The control elements include dual entries (1) and (2), wherein one entry is always a current entry, for example:

(1) Timestamp control I Control Info I Timestamp Control

(2) Timestamp Control I Control Info I Timestamp Control.

At any point in time either entry (1) or (2) is the current or valid entry, wherein a valid entry is that entry with equal timestamp controls at the front and back. Disaster recovery uses the valid entry with the latest timestamp to obtain control information. This control information, along with state information (environmental information regarding storage controllers, devices, and applied consistency groups), is used for determining what record updates have been applied to the secondary storage controllers 415.

After all read record sets across all primary storage controllers 405 for a predetermined time interval are received at the secondary site 431, the SDM 414 interprets the received control information and applies the received read record sets to the secondary DASDs 416 in groups of record updates such that the record updates are applied in the same sequence that those record updates were originally written on the primary DASDs 406. Thus, all primary application order (data integrity) consistency is maintained at the secondary site 431. This process is hereinafter referred to as forming consistency groups. Forming consistency groups is based on the following assumptions: (A) application writes that are independent can be performed in any order if they do not violate controller sequence order; (B) application writes that are dependent must be performed in timestamp order, hence an application cannot perform a dependent write number two before receiving control unit end, device end from write number one; and (C) a second write will always be either (1) in a same record set consistency group as a first write with a later timestamp or (2) in a subsequent record set consistency group.

Referring to FIG. 9, an example of forming a consistency group (the consistency group could be formed at either the primary site 421 or secondary site 431), for example, for storage controllers SSID 1, SSID 2, and SSID 3 is shown (any number of storage controllers can be included but three are used in this example for clarity). Time intervals T1, T2 and T3 are assumed to occur in ascending order. An operational time stamp 502 of time interval T1 is established for storage controllers SSID 1, SSID 2 and SSID 3. The PDM 404 obtains record set data from storage controller SSIDs 1, 2, and 3 for time interval T1-T3. The record sets for SSIDs 1, 2, and 3 for time interval T1 are assigned to time interval group 1, G1 (time interval group number 503). The sequence number within group 504 is shown for each SSID 1, 2, and 3, wherein SSID has three updates as 11:59. 12:00, and 12:01, SSID 2 has two updates at 12:

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00 and 12:02, and SSID 3 has three updates at 11:58, 11:59, and 12:02. Record sets of time intervals T2 and T3 are listed but example times of updates are not given for simplicity.

Consistency group N can now be formed based upon the control information and record updates received at the secondary site 431. In order to ensure that no record update in time interval group number one is later than any record update of time interval group number two, a min-time is established which is equal to a the earliest read record set time of the last record updates for each storage controller SSID 1, 2, and 3. In this example then, min-time is equal to 12:01. Any record updates having a read record set time greater than or equal to min-time is included in the consistency group N + 1. If two record update times to a same volume were equal, though unlikely given sufficient resolution of the sysplex timer 407, the record update having the earlier sequence number within the time interval group N is kept with that group for consistency group N. The record updates are now ordered based upon read record set times. Record updates having equal times will cause the record update having the lower sequence number to be place before the later sequence numbered record update. Alternatively, record updates having equal time stamps, but to differing volumes, may be ordered arbitrarily as long as they are kept in the same consistency group.

If a primary storage controller 405 fails to complete a response to a read record set during a specified time interval, then a consistency group cannot be formed until that primary storage controller 405 completes. In the event that the primary storage controller 405 fails to complete its operation, then a missing interrupt results causing a system missing interrupt handler to receive control and the operation will be terminated. On the other hand, if the primary storage controller 405 timely completes the operation then the I/O will be driven to completion and normal operation will continue. Consistency group formation expects that write operations against the primary storage controllers 405 will have time stamps. Some programs, however, will cause writes to be generated without time stamps, in which case the primary storage controller 405 will return zeros for the time stamp. Consistency group formation can bound those records without time stamps based upon the timestamp that the data was read. If too many record updates without time stamps occur over a time interval such that the record updates are not easily bounded by consistency group times, then an error that the duplex volumes are out of synchronization may result.

FIGs 10 and 11 are flow diagrams presenting the method of forming consistency groups. Referring to FIG. 10, the process starts at step 1000 with the primary site 421 establishing remote data shadowing to occur. At step 1010 all application I/O operations are time stamped using the sysplex timer 407 as a synchronization clock (FIG. 4). The PDM 404 starts a remote data shadowing session with each primary storage controller 405 at step 1020 which includes identifying those primary volumes that will have data or records shadowed. Record set information 600 is trapped by the primary storage controllers 405 for each application WRITE I/O operation (see FIG. 6) by step 1030.

Step 1040 involves the PDM 404 reading the captured record set information 600 from each primary storage controller 405 according to a prompt including an attention message, a predetermined timing interval, or a notification of more records to read as described earlier. When the PDM 404 begins reading record sets, at step 1050, the PDM 404 prefixes each record set with a prefix header 500 (see FIG. 5) for creating specific journal records (a journal record includes the prefix header 500 and the record set information 600). The journal records contain the control information (and records) necessary for forming consistency groups at the secondary site 431 (or at the primary site 421).

At step 1060 the PDM 404 transmits the generated journal records to the SDM 414 via the communications link 408 (or within the same data mover system if the consistency groups are formed therein). The SDM 414 uses the state table 700 at step 1070 to gather the received record updates by group and sequence numbers for each time interval group and primary storage controller 405 established for the data shadowing session. The SDM 414 inspects the journal records at step 1080 to determine whether all record information has been received for each time interval group. If the journal records are incomplete, then step 1085 causes the SDM 414 to notify the PDM 404 to resend the required record sets. If the PDM 404 is unable to correctly resend, then the duplex volume pair is failed. If the journal records are complete, then step 1090 is performed which encompasses the SDM 414 forming the consistency groups.

Referring to FIG. 11, steps 1100-1160 representing step 1090 (FIG. 10) for forming consistency groups is shown. Consistency group formation starts at step 1100 wherein each software consistency group is written to an SDM 414 journal log ("hardened") on the secondary DASD 417 (FIG. 4). Step 1110 performs a test for determining whether the time interval groups are complete, that is, each primary storage controller 405 must have either presented at least one read record set buffer or have confirmation from the PDM 404 that no such record updates were placed in the record set buffer, and all read record set buffers with data (or null) must have been received by the SDM 414. If a time interval group is incomplete, then step 1110 retries reading the record sets from the primary storage controller 405 until the required data is received. If errors occur, a specific duplex volume pair or pairs may be failed. Having received complete time interval groups, step 1120 determines a first consistency group journal record. The first (or current) consistency group journal record is that record which contains the earliest operational time stamp 502 and the earliest time

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of update 610 of all records having equal operational time stamps 502.

Step 1130 inspects the records contained in the current consistency group journal record to determine which record will be the last record to be included therein (some records will be dropped and included in the next consistency group journal record). The last record in the current consistency group journal record is determined as a minimum update time (min-time) of the maximum update times for each primary storage controller 405 (that is, the last update of each primary storage controller 405 is compared and only the earliest of these remains in the current consistency group journal record).

Those remaining record updates in the current consistency group journal record are ordered according to time of update 610 and sequence number within group 504 by step 1140. A primary storage controller 405 that had no record updates does not participate in the consistency group. At step 1150, the remaining record updates of the current consistency group (having update times later than min-time) are passed to the next consistency group. Each sequence number within a group 504 should end with a null buffer indicating that all read record sets have been read for that operational time interval. If the null buffer is absent, then the step 1120 of defining the last record in the current software consistency group, coupled with the records read time 507 and time of update 610 can be used to determine the proper order of the application WRITE I/O operations across the primary storage controllers 405.

Step 1160 represents a back-end of the remote data shadowing process wherein specific write updates are applied to secondary DASDs 416 under full disaster recovery constraint. If when writing the updates to the secondary DASDs 416 an I/O error occurs, or the entire secondary site 431 goes down and is re-initialized, then the entire consistency group that was in the process of being written can be re-applied from the start. This permits the remote shadowing to occur without having to track which secondary DASDs 416 I/Os have occurred, which I/Os have not occurred, and which I/Os were in process, etc.

A key component of step 1160 is that the PDM 414 causes the records to be written efficiently to the secondary DASDs 416 so that the secondary site 431 can keep pace with the primary site 421. The requisite efficiency is accomplished, in part, by concurrently executing multiple I/O operations to different secondary DASDs 416. Serially writing one secondary DASD 416 at a time would cause the secondary site 431 to fall too far behind the primary site 421. Yet more efficiency is gained at the secondary site 431 by writing the records for each consistency group destined for a single secondary device via a single channel command word (CCW) chain. Within each single CCW chain, the I/O operations therein can be further optimized as long as those I/O operations to each secondary DASD 416 data track are maintained in the order of occurrence on the primary volumes.

Optimizing secondary I/O operations for specific consistency groups and within single CCW chains is based in part upon the pattern of primary write I/O operations, and in part upon the physical characteristics of the secondary DASDs 416. Optimization may vary somewhat depending upon whether secondary DASD 415 is count/key/data (CKD), extended count/key/data (ECKD), fixed block architecture (FBA), etc. Consequently, a number of WRITE I/Os (m) to a primary DASD 406 volume during a given time interval can be reduced to a single START I/O operation to a secondary DASD 416 volume. This optimization of the number of START I/Os to the secondary storage controllers 415 of m:1 can allow the secondary DASDs 416 to catch up with and thereby closer shadow the record updates at the primary site 421.

A key to successful remote data shadowing, and hence secondary I/O optimization, is minimizing unrecoverable errors in any of the concurrent multiple I/O operations to secondary DASDs 416 so that consistent copies are available for recovery. A failure in a given secondary write could permit a later dependent write to be recorded without the conditioning write (e.g., a log entry indicating that a data base record has been updated when in reality the actual update write for the data base had failed violates the sequence integrity of the secondary DASD 416 copy).

A failed secondary 416 copy is unusable for application recovery until that failure to update has been recovered. The failed update could be corrected by having the SDM 414 request a current copy from the PDM 404. In the mean time the secondary data copy is inconsistent and hence unusable until the PDM 404 responds with the current update and all other previous updates are processed by the PDM 414. The time required to recover the failed update typically presents an unacceptably long window of non-recovery for adequate disaster recovery protection.

Effective secondary site 431 I/O optimization is realized by inspecting the data record sets to be written for a given consistency group and building chains based upon rules of the particular secondary DASD 416 architecture, for example, an ECKD architecture. The optimization technique disclosed herein simplifies recovery from I/O errors such that when applying a consistency group, if an I/O error occurs, the CCW chain can be re-executed, or in the event of a secondary initial program load (IPL) recovery, the entire consistency group can be re-applied without data loss.

FIG. 12 summarizes full consistency group recovery (FCGR) rules for building CCW chains for all WRITE I/O combinations for an ECKD architecture, wherein CCHHR record format is used (cylinder number, head number, record number). FIG. 12 is created by inspecting each possible combination of WRITE I/O operations to a DASD track within a consistency group's scope. The FCGR rules of FIG. 12, described in FIG.s 13A and 13B,

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are then followed to govern data placement (secondary DASD 416 I/O write CCW chains) for yielding full recovery for an error in applying a consistency group. The FCGR rules depicted in FIG. 12 would be extended appropriately as new WRITE I/O operations are added. These rules can exist in hardware or software at the secondary site 431. The FCGR rules advantageously reduces READ record set to a same DASD track analysis to an inspection of the primary DASD 406 WRITE I/O type, search argument, and count and key fields.

If a DASD track is written without inspecting the consistency group write operations as shown in FIG. 12, then previously written data records potentially cannot be re-written. For example, assume that a chain includes:

WRITE UPDATE to record five; and

FORMAT WRITE to record one,

wherein record one and record five occur on the same DASD track with record one preceding record five. Record five is updated by an UPDATE WRITE CCW and a FORMAT WRITE I/O CCW updates record one erasing a remainder of the track thus deleting record five. If this chain had to be re-executed, a LOCATE RECORD CCW that will position to the beginning of record five will no longer have a positioning point (record five no longer exists), and the chain is not fully recoverable from the beginning. Since the write operations have already been successful at the primary site 421, always being able to apply an entire consistency group on the secondary DASD 416 is required to maintain data consistency and integrity.

FIG. 14, steps 1410 through 1470, provides more detail as to the process represented by step 1160 of FIG. 11, while using the FCGR rules defined in FIG. 12. At step 1410 the SDM 414 divides the records of the current consistency group into two categories. A first category includes I/O orders directed to a same secondary DASD volume, and a second category includes I/O orders of those records in the first category that are directed to a same CCHH (i.e., records being updated to a same DASD track).

Having categorized the records of the current consistency group, step 1420 conforms application WRITE I/Os and SDM 414 WRITE I/Os to the architecture of the secondary DASDs 416, for example, to ECKD architecture FCGR rules (see FIG. 12) for identifying data placement on a track and track/record addressing. The SDM 414 groups secondary DASD WRITE I/O operations to the same volumes into single I/O CCW chains at step 1430. Step 1440 involves moving the head disk assembly (HDA) of each secondary DASD 416 according to search arguments and specific record data (CKD fields) for the actual secondary DASD 416 writes.

Step 1450 compares READ SET BUFFERS one and two for those records making up the second categories (there typically will be a plurality of second categories, one for each track receiving records), using the FCGR rules of FIG. 12 for determining whether a subsequent write operation invalidates a previous write operation or DASD search argument (positioning at a record that is now erased, etc.). The READ SET BUFFERS one and two contain adjacent read record sets. Following the FCGR rules ensures that the SDM 414 can re-write an entire consistency group, in the event of an error, without re-receiving record updates from the primary site 421. After the SDM 414 applies the current consistency group to the secondary DASD 416, step 1460 updates the state table (FIG. 7) and the master journal (FIG. 8).

The remote copy process continues in real time as step 1470 gets a next consistency group (which becomes the current consistency group) and returns processing to step 1410. The remote copy process will stop if the primary site 421 to secondary site 431 communication terminates. The communication may terminate if volume pairs are deleted from the process by the PDM 404, the primary site is destroyed (disaster occurs), an orderly shutdown is performed, or a specific takeover action occurs at the secondary site 431. Consistency groups journaled on the secondary site 431 can be applied to the secondary DASD 416 during a takeover operation. The only data lost is that data captured by the primary site 421 that has not been completely received by the SDM 414.

In summary, synchronous and asynchronous remote data duplexing systems have been described. The asynchronous remote data duplexing system provides storage based, real time data shadowing. A primary site runs applications generating record updates, and a secondary site, remote from the primary site, shadows the record updates and provides disaster recovery for the primary site. The asynchronous remote data duplexing system comprises a sysplex timer for synchronizing time dependent processes in the primary site, and a primary processor at the primary site for running the applications, the primary processor having a primary data mover therein. A plurality of primary storage controllers are coupled to the primary processor for issuing write I/O operations for each record update, each primary storage controller DASD write I/O operation being synchronized to the sysplex timer. A plurality of primary storage devices receive the write I/O operations and store the record updates therein accordingly. The primary data mover collects record set information from the plurality of primary storage controllers for each record update and appends a prefix header to a predetermined group of record set informations. The prefix header and predetermined group of record set informations form the self describing record sets. Each record set information includes a primary device address, a cylinder number and head number (CCHH), a record update sequence number, a write I/O type, a search argument, a sector number, and a record update time. The prefix header

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includes a total data length, an operational time stamp, a time interval group number, and a records read time. A secondary processor at the secondary site has a secondary data mover, the secondary data mover receiving the self describing record sets from the primary site. A plurality of secondary storage controllers are coupled to the secondary processor, and a plurality of secondary storage devices are coupled to the secondary storage controllers for storing the record updates copies. The secondary data mover determines whether the transmitted self describing record sets are complete and forms consistency groups from the self describing record sets and provides the record updates from each consistency group to the plurality of secondary storage controllers for writing to the plurality of secondary storage devices in an order consistent with a sequence that the record updates were written to the plurality of primary storage devices.

While the invention has been particularly shown and described with reference to preferred embodiments thereof, it will be understood by those skilled in the art that various changes in form and details may be made therein without departing from the scope of the invention as defined in the appended claims. For example, the consistency groups have been described as being formed by the secondary data mover based upon received self describing record sets, however, the consistency groups could be formed at the primary site based upon write record sets or elsewhere in the secondary site. The formats the storage devices at the primary and secondary sites need not be identical. For example, CKD records could be converted to fixed block architecture (FBA) type records, etc. Nor are the storage devices meant to be limited to DASD devices.

Claims

1. A method of providing asynchronous data duplexing, wherein data updates generated by one or more applications running in a primary processor are received by a primary storage subsystem, the primary storage subsystem causing I/O write operations to write each data update therein, each write I/O operation being time stamped, the time stamps synchronized by a common timer, and wherein a secondary system, whether local to or remote from the primary processor, shadows the data updates in sequence consistent order such that the secondary site is available for disaster recovery purposes, the method comprising the steps of:

   (a) time stamping each write I/O operation occurring in the primary storage subsystem;

   (b) capturing write I/O operation record set information from the primary storage subsystem for each data update;

   (c) generating self describing record sets from the data updates and respective record set informations, the self describing record sets containing sufficient control information to enable recreation of a sequence of the write I/O operations solely by the secondary system;

   (d) grouping the self describing record sets into interval groups, each interval group being measured from an operational time stamp start time and continuing for a predetermined interval threshold; and

   (e) selecting a current consistency group as that interval group of self describing record sets having an earliest operational time stamp, the individual data updates being ordered within the current consistency group based upon time sequences of the I/O write operations in the primary storage subsystem.

2. The method as claimed in claim 1 wherein the step (b) further includes initiating sessions with the primary storage subsystem based upon the operational time stamps for identifying a starting time for each interval group, each interval group being bounded by consecutive operational time stamps.

3. The method as claimed in claim 1 or claim 2 wherein the step (d) includes adding a prefix header describing each interval group.

4. The method as claimed in any preceding claim further comprising a step (f) transmitting the interval groups of self describing record sets to the secondary site .

5. The method as claimed in claim 4 further comprising a step (g) determining at the secondary site whether each received self describing record set is complete.

6. The method as claimed in claim 5 wherein the step (g) further includes the secondary site requesting the primary site to re-transmit any missing data updates if the secondary site determined a self describing record set is incomplete.

7. The method as claimed in claim 6 further comprising a step (h) determining at the secondary site whether each time interval group is complete.

8. The method as claimed in claim 7 wherein the step (h) further includes the secondary site requesting the primary site to re-send a missing record set if the secondary site determined that an interval group was incomplete.

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9. The method as claimed in claim 8 further comprising a step (i) writing the received data updates at the secondary site to the secondary storage subsystem according to the sequence of the corresponding write I/O operations at the primary site as ordered in the consistency groups.

10. A method for providing remote data shadowing for disaster recovery purposes in a data processing system including a primary site having a primary processor running a primary data mover and applications generating record updates, the primary processor coupled to a primary storage subsystem having storage devices for storing the record updates according to write I/O operations issued by the primary processor to the primary storage subsystem, the primary site further including a common system timer for synchronizing time dependent operations in the primary site, the system further including a secondary site having a secondary processor communicating with the primary processor, and a secondary storage subsystem for storing copies of the record updates in sequence consistent order, the method comprising the steps of:

(a) time stamping each write I/O operation in the primary storage subsystem;

(b) establishing a session with each storage device in the primary storage subsystem;

(c) capturing record set information from each storage device in the primary storage subsystem;

(d) reading record sets and respective record set information in the primary data mover;

(e) prefixing each record set with a header and creating self describing record sets therefrom;

(f) transmitting the self describing record sets to the secondary processor in time interval groups according to predetermined time intervals;

(g) forming consistency groups from the self describing record sets; and

(h) shadowing the record updates of each consistency group to the secondary storage subsystem in a sequence consistent order.

11. The method as claimed in claim 10 wherein the record sets are transmitted to the secondary processor asynchronously.

12. The method as claimed in claim 10 or claim 11 wherein the step (g) is performed at the secondary site.

13. The method as claimed in any of claims 10 to 12 wherein the step (f) further includes determining at the secondary site whether each received self describing record set is complete.

14. The method as claimed in claim 13 wherein the step (f) further includes requesting the primary site to retransmit any missing record updates if the primary site determined a received self describing record set is incomplete.

15. The method as claimed in any of claims 10 to 14 further comprising a step (i) determining at the secondary site whether each time interval group is complete.

16. The method as claimed in claim 15 wherein the step (i) further includes requesting the primary site to resend a missing record set if the secondary site determined that a interval group was incomplete.

17. The method as claimed in any of claims 10 to 16 wherein the step (c) identifies, in the record set information, a physical location on the primary storage devices where each record update is stored.

18. The method as claimed in claim 17 wherein the step (c) identifies, in the record set information, a sequence and time of update of each record update stored to the primary storage devices within the session.

19. The method as claimed in any of claims 10 to 18 wherein the step (e) identifies, in the prefix header, an interval group number for the session and sequence within group for each record update referred to therein.

20. A data processing system with a primary data processing system and a secondary data processing system, the primary data processing system having a primary processor running one or more applications, the one or more applications generating record updates, the primary processor generating self describing record sets therefrom, the self describing record sets being sent to the secondary system, the secondary system shadowing the record updates in sequence consistent order based upon the self describing record sets for real time disaster recovery purposes, the primary processor being coupled to a primary storage subsystem wherein the primary storage subsystem receives the record updates and executes write I/O operations for storing each record update therein, the primary processor comprising:

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a timer for providing a common time source to the applications and primary storage subsystem for synchronization purposes; and

primary data mover means prompting the primary storage subsystem for providing record set information to the primary data mover means for each record update, the primary data mover means grouping a plurality of record updates and each corresponding record set information into time interval groups, and inserting a prefix header thereto, each time interval group the self describing record sets. interval groups, and inserting a prefix header thereto, each time interval group the self describing record sets.

21. The primary system as claimed in claim 20 wherein the primary storage subsystem comprises:

a plurality of primary storage controllers, the plurality of primary storage controllers issuing the write I/O operations; and

a plurality of primary storage devices coupled to the plurality of primary storage controllers.

22. The primary system as claimed in claim 20 or claim 21 wherein the primary data mover means collects record set information for each write I/O operation for each primary storage controller of the plurality of primary storage controllers participating with each time interval group.

23. The primary system as claimed in any of claims 20 to 22 wherein each write I/O operation is time-stamped in the primary processor relative to the sysplex timer, each write I/O operation being issued to a primary storage controller of the plurality of primary storage controllers, each primary storage controller preserving the time-stamp and returning that time-stamp in the corresponding read record set to the primary data mover means.

24. The primary system as claimed in claim 23 wherein each record set information identifies a corresponding record update's physical location on a primary storage device of the plurality of primary storage devices.

25. The primary system as claimed in claim 23 or claim 24 wherein each record set information identifies a corresponding record update's primary subsystem identification, primary device address, cylinder number, and head number.

26. The primary system as claimed in claim 23 wherein the primary data mover means identifies a relative sequence of each write I/O update across all primary storage controllers participating in a time interval group.

27. The primary system as claimed in claim 26 wherein the primary data mover means creates a state table for journaling record updates and cross referencing a storage location of each record update on the primary system and the secondary system.

28. The primary system as claimed in claim 26 wherein the primary data mover means communicates the state table to the secondary system.

29. A remote data shadowing system including a primary site and a secondary site, the secondary site asynchronously shadowing record updates of the primary site in real time for disaster recovery purposes, the record updates generated by applications running at the primary site, the primary site comprising:

a sysplex timer;

a primary processor running the applications generating the record updates and issuing a corresponding write I/O operation for each record update, the primary processor having a primary data mover therein;

a plurality of primary storage controllers directed to store the record updates, the plurality of primary storage controllers executing the issued write I/O operation for each record update; and

a plurality of primary storage devices receiving and storing the record updates therein according to the corresponding write I/O operations,

wherein the primary processor and each write I/O are time-stamped by the primary processor, as synchronized by the sysplex timer, such that write I/O operations are accurately sequence ordered relative to each other, the primary data mover collecting sets of record updates and combining each record set information as provided by each one of the plurality of primary storage controllers with the corresponding record update, each record set information including a relative sequence and time of each corresponding write I/O operation, the primary data mover collecting record updates into time interval groups and inserting a prefix header to each time interval group, wherein the prefix header includes information identifying the record updates included in each time interval group, each record set information and prefix

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header combined for creating self describing record sets, the self describing record sets being transmitted to the secondary site, wherein the self describing record sets provide information adequate for the secondary site to shadow the record updates therein in sequence consistent order without further communications from the primary site.

Patentansprüche

1. Ein Verfahren zur Bereitstellung einer asynchronen Datenduplexierung, bei dem Datenaktualisierungen, die von einer oder mehreren Anwendungen, die in einem primären Prozessor ablaufen, erzeugt werden, von einem primären Speichersubsystem empfangen werden, wobei das primäre Speichersubsystem E/A-Schreiboperationen dazu veranlassen, jede Datenaktualisierung dort hineinzuschreiben, wobei jede E/A-Schreiboperation zeitgestempelt wird, wobei die Zeitstempel von einem gemeinsamen Timer synchronisiert werden und wobei ein sekundäres System, unabhängig davon, ob es sich hierbei um ein lokales oder ein vom primären Prozessor entferntes sekundäres System handelt, die Datenaktualisierungen in Übereinstimmung mit der Sequenz schattiert, so daß dieser sekundäre Ausführungsort im Notfall zu Wiederherstellungszwekken verfügbar ist, wobei das Verfahren die folgenden Schritte umfaßt:

   (a) Versehen jeder E/A-Schreiboperation, die im primären Speichersubsystem auftaucht, mit einem Zeitstempel;

   (b) Festhalten der Aufzeichnungsinformationen über die E/A-Schreiboperation, die aus dem primären Speichersubsystem kommen, für jede Datenaktualisierung;

   (c) Erzeugen selbstbeschreibender Aufzeichnungsgruppen anhand der Datenaktualisierungen und der dazugehörigen Aufzeichnungsgruppeninformationen, wobei die selbstbeschreibenden Aufzeichnungsgruppen ausreichend viele Steuerinformationen enthalten, um eine Wiederherstellung einer Sequenz der E/A-Schreiboperation allein durch das sekundäre System zu ermöglichen;

   (d) Gruppieren der selbstbeschreibenden Aufzeichnungsgruppen in Intervallgruppen, wobei jede Intervallgruppe ab einer Zeitstempel-Betriebsanfangszeit und bis zu einem vorbestimmten Intervall-Schwellenwert gemessen wird; und

   (e) Auswählen einer aktuellen Konsistenzgruppe als diejenige Intervallgruppe mit selbstbeschreibenden Aufzeichnungsgruppen, die den frühesten Betriebszeitstempel besitzt, wobei die einzelnen Datenaktualisierungen innerhalb der aktuellen Konsistenzgruppe auf der Grundlage der Zeitsequenzen der E/A-Schreiboperationen im primären Speichersubsystem sortiert werden.

2. Das Verfahren gemäß Anspruch 1, wobei der Schritt (b) weiterhin die Initiierung von Sitzungen mit dem primären Speichersubsystem auf der Grundlage der Betriebszeitstempel zur Identifikation einer Anfangszeit für jede Intervallgruppe umfaßt, wobei jede Intervallgruppe durch aufeinanderfolgende Betriebszeitstempel begrenzt ist.

3. Das Verfahren gemäß Anspruch 1 oder 2, wobei der Schritt (d) weiterhin das Hinzufügen eines Präfixtitels umfaßt, der jede Intervallgruppe beschreibt.

4. Das Verfahren gemäß allen bisherigen Ansprüchen, wobei weiterhin ein Schritt (f) enthalten ist, in dem die Intervallgruppen der selbstbeschreibenden Aufzeichnungsgruppen an den sekundären Ausführungsort übertragen werden.

5. Das Verfahren gemäß Anspruch 4, wobei weiterhin ein Schritt (g) enthalten ist, in dem am sekundären Ausführungsort festgestellt wird, ob jede selbstbeschreibende Aufzeichnungsgruppe vollständig ist.

6. Das Verfahren gemäß Anspruch 5, bei dem der Schritt (g) weiterhin einschließt, daß der sekundäre Ausführungsort vom primären Ausführungsort die erneute Übertragung eventuell fehlender Datenaktualisierungen anfordert, wenn der sekundäre Ausführungsort festgestellt hat, daß eine selbstbeschreibende Aufzeichnungsgruppe unvollständig ist.

7. Das Verfahren gemäß Anspruch 6, wobei weiterhin ein Schritt (h) enthalten ist, in dem am sekundären Ausführungsort festgestellt wird, ob jede Zeitintervallgruppe vollständig ist.

8. Das Verfahren gemäß Anspruch 7, bei dem der Schritt (h) weiterhin einschließt, daß der sekundäre Ausführungsort vom primären Ausführungsort die erneute Übertragung einer eventuell fehlenden Aufzeichnungsgruppe anfordert, wenn der sekundäre Ausführungsort festgestellt hat, daß eine Intervallgruppe unvollständig ist.

9. Das Verfahren gemäß Anspruch 8, wobei weiterhin ein Schritt (i) enthalten ist, in dem die empfangenen Datenaktualisierungen am sekundären Ausfüh-

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rungsort in Übereinstimmung mit der Sequenz der dazugehörigen E/A-Schreiboperationen am primären Ausführungsort gemäß Festlegung in den Konsistenzgruppen in das sekundäre Speichersubsystem geschrieben werden.

10. Ein Verfahren zur Bereitstellung einer Datenfernschattierung zu Wiederherstellungszwecken in einem Datenverarbeitungssystem in einem Notfall, wobei dieses Verfahren einen primären Ausführungsort mit einem primären Prozessor, der einen primären Datenbeweger und Anwendungen zur Erzeugung von Aufzeichnungsaktualisierungen betreibt, wobei der primäre Prozessor an ein primäres Speichersubsystem mit Speichermitteln zur Speicherung der Aufzeichnungsaktualisierungen in Übereinstimmung mit den E/A-Schreiboperationen, die vom primären Prozessor an das primäre Speichersubsystem ausgegeben werden, gekoppelt ist, wobei der primäre Ausführungsort weiterhin einen gemeinsamen System-Timer zur Synchronisation zeitabhängiger Operationen am primären Ausführungsort umfaßt, wobei das System weiterhin einen sekundären Ausführungsort mit einem sekundären Prozessor umfaßt, der mit dem primären Prozessor kommuniziert, und ein sekundäres Speichersubsystem zur Speicherung von Kopien der Aufzeichnungsaktualisierungen in der Reihenfolge der Sequenz umfaßt, wobei dieses Verfahren die folgenden Schritte umfaßt:

(a) Versehen jeder E/A-Schreiboperation im primären Speichersubsystem mit einem Zeitstempel;

(b) Aufbau einer Sitzung mit jeder Speichereinrichtung im primären Speichersubsystem;

(c) Festhalten der Aufzeichnungsinformationen aus jeder Speichereinrichtung im primären Speichersubsystem;

(d) Lesen von Aufzeichnungsgruppen und entsprechenden Aufzeichnungsinformationen im primären Datenbeweger;

(e) Versehen jeder Aufzeichnungsgruppe mit einem Titel, und Erstellen selbstbeschreibender Aufzeichnungsgruppen daraus;

(f) Übertragung der selbstbeschreibenden Aufzeichnungsgruppen an den sekundären Prozessor in Zeitintervallgruppen in Übereinstimmung mit den vorbestimmten Zeitintervallen;

(g) Bildung von Konsistenzgruppen anhand der selbstbeschreibenden Aufzeichnungsgruppen; und

(h) Schattierung der Aufzeichnungsaktualisierungen jeder Konsistenzgruppe in das sekundäre Speichersubsystem in der Reihenfolge der Sequenz.

11. Das Verfahren gemäß Anspruch 10, bei dem die Aufzeichnungsgruppen asynchron an den sekundären Prozessor übertragen werden.

12. Das Verfahren gemäß Anspruch 10 oder 11, bei dem der Schritt (g) am sekundären Ausführungsort ausgeführt wird.

13. Das Verfahren gemäß Anspruch 10 oder 12, wobei der Schritt (f) weiterhin die Bestimmung am sekundären Ausführungsort, ob jede empfangene selbstbeschreibende Aufzeichnungsgruppe vollständig ist, umfaßt.

14. Das Verfahren gemäß Anspruch 13, wobei der Schritt (f) weiterhin umfaßt, daß vom primären Ausführungsort die erneute Übertragung eventuell fehlender Aufzeichnungsaktualisierungen angefordert wird, wenn der primäre Ausführungsort festgestellt hat, daß eine empfangene selbstbeschreibende Aufzeichnungsgruppe unvollständig ist.

15. Das Verfahren gemäß jedem der Ansprüche 10 bis 14, das weiterhin einen Schritt (i) umfaßt, in dem am sekundären Ausführungsort festgestellt wird, ob jede Zeitintervallgruppe vollständig ist.

16. Das Verfahren gemäß Anspruch 15, wobei der Schritt (i) weiterhin umfaßt, daß vom primären Ausführungsort die erneute Übertragung eventuell fehlender Aufzeichnungsgruppen angefordert wird, wenn der sekundäre Ausführungsort festgestellt hat, daß eine Intervallgruppe unvollständig ist.

17. Das Verfahren gemäß jedem der Ansprüche 10 bis 16, bei dem der Schritt (c) in den Aufzeichnungsgruppeninformationen eine physikalische Position in den primären Speichereinrichtungen angibt, wo jede Aufzeichnungsaktualisierung gespeichert ist.

18. Das Verfahren gemäß Anspruch 17, wobei der Schritt (c) in den Aufzeichnungsgruppeninformationen in jeder Sitzung eine Sequenz und eine Zeit für die Aktualisierung jeder Aufzeichnungsaktualisierung, die in den primären Speichereinrichtungen gespeichert ist, angibt.

19. Das Verfahren gemäß jedem der Ansprüche 10 bis 18, bei dem der Schritt (e) im Präfixtitel eine Intervallgruppennummer für die Sitzung und für jede Aufzeichnungsaktualisierung, auf die darin Bezug genommen wird, die Sequenz innerhalb der Gruppe angibt.

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20. Ein Datenverarbeitungssystem mit einem primären Datenverarbeitungssystem und einem sekundären Datenverarbeitungssystem, wobei das primäre Datenverarbeitungssystem einen primären Prozessor besitzt, der eine oder mehrere Anwendungen ausführt, und wobei diese eine oder mehrere Anwendungen Aufzeichnungsaktualisierungen erstellen, und wobei der primäre Prozessor daraus selbstbeschreibende Aufzeichnungsgruppen erzeugt, wobei diese selbstbeschreibenden Aufzeichnungsgruppen an das sekundäre Datenverarbeitungssystem gesendet werden, das sekundäre Datenverarbeitungssystem die Aufzeichnungsaktualisierungen in Übereinstimmung mit der Sequenz in der richtigen Reihenfolge auf der Grundlage der selbstbeschreibenden Aufzeichnungsgruppen für Echtzeit-Wiederherstellungszwecke in einem Notfall schattiert, wobei der primäre Prozessor an ein primäres Speichersubsystem gekoppelt ist, in dem das primäre Speichersubsystem die Aufzeichnungsaktualisierungen empfängt und E/A-Schreiboperationen zur Speicherung jeder Aufzeichnungsaktualisierung darin ausführt, und wobei der primäre Prozessor folgendes umfaßt:

einen Timer zur Bereitstellung einer gemeinsamen Zeitquelle an die Anwendungen und ein primäres Speichersubsystem zu Synchronisationszwecken; und

ein primäres Datenbewegermittel, das vom primären Speichersubsystem für jede Aufzeichnungsaktualisierung die Bereitstellung von Aufzeichnungsgruppeninformationen an das primäre Datenbewegermittel anfordert, wobei das primäre Datenbewegermittel eine Mehrzahl von Aufzeichnungsaktualisierungen und alle dazugehörigen Aufzeichnungsgruppeninformationen in Zeitintervallgruppen einteilt und in jede der Aufzeichnungsgruppeninformationen einen Präfixtitel einfügt, wobei jedes Zeitintervall die selbstbeschreibenden Aufzeichnungsgruppen einteilt.

21. Das primäre Datenverarbeitungssystem gemäß Anspruch 20, in dem das primäre Speichersubsystem folgendes umfaßt:

eine Mehrzahl an primären Speicher-Controllern, wobei die Mehrzahl an primären Speicher-Controllern die E/A-Schreiboperationen ausgeben; und

eine Merhzahl an primären Speichereinrichtungen, die an die Merhzahl der primären Speicher-Controller gekoppelt sind.

22. Das primäre Datenverarbeitungssystem gemäß Anspruch 20 oder 21, in dem das primäre Datenbewegermittel Aufzeichnungsgruppeninformationen für jede E/A-Schreiboperation für jeden primären Speicher-Controller aus der Mehrzahl der primären Speicher-Controller, die Bestandteil jeder Zeitintervallgruppe sind, sammelt.

23. Das primäre Datenverarbeitungssystem gemäß jedem der Ansprüche 20 bis 22, in dem jede E/A-Schreiboperation im primären Prozessor bezüglich des Sysplex-Timers mit einem Zeitstempel versehen ist, wobei jede E/A-Schreiboperation an einen primären Speicher-Controller aus der Mehrzahl der primären Speicher-Controller ausgegeben wird, wobei jeder primäre Speicher-Controller den Zeitstempel bewahrt und ihn in der betreffenden Leseaufzeichnungsgruppe an das primäre Datenbewegermittel zurückgibt.

24. Das primäre Datenverarbeitungssystem gemäß Anspruch 23, in dem jede Aufzeichnungsgruppeninformation die physikalische Position einer entsprechenden Aufzeichnungsaktualisierung in einer primären Speichereinrichtung aus der Mehrzahl der primären Speichereinrichtungen angibt.

25. Das primäre Datenverarbeitungssystem gemäß Anspruch 23 oder 24, in dem jede Aufzeichnungsgruppeninformation die betreffende primäre Subsystemidentifikation der Aufzeichnungsaktualisierung, die primäre Geräteadresse, die Zylinderzahl und die Kopfzahl angibt.

26. Das primäre Datenverarbeitungssystem gemäß Anspruch 23, in dem das primäre Datenbewegermittel eine relative Sequenz jeder E/A-Schreibaktualisierung aller primären Speicher-Controller angibt, die Bestandteil einer Zeitintervallgruppe sind.

27. Das primäre Datenverarbeitungssystem gemäß Anspruch 26, in dem das primäre Datenbewegermittel eine Statustabelle zur Aufnahme von Aufzeichnungsaktualisierungen erstellt und einen Querverweis zur Speicherstelle jeder Aufzeichnungsaktualisierung im primären Datenverarbeitungssystem und im sekundären Datenverarbeitungssystem herstellt.

28. Das primäre Datenverarbeitungssystem gemäß Anspruch 26, in dem das primäre Datenbewegermittel die Statustabelle an das sekundäre Datenverarbeitungssystem leitet.

29. Ein Datenfernschattierungssystem, das einen primären Ausführungsort und einen sekundären Ausführungsort umfaßt, wobei der sekundäre Ausführungsort Aufzeichnungsaktualisierungen des primären Ausführungsortes zu Datenwiederherstel-

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lungszwecken im Notfall in Echtzeit asynchron schattiert, wobei die von den Anwendungen erzeugten Aufzeichnungsaktualisierungen am primären Ausführungsort ausgeführt werden, wobei der primäre Ausführungsort folgendes umfaßt:

einen Sysplex-Timer;

einen primären Prozessor, der die Anwendungen ausführt, die die Aufzeichnungsaktualisierungen erzeugen, und der für jede Aufzeichnungsaktualisierung eine entsprechende E/A-Schreiboperation ausgibt, wobei der primäre Prozessor einen primären Datenbeweger darin besitzt;

eine Mehrzahl primärer Speicher-Controller, die darauf ausgelegt sind, die Aufzeichnungsaktualisierungen zu speichern, wobei die Mehrzahl primärer Speicher-Controller die ausgegebene E/A-Schreiboperation für jede Aufzeichnungsaktualisierung ausführt; und

eine Mehrzahl primärer Speichereinrichtungen, die entsprechend den jeweiligen E/A-Schreiboperationen die Aufzeichnungsaktualisierungen empfangen und speichern,

wobei der primäre Prozessor und jede E/A-Schreiboperation vom primären Prozessor mit einem Zeitstempel versehen werden, der angibt, daß der Sysplex-Timer eine Synchronisation durchgeführt hat, so daß E/A-Schreiboperationen entsprechend ihrer Sequenz untereinander genau sortiert werden, wobei der primäre Datenbeweger Gruppen von Aufzeichnungsaktualisierungen sammelt und jede Aufzeichnungsgruppeninformation, die von jedem primären Speicher-Controller bereitgestellt wird, mit der dazugehörigen Aufzeichnungsaktualisierung kombiniert, wobei jede Aufzeichnungsgruppeninformation eine relative Sequenz und Zeit jeder betreffenden E/A-Schreiboperation umfaßt, wobei der primäre Datenbeweger Aufzeichnungsaktualisierungen sammelt und sie in Zeitintervallgruppen einteilt und in jede Zeitintervallgruppe einen Präfixtitel einfügt, wobei der Präfixtitel Informationen enthält, die die Aufzeichnungsaktualisierungen identifizieren, die in jeder Zeitintervallgruppe, in jeder Aufzeichnungsgruppeninformation und in jedem Präfixtitel enthalten sind, und die so kombiniert werden, daß dadurch selbstbeschreibende Aufzeichnungsgruppen entstehen, wobei die selbstbeschreibenden Aufzeichnungsgruppen an den sekundären Ausführungsort übertragen werden, an dem die selbstbeschreibenden Aufzeichnungsgruppen Informationen liefern, mit denen der sekundäre Ausführungsort darin die Aufzeichnungsaktualisierungen in der richtigen Reihenfolge ohne weitere Kommunikation vom primären Ausführungsort schattieren kann.

Revendications

1. Procédé de duplication asynchrone de données, dans lequel des mises à jour de données, ayant été générées par une ou plusieurs applications fonctionnant sur un processeur primaire, sont reçues par un sous-système de stockage primaire, le sous-système de stockage primaire provoquant des opérations E/S d'écriture, destinées à y écrire chaque mise à jour de données, chaque opération E/S d'écriture étant dotée d'un repère temporel, les repères temporels étant synchronisés avec un cadenceur commun, et dans lequel un système secondaire, local ou distant vis-à-vis du processeur primaire, occulte une mise à jour de données dans un ordre séquentiellement cohérent, de manière que le site secondaire soit disponible à des fins de récupération de secours de centres informatiques, le procédé comprenant cohérent à :

   (a) doter d'un repère temporel chaque opération E/S d'écriture se produisant dans le sous-système de stockage primaire;

   (b) capturer l'information du jeu d'enregistrement d'opération E/S d'écriture à partir du sous-système de stockage primaire pour chaque mise à jour de données;

   (c) générer lesdits jeux d'enregistrement auto-descriptifs à partir des mises à jour de données et des informations de jeux d'enregistrement respectives, les jeux d'enregistrement auto-descriptifs contenant une information de contrôle suffisante pour permettre la recréation d'une séquence d'opérations E/S d'écriture seulement par le système secondaire;

   (d) grouper les jeux d'enregistrement auto-descriptifs en formant des groupes d'intervalles, chaque groupe d'intervalles étant mesuré à partir d'un moment de départ du repère temporel opérationnel et continuant pendant un seuil d'intervalle prédéterminé; et

   (e) sélectionner un groupe de cohérence actuel comme groupe d'intervalles des jeux d'enregistrement auto-descriptifs ayant un repère temporel opérationnel de précocité maximale, les mises à jour de données individuelles étant classées dans le groupe de cohérence actuelle selon les séquences temporelles des opéra-

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tions E/S d'écriture dans le sous-systèmes de stockage primaire.

2. Le procédé selon la revendication 1, dans lequel l'étape (b) comprend en outre le lancement de sessions avec le sous-système de stockage primaire, en se basant sur les repères temporels opérationnels pour identifier un moment de départ pour chaque groupe d'intervalles, chaque groupe d'intervalles étant lié par des repères temporels opérationnels consécutifs.

3. Le procédé selon la revendication 1 ou la revendication 2, dans lequel l'étape (d) comprend l'addition d'une en-tête de préfixe décrivant chaque groupe d'intervalles.

4. Le procédé selon l'une quelconque des revendications précédentes, comprenant en outre une étape (f) de transmission des groupes d'intervalles des jeux d'enregistrement auto-descriptifs à destination du site secondaire.

5. Le procédé selon la revendication 4, comprenant en outre une étape (g) déterminant au niveau du site secondaire si chaque jeu d'enregistrement auto-descriptif reçu est complet.

6. Le procédé selon la revendication 5, dans lequel l'étape (g) comprend en outre la requête par le site secondaire du site primaire en vue de retransmettre toutes les éventuelles mises à jour de données manquantes, si le site secondaire a déterminé qu'un jeu d'enregistrement auto-descriptif était incomplet.

7. Le procédé selon la revendication 6, comprenant en outre une étape (h) déterminant au niveau du site secondaire si chaque groupe d'intervalles de temps est complet.

8. Le procédé selon la revendication 7, dans lequel l'étape (h) comprend en outre la requête par le site secondaire à destination du site primaire de réémission d'un jeu d'enregistrement manquant si le site secondaire a déterminé qu'un groupe d'intervalles était incomplet.

9. Le procédé selon la revendication 8, comprenant en outre une étape (i) d'écriture des mises à jour de données reçues au niveau du site secondaire sur le sous-système de stockage secondaire selon la séquence des opérations E/S d'écriture correspondantes au niveau du site primaire, tel que classé dans les groupes de cohérence.

10. Un procédé pour fournir une occultation de données distantes en vue d'effectuer un secours de centres informatiques dans un système de traitement de données comprenant un site primaire ayant un processeur primaire faisant fonctionner un élément de transfert de données primaires et faisant fonctionner des applications générant des mises à jour d'enregistrement, le processeur primaire étant couplé à un sous-système de stockage primaire comportant des dispositifs de stockage destinés à stocker les mises à jour d'enregistrements selon les opérations E/S d'écriture émises par le processeur primaire, à destination du sous-système de stockage primaire, le site primaire comprenant en outre un cadenceur de système commun destiné à synchroniser les opérations dépendant du temps dans le site primaire, le système comprenant en outre un site secondaire ayant un processeur secondaire qui communique avec le processeur primaire, et un sous-système de stockage secondaire destiné à stocker des copies des mises à jour d'enregistrement dans un ordre de cohérence de séquences, le procédé comprenant les étapes consistant à :

(a) doter d'un repère temporel chaque opération E/S d'écriture dans le sous-système de stockage primaire;

(b) établir une cession avec chaque dispositif de stockage se trouvant dans le sous-système de stockage primaire;

(c) capturer une information de jeu d'enregistrement à partir de chaque dispositif de stockage situé dans le sous-système de stockage primaire;

(d) lire les jeux d'enregistrements et l'information de jeu d'enregistrement respective dans l'élément de transfert de données primaires;

(e) doter chaque jeu d'enregistrement d'un préfixe avec un en-tête et créer à partir de cela des jeux d'enregistrement auto-descriptifs;

(f) transmettre les jeux d'enregistrement auto-descriptifs aux processeurs secondaires en formant des groupes d'intervalles de temps selon des intervalles de temps prédéterminés;

(g) former des groupes de cohérence à partir des jeux d'enregistrement auto-descriptifs; et

(h) occulter les mises à jour d'enregistrement de chaque groupe de cohérence sur le sous-système de stockage secondaire, dans un ordre de cohérence de séquence.

11. Le procédé selon la revendication 10, dans lequel

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les jeux d'enregistrement sont transmis de façon asynchrone au processeur secondaire.

12. Le procédé selon la revendication 10 ou la revendication 11, dans lequel l'étape (g) est exécutée au niveau du site secondaire.

13. Le procédé selon l'une quelconque des revendications 10 à 12, dans lequel l'étape (f) comprend en outre la détermination au niveau du site secondaire du fait que chaque jeu d'enregistrement auto-descriptif ayant été reçu est complet.

14. Le procédé selon la revendication 13, dans lequel l'étape (f) comprend en outre la requête par le site primaire de retransmettre toutes les éventuelles mises à jour d'enregistrement manquantes si le site primaire à déterminé que le jeu d'enregistrement auto-descriptif ayant été reçu était incomplet.

15. Le procédé selon l'une quelconque des revendications 10 à 14 comprenant en outre une étape (i) déterminant au niveau du site secondaire si chaque groupe d'intervalles de temps est complet.

16. Le procédé selon la revendication 15 dans lequel l'étape (i) comprend en outre la requête par le site primaire de réémission d'un jeu d'enregistrement manquant si le site secondaire a déterminé qu'un groupe d'intervalles était incomplet.

17. Le procédé selon l'une quelconque des revendications 10 à 17 dans lequel l'étape (c) identifie, dans l'information de jeu d'enregistrement, sur les dispositifs de stockage primaire, un emplacement physique auquel chaque mise à jour d'enregistrement est stockée.

18. Le procédé selon la revendication 17, dans lequel l'étape (c) identifie, dans l'information de jeu d'enregistrement, une séquence et un moment de mise à jour de chaque mise à jour d'enregistrement ayant été stockée sur les dispositifs de stockage primaires se trouvant dans la session.

19. Le procédé selon l'une quelconque des revendications 10 à 18, dans lequel l'étape (e) identifie, dans l'en-tête de préfixe, un numéro de groupe d'intervalles pour la session et la séquence dans le groupe pour chaque mise à jour d'enregistrement y étant référée.

20. Un système de traitement de données équipé d'un système de traitement de données primaire et d'un système de traitement de données secondaire, le système de traitement de données primaire comportant un processeur primaire qui fait fonctionner une ou plusieurs applications, les unes ou plusieurs applications générant des mises à jour d'enregistrement, le processeur primaire générant à partir de cela des jeux d'enregistrement auto-descriptifs, les jeux d'enregistrement auto-descriptifs étant envoyés au système secondaire, le système secondaire occultant les mises à jour d'enregistrement dans un ordre de cohérence de séquence en se basant sur les jeux d'enregistrement auto-descriptifs à des fins de secours de centres informatiques en temps réel, le processeur primaire étant couplé à un sous-système de stockage primaire, dans lequel le sous-système de stockage primaire reçoit les mises à jour d'enregistrement et exécute des opérations E/S d'écriture pour y stocker chaque mise à jour d'enregistrement, le processeur primaire comprenant :

un cadenceur pour fournir une source de temps commune aux applications et au sous-système de stockage primaire, à des fins de synchronisation; et

des moyens de transfert de données primaires, invitant le sous-système de stockage primaire à fournir une information de jeu d'enregistrement à des moyens de transfert de données primaires pour chaque mise à jour d'enregistrement, les moyens de transfert de données primaires groupant une pluralité de mises à jour d'enregistrement et chaque information de jeu d'enregistrement correspondante en des groupes d'intervalle de temps, et insérant dans ceux-ci un en-tête de préfixe, pour chaque groupe d'intervalles de temps que le jeux d'enregistrement auto-descriptifs fixe.

21. Le système primaire selon la revendication 20, dans lequel le sous-système de stockage primaire comprend :

une pluralité de contrôleurs de stockage primaire, la pluralité de contrôleurs de stockage primaires émettant les opérations E/S d'écriture;

une pluralité de dispositifs de stockage primaires, couplés à la pluralité des contrôleurs de stockage primaires.

22. Le système primaire selon la revendication 20 ou la revendication 21, dans lequel le moyen de transfert de données primaire collecte l'information de jeu d'enregistrement pour chaque opération E/S d'écriture pour chaque contrôleur de stockage primaire de la pluralité des contrôleurs de stockage primaires participant à chaque groupe d'intervalles de temps.

23. Le système primaire selon l'une quelconque des re-

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vendications 20 à 22, dans lequel chaque opération E/S est dotée d'un repère temporel dans le processeur primaire, par rapport au cadenceur sysplex, chaque opération E/S d'écriture étant émise à destination d'un contrôleur de stockage primaire de la pluralité des contrôleurs de stockage primaires, chaque contrôleur de stockage primaire préservant le repère temporel et retournant ce repère temporel dans le jeu d'enregistrement de lecture correspondant, à destination du moyen de transfert de données primaire.

24. Le système primaire selon la revendication 23, dans lequel chaque information de jeu d'enregistrement identifie un emplacement physique de mise à jour d'enregistrement correspondant sur un dispositif de stockage primaire appartenant à la pluralité des dispositifs de stockage primaires.

25. Le système primaire selon la revendication 23 ou la revendication 24, dans lequel chaque information de jeu d'enregistrement identifie une identification de sous-système primaire de mise à jour d'enregistrement correspondante, une adresse de dispositifs primaires, un numéro de cylindre et un numéro de tête.

26. Le système primaire selon la revendication 23, dans lequel le moyen de transfert de données primaire identifie une séquence relative de chaque mise à jour d'écriture E/S dans la totalité des contrôleurs de stockage primaire participants, dans un groupe d'intervalles de temps.

27. Le système primaire selon la revendication 26, dans lequel le moyen de transfert de données primaire crée une table d'état destinée à enregistrer dans un journal des mises à jour d'enregistrement et à effectuer des références croisées d'un emplacement de stockage de chaque mise à jour d'enregistrement sur le système primaire et le système secondaire.

28. Le système primaire selon la revendication 26, dans lequel le moyen de transfert de données primaire communique la table d'état au système secondaire.

29. Un système d'occultation de données distante, comprenant un site primaire et un site secondaire, le site secondaire occupant de façon asynchrone des mises à jour d'enregistrement du site primaire en temps réel, à des fins de secours de centres informatiques, les mises à jour d'enregistrement ayant été générées par des applications fonctionnant au niveau du site primaire, le site primaire comprenant :

un cadenceur sysplex;

un processeur primaire faisant fonctionner les applications générant les mises à jour d'enregistrement et émettant une opération E/S d'écriture correspondante pour chaque mise à jour d'enregistrement, le processeur primaire ayant en lui un élément de transfert de donnés primaire;

une pluralité de contrôleurs de stockage primaires, géré pour mémoriser les mises à jour d'enregistrement, la pluralité de contrôleurs de stockage primaires exécutant l'opération E/S d'écriture émise pour chaque mise à jour d'enregistrement; et

une pluralité de dispositifs de stockage primaires, recevant et stockant les mises à jour d'enregistrement en leur sein, selon les opérations E/S d'écriture correspondantes,

dans lequel le processeur primaire et chaque opération E/S d'écriture sont dotées d'un repère temporel par le processeur primaire, tel que synchronisé par le cadenceur sysplex, de manière que des opérations E/S d'écriture soient classées en séquences précises les unes par rapport aux autres, l'élément de transfert de données primaires collectant des jeux de mises à jour d'enregistrement et combinant chaque information de jeu d'enregistrement, tel que fournie par chacun parmi la pluralité des contrôleurs de stockage primaires, avec la mise à jour d'enregistrement correspondante, chaque information de jeu d'enregistrement comprenant une séquence relative et le moment de chaque opération E/S d'écriture correspondante, l'élément de transfert de données primaire collectant les mises à jour d'enregistrement dans des groupes d'intervalles de temps et insérant une en-tête de préfixe dans chaque groupe d'intervalles de temps, dans lequel l'en-tête de préfixe comprend une information identifiant les mises à jour d'enregistrement incluses dans chaque groupe d'intervalles de temps, chaque information de jeux d'enregistrement et en-tête de préfixe étant combinés pour créer des jeux d'enregistrements auto-descriptifs, les jeux d'enregistrement auto-descriptifs étant transmis au site secondaire, dans lequel les jeux d'enregistrement auto-descriptifs fournissent une information adéquate pour le site secondaire afin d'occulter les mises à jour d'enregistrement s'y trouvant dans un ordre de cohérence de séquence, sans qu'il y ait d'autres communications depuis le site primaire.

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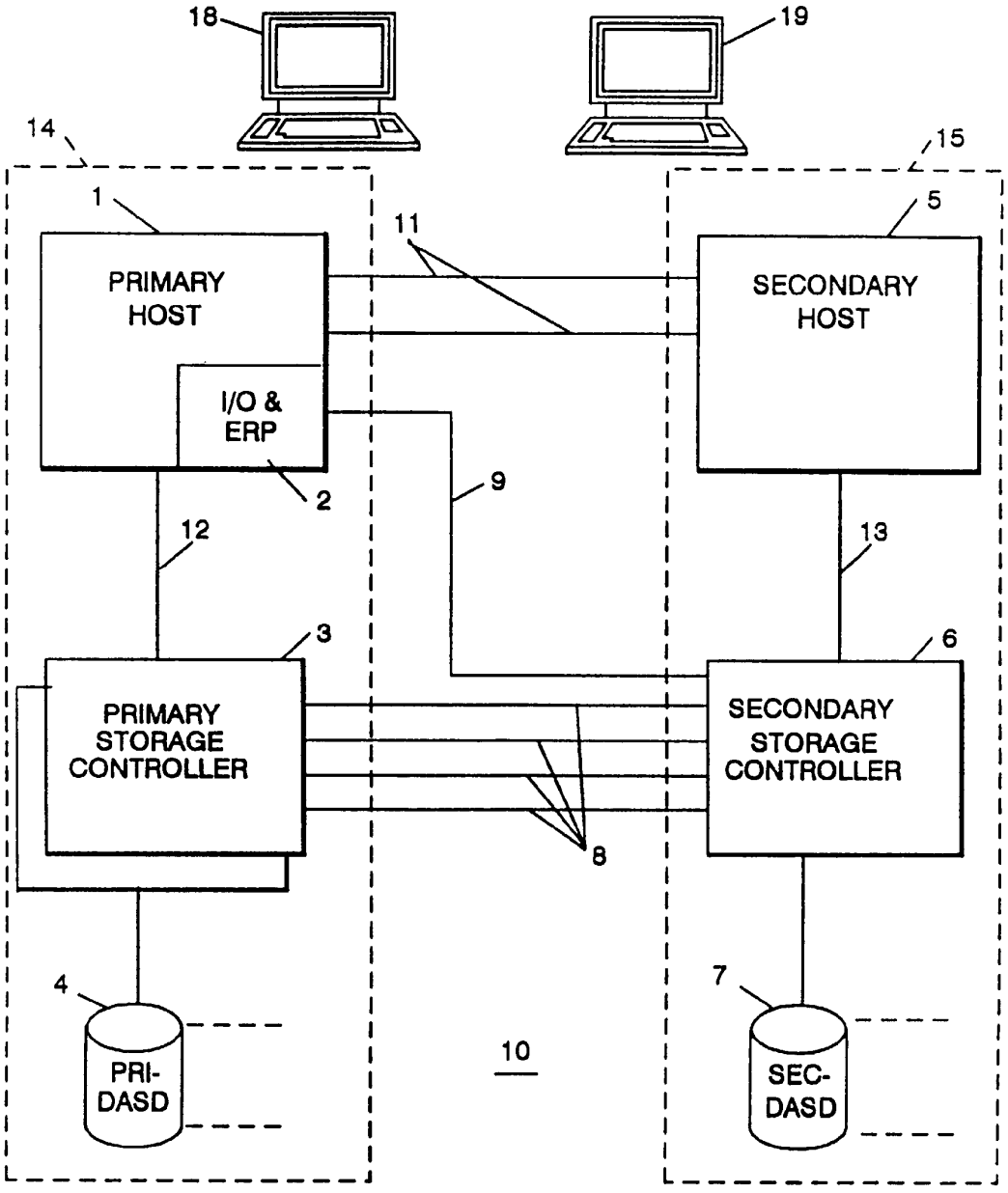
FIG. 1


18
19
14
15
1
5
11
PRIMARY HOST
SECONDARY HOST
I/O & ERP
2
9
12
13
3
6
PRIMARY STORAGE CONTROLLER
SECONDARY STORAGE CONTROLLER
8
4
7
PRI-DASD
SEC-DASD
10

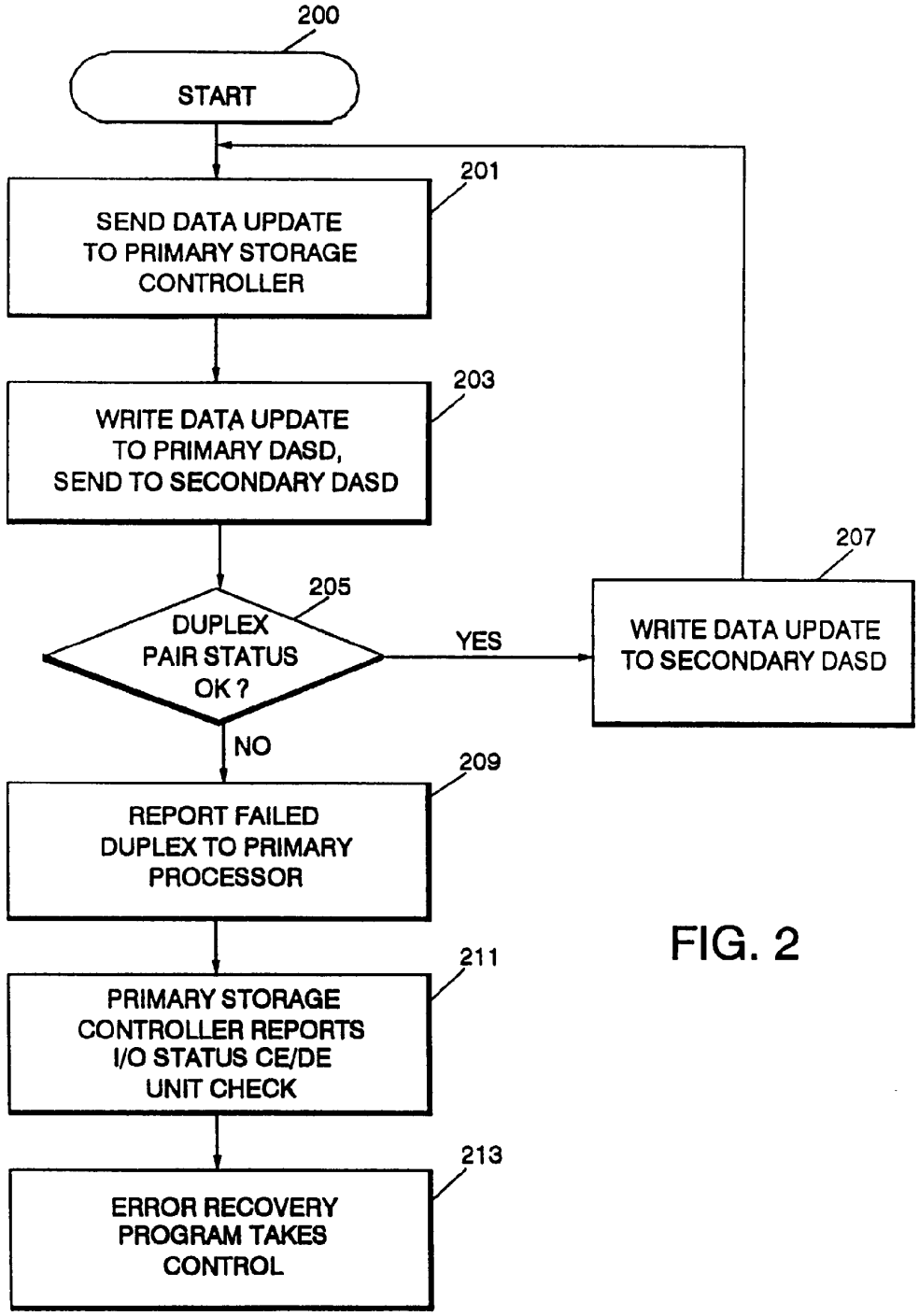

200
START
201
SEND DATA UPDATE TO PRIMARY STORAGE CONTROLLER
203
WRITE DATA UPDATE TO PRIMARY DASD, SEND TO SECONDARY DASD
205
DUPLEX PAIR STATUS OK ?
YES
207
WRITE DATA UPDATE TO SECONDARY DASD
NO
209
REPORT FAILED DUPLEX TO PRIMARY PROCESSOR
211
PRIMARY STORAGE CONTROLLER REPORTS I/O STATUS CE/DE UNIT CHECK
213
ERROR RECOVERY PROGRAM TAKES CONTROL

FIG. 2

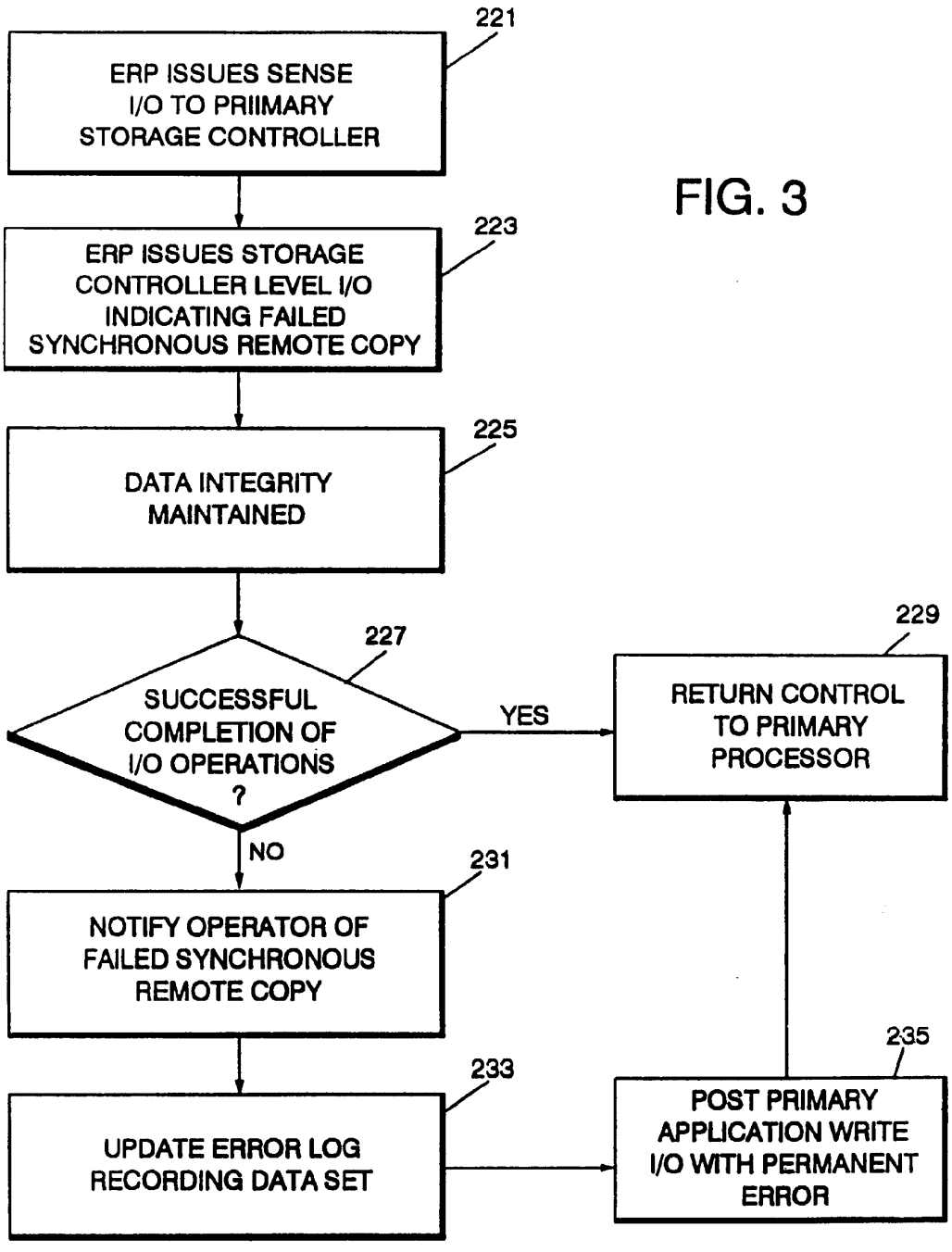


FIG. 3

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FIG. 4

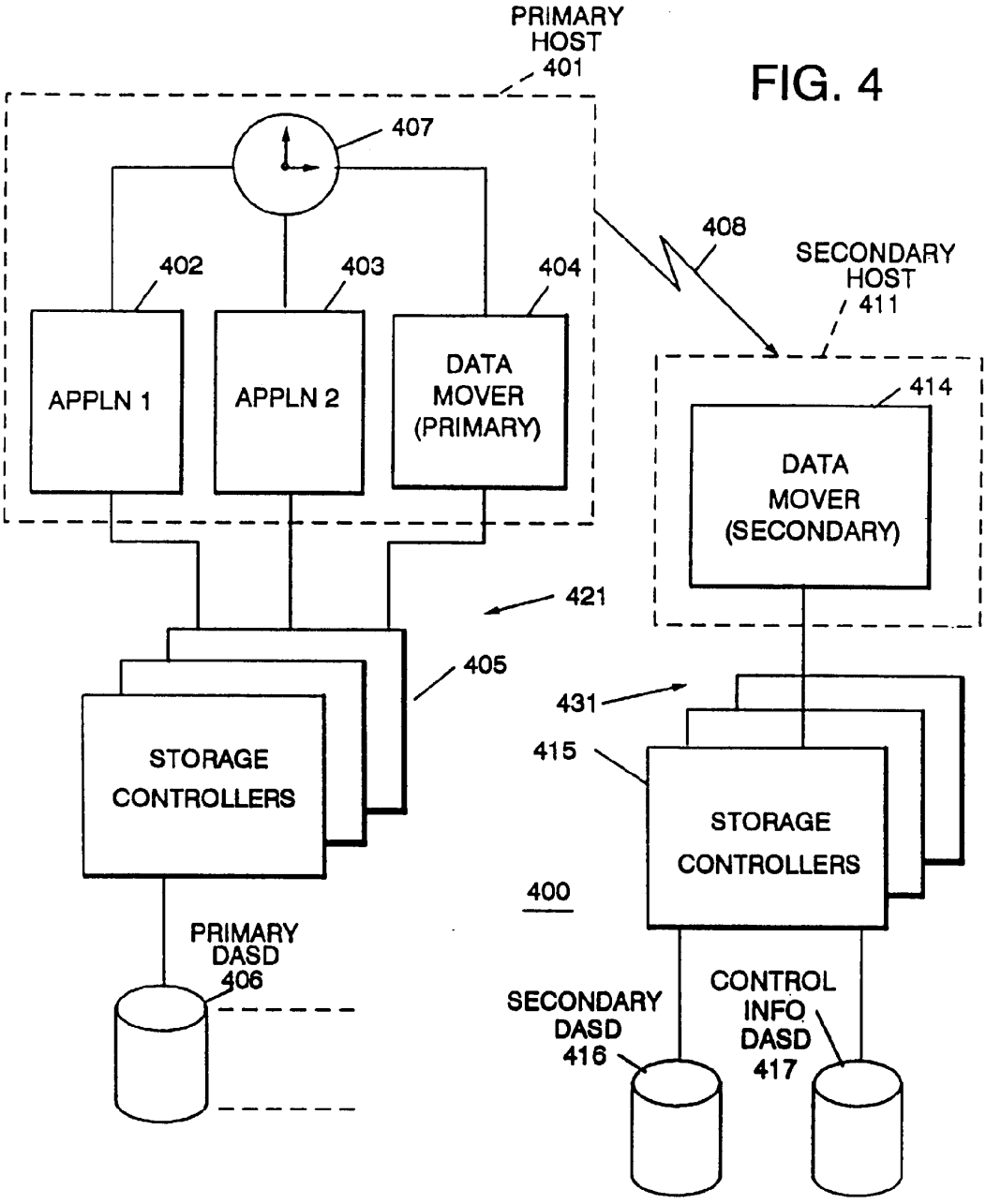
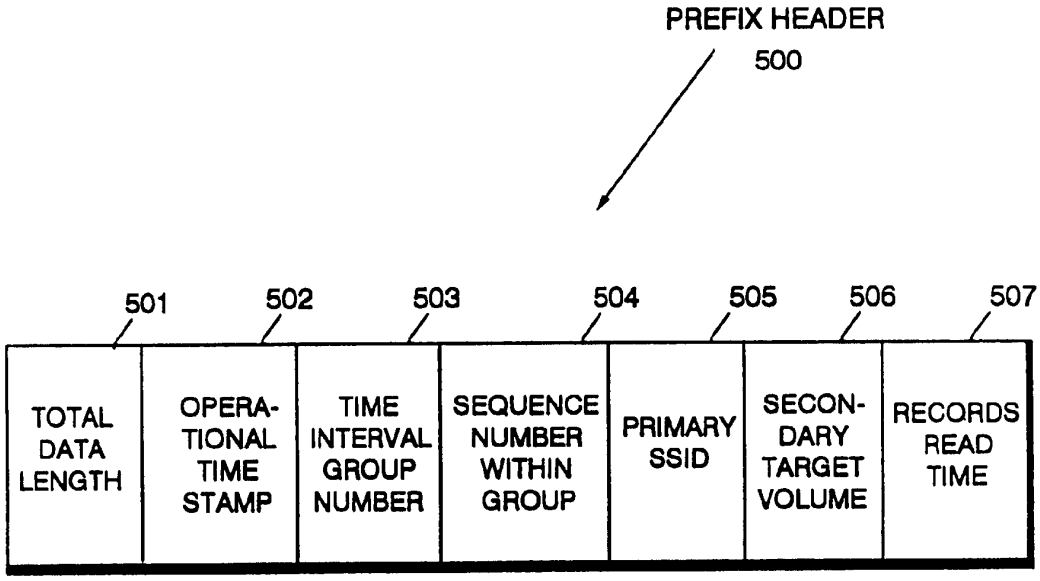

PRIMARY HOST
401
407
408
SECONDARY HOST
411
402
403
404
APPLN 1
APPLN 2
DATA MOVER (PRIMARY)
414
DATA MOVER (SECONDARY)
421
405
431
415
STORAGE CONTROLLERS
STORAGE CONTROLLERS
400
PRIMARY DASD
406
SECONDARY DASD
416
CONTROL INFO DASD
417

FIG. 5


PREFIX HEADER
500
501
502
503
504
505
506
507
TOTAL DATA LENGTH
OPERA-TIONAL TIME STAMP
TIME INTERVAL GROUP NUMBER
SEQUENCE NUMBER WITHIN GROUP
PRIMARY SSID
SECON-DARY TARGET VOLUME
RECORDS READ TIME

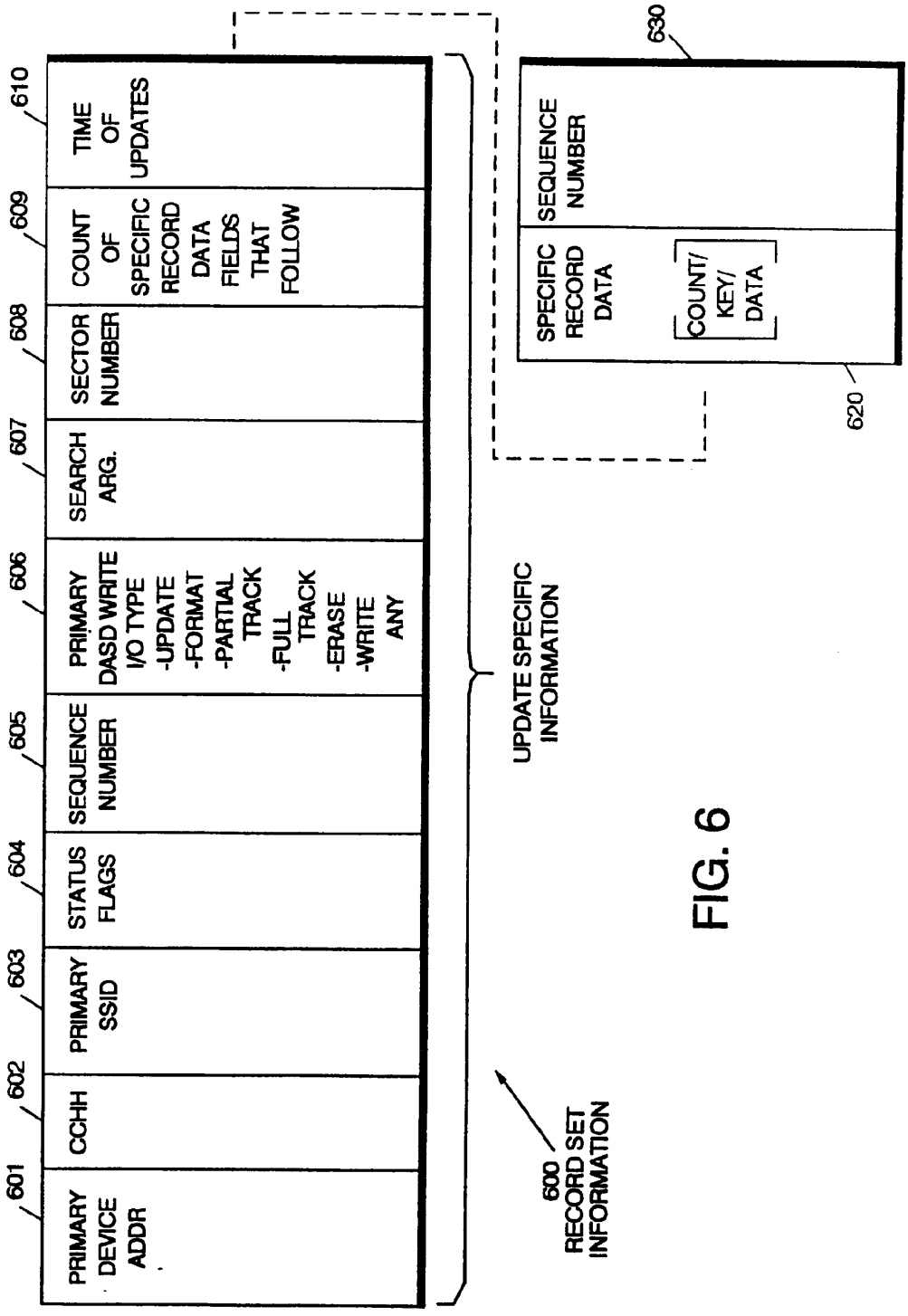
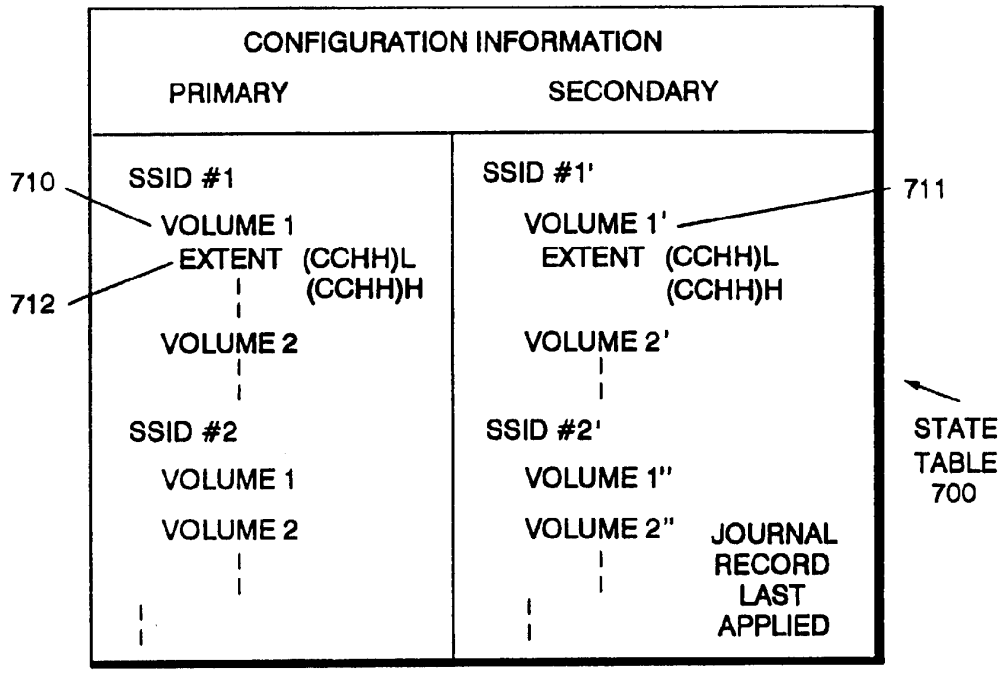

PRIMARY DEVICE ADDR
601
CCHH
602
PRIMARY SSID
603
STATUS FLAGS
604
SEQUENCE NUMBER
605
PRIMARY DASD WRITE I/O TYPE -UPDATE -FORMAT -PARTIAL TRACK -FULL TRACK -ERASE -WRITE ANY
606
SEARCH ARG.
607
SECTOR NUMBER
608
COUNT OF SPECIFIC RECORD DATA FIELDS THAT FOLLOW
609
TIME OF UPDATES
610
600 RECORD SET INFORMATION
UPDATE SPECIFIC INFORMATION
630
SEQUENCE NUMBER
SPECIFIC RECORD DATA
COUNT/ KEY/ DATA
620

FIG. 6

FIG. 7


CONFIGURATION INFORMATION
PRIMARY
SECONDARY
710
SSID #1
VOLUME 1
EXTENT (CCHH)L
(CCHH)H
712
VOLUME 2
SSID #2
VOLUME 1
VOLUME 2
SSID #1'
VOLUME 1'
EXTENT (CCHH)L
(CCHH)H
711
VOLUME 2'
SSID #2'
VOLUME 1"
VOLUME 2"
JOURNAL RECORD LAST APPLIED
STATE TABLE 700

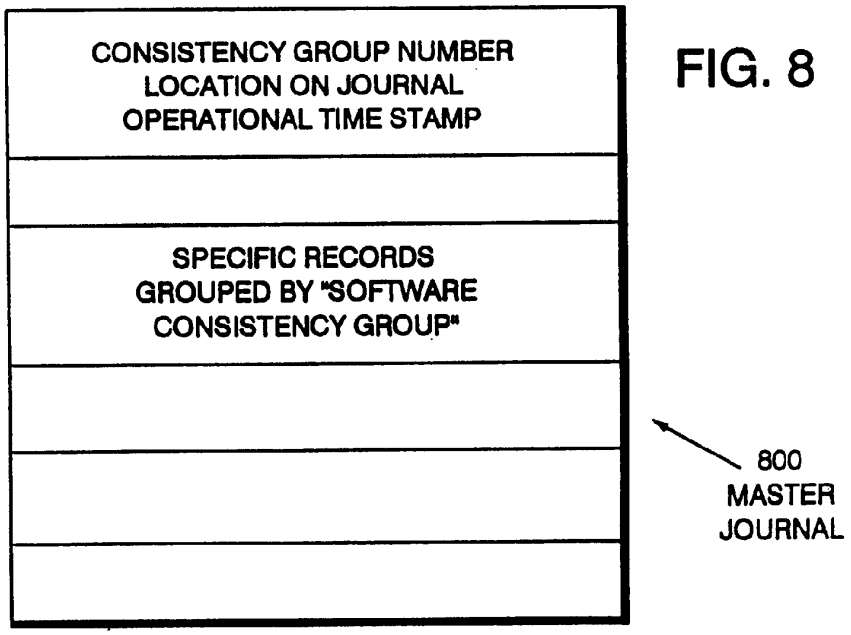

CONSISTENCY GROUP NUMBER
LOCATION ON JOURNAL
OPERATIONAL TIME STAMP
SPECIFIC RECORDS GROUPED BY "SOFTWARE CONSISTENCY GROUP"
800 MASTER JOURNAL

FIG. 8

FIG. 9

PHYSICAL CONTROL-LER ID	OPER-ATIONAL TIME STAMP	TIME INT GROUP #	READ RECORD SET TIME OF UPDATE / CONTROLLER		
			SEQ. 1 OF 3	SEQ. 2 OF 3	SEQ. 3 OF 3
SSID1	T_1	G_1	11:59 (2)	12:00 (5)	12:01 (6)
SSID2	T_1	G_1	12:00 (4)	12:02 (7)*	———
SSID3	T_1	G_1	11:58 (1)	11:59 (3)	12:02 (8)*
SSID1	T_2	G_2			
SSID2	T_2	G_2			
SSID3	T_2	G_2			
	T_3	G_3			

CONSISTENCY GROUP #1

(1) 11:58
(2) 11:59
(3) 11:59
(4) 12:00
(5) 12:00
(6) 12:01

EARLIEST OPERATIONAL TIME T_1,
EARLIEST TIME OF UPDATE ACROSS SSID,
ORDERED IN READ SEQUENCE

MIN TIME OF THE MAX TIMES OF UPDATE ACROSS ALL SSIDS

CONSISTENCY GROUP #2

(7) - - - - -
(8) - - - - -

FIG. 10

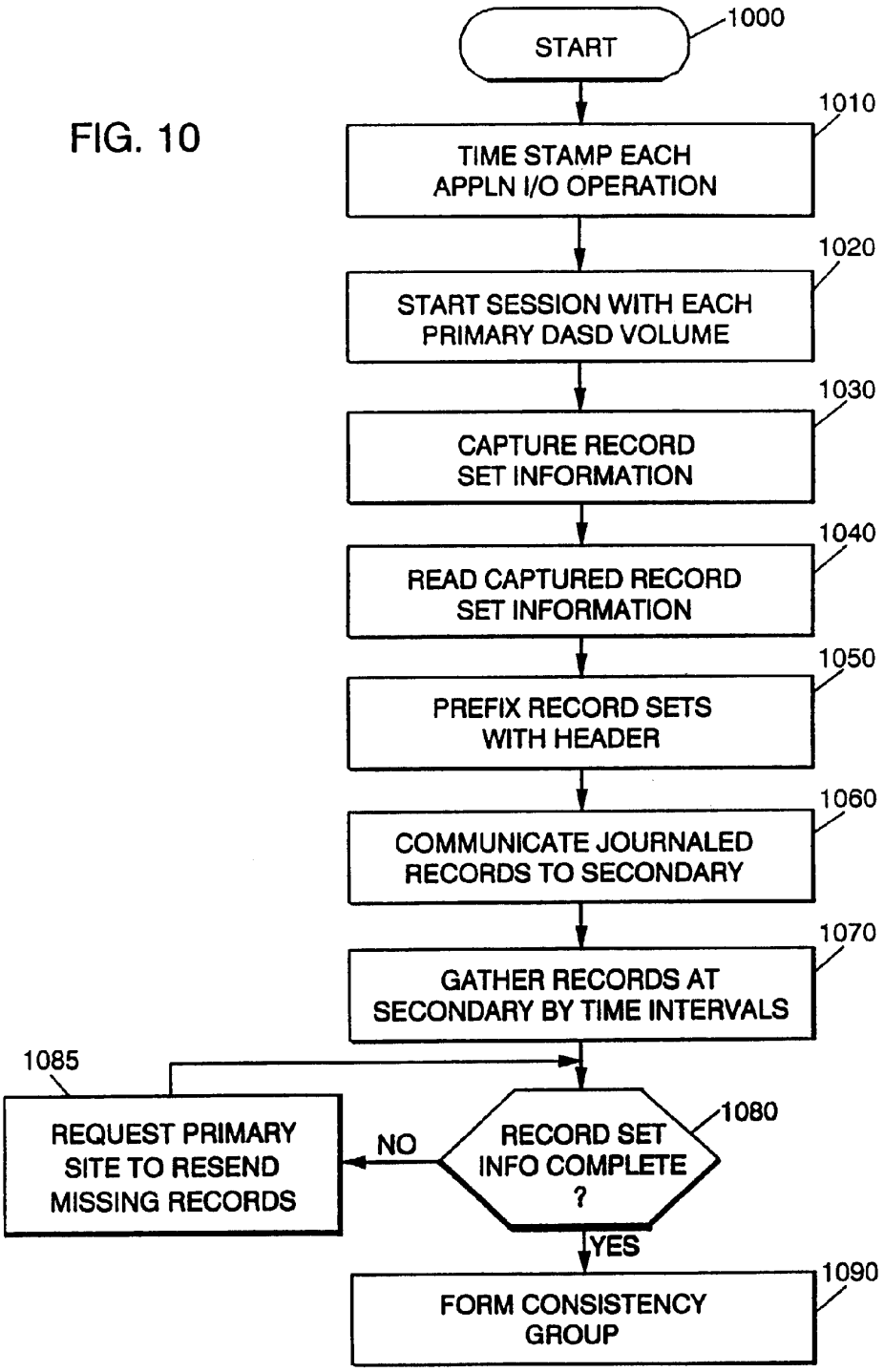

START
1000
TIME STAMP EACH APPLN I/O OPERATION
1010
START SESSION WITH EACH PRIMARY DASD VOLUME
1020
CAPTURE RECORD SET INFORMATION
1030
READ CAPTURED RECORD SET INFORMATION
1040
PREFIX RECORD SETS WITH HEADER
1050
COMMUNICATE JOURNALED RECORDS TO SECONDARY
1060
GATHER RECORDS AT SECONDARY BY TIME INTERVALS
1070
RECORD SET INFO COMPLETE ?
1080
NO
REQUEST PRIMARY SITE TO RESEND MISSING RECORDS
1085
YES
FORM CONSISTENCY GROUP
1090

FIG. 11

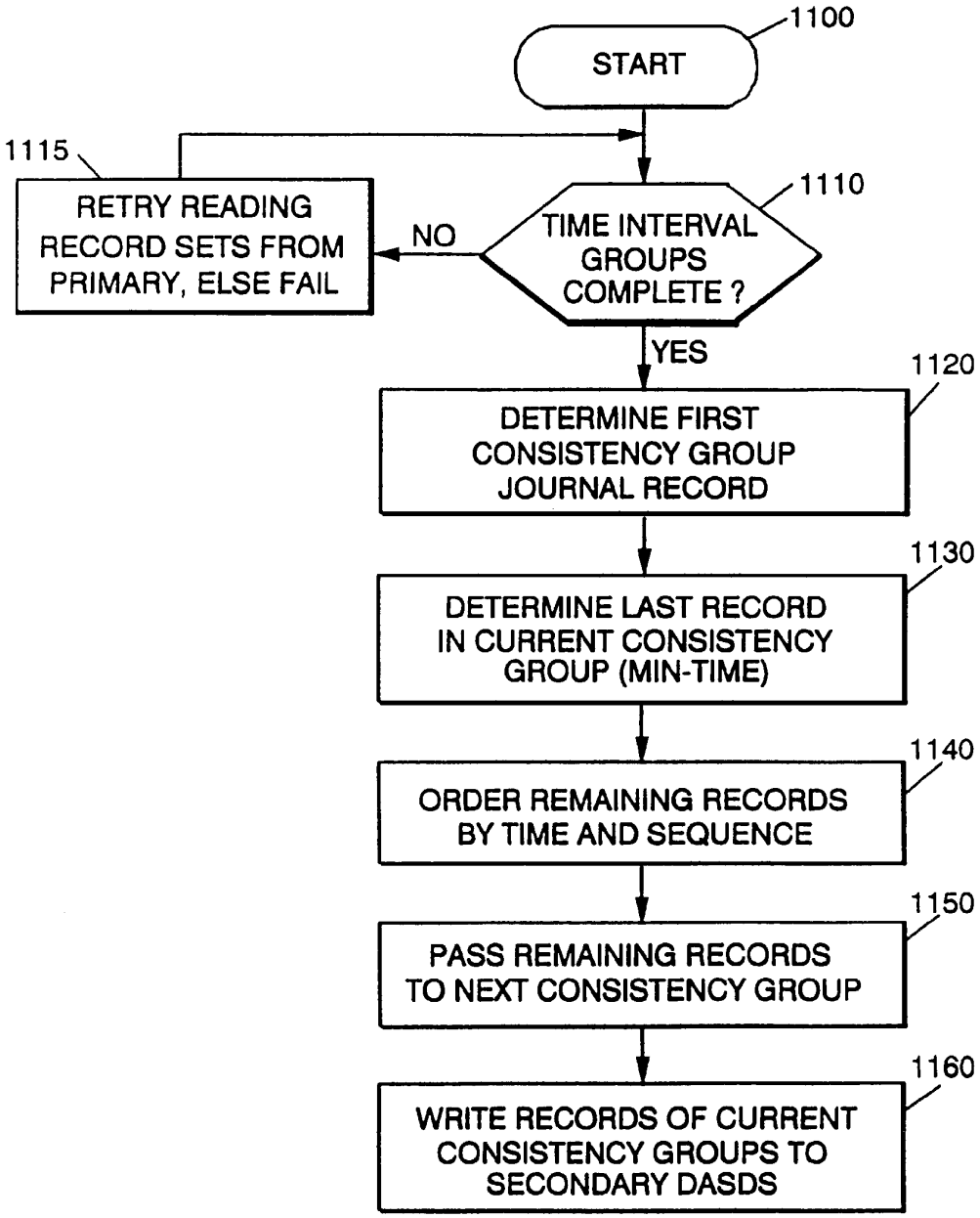


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FIG. 12

FULL CONSISTENCY GROUP RECOVERY RULES

READ RECORD SET BUFFER #2	READ RECORD SET BUFFER #1							
TYPE I/O WRITE OPERATION								
	UPDATE WRITE KL = 0	UPDATE WRITE KL ≠ 0	FORMAT WRITE FULL	FORMAT WRITE PARTIAL	ERASE FULL	ERASE PARTIAL	WRITE ANY KL = 0	WRITE ANY KL ≠ 0
UPDATE WRITE KL = 0	W*	E*	N	J	D	K	W	E*
UPDATE WRITE KL ≠ 0	E*	W*	N	J	D	K	E*	W
FORMAT WRITE FULL	T	T	R	T	R	T	R	R
FORMAT WRITE PARTIAL	C	C	N	H	F	L	W	W
ERASE FULL	T	T	R	R	R	T	T	T
ERASE PARTIAL	B	B	N	M	E	G	W	W
WRITE ANY KL = 0	W	E*	W	W	E	W	W	E*
WRITE ANY KL ≠ 0	E*	W	W	W	E	W	E*	W

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FIG. 13

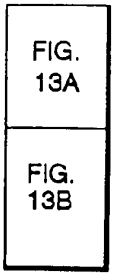

FIG. 13A

B - IF #1'S SEARCH ARG IS HIGHER THAN THE SEARCH ARG FOR #2, THEN THROW #1, ELSE DO BOTH.

C - IF #1'S RECORD IS EQUAL TO OR HIGHER THAN THE FIRST RECORD IN #2, THEN THROW #1, ELSE DO BOTH.

D - IF #2 IS UPDATING R0, THEN DO BOTH, ELSE ERROR.

E - ERROR (SHOULD NEVER HAPPEN).

E*- ERROR IF #1 AND #2 ARE THE SAME RECORD. (SHOULD NEVER HAPPEN WITHOUT A FORMAT WRITE IN BETWEEN).

F - IF FIRST RECORD IN #2 IS R1, THEN WRITE BOTH, ELSE ERROR.

G - IF #1'S SEARCH ARG IS EQUAL TO OR HIGHER THAN THE SEARCH ARG FOR #2, THEN THROW #1, ELSE ERROR.

H - IF #1'S SEARCH ARG IS HIGHER THAN THE LAST RECORD FOR #2. THEN THROW #1. ELSE IF #2'S SEARCH ARG IS HIGHER THAN THE LAST RECORD IN #1, THEN ERROR, ELSE WRITE BOTH.

TO OPTIMIZE FURTHER, CAN DO THE FOLLOWING· INSTEAD:

IF (1'S SEARCH IS EQUAL TO OR HIGHER THAN THE LAST RECORD IN #2) OR (THE LAST RECORD IN #1 IS EQUAL TO OR HIGHER THAN THE LAST RECORD IN #2) AND (2'S SEARCH IS LESS THAN OR EQUAL TO THE LAST RECORD IN #1)
THEN THROW 1
ELSE IF (#2'S SEARCH ARG IS HIGHER THAN THE LAST RECORD IN #1)
THEN ERROR
ELSE WRITE BOTH

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J - IF #2'S RECORD (OR SEARCH) IS HIGHER THAN THE LAST RECORD IN #1, THEN ERROR, ELSE WRITE BOTH.

K -IF #2'S RECORD (OR SEARCH) IS HIGHER THAN #1'S SEARCH, THEN ERROR, ELSE WRITE BOTH.

L -IF #1'S SEARCH ARG IS EQUAL TO OR HIGHER THAN #2'S SEARCH ARG THEN EITHER WRITE BOTH OR OK TO THROW #1, ELSE ERROR.

M -IF (#1'S SEARCH ARG IS EQUAL TO OR HIGHER THAN #2'S SEARCH ARG) THEN THROW 1
ELSE IF (#2'S SEARCH ARG IS HIGHER THAN THE LAST RECORD IN #1)
THEN ERROR
ELSE WRITE BOTH.

N -IF #2'S SEARCH ARG IS HIGHER THAN THE LAST RECORD IN #1, THEN ERROR, ELSE WRITE BOTH.

R -OK TO THROW #1.

T -MUST THROW 1.

W -WRITE BOTH.

W*-IF #1 AND #2 HAVE THE SAME RECORDS, THEN THROW #1, ELSE DO BOTH OR MERGE RECORDS AND DO ONE WRITE.

FIG. 13B

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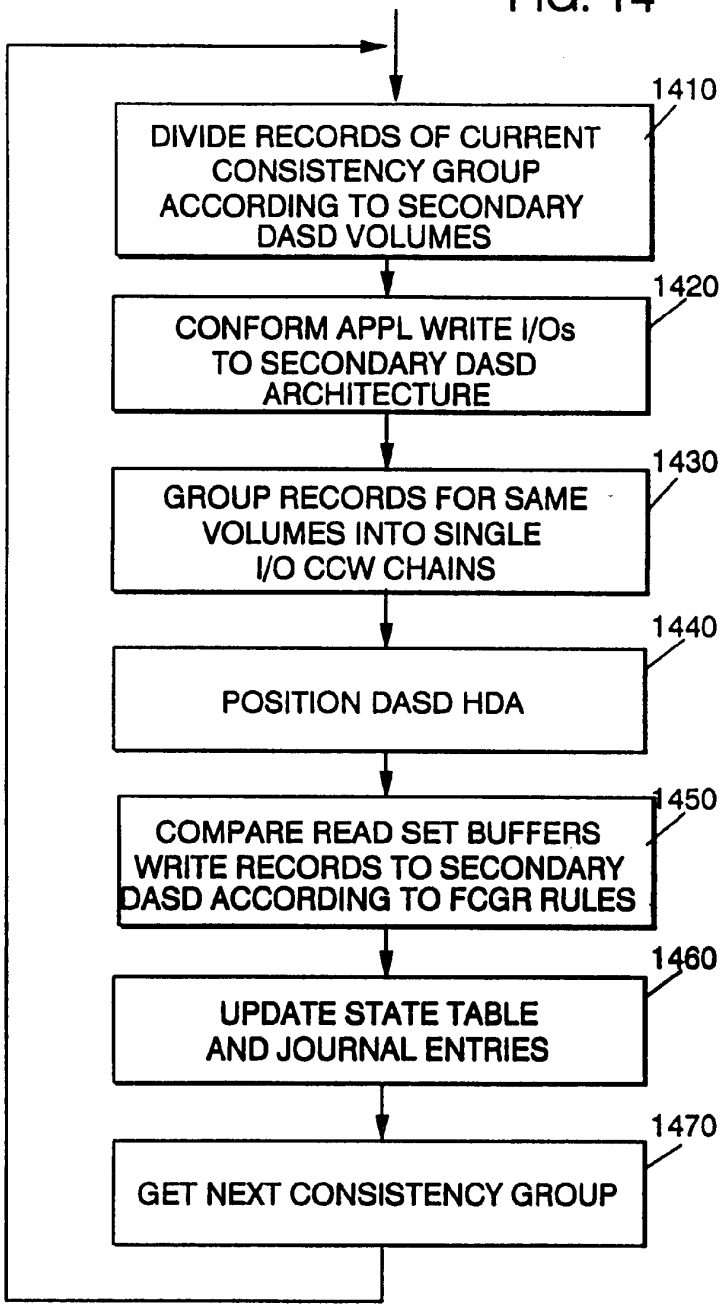
FIG. 14



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(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 111 527 B1

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
22.03.2006 Bulletin 2006/12

(51) Int Cl.:
G06Q 90/00 *(2006.01)* ***H04L 29/06*** *(2006.01)*
G06F 17/30 *(2006.01)*

(21) Application number: **00310244.9**

(22) Date of filing: **17.11.2000**

(54) **Communication method for data sychronization processing and electronic device therefor**

Kommunikationsverfahren für Datensynchronisierung und elektronische Vorrichtung dafür

Procédé de communication pour la synchronisation de données et dispositif électronique à cet effet

(84) Designated Contracting States:
DE FR GB

(30) Priority: **19.11.1999 JP 33023599**

(43) Date of publication of application:
27.06.2001 Bulletin 2001/26

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EP-A- 0 926 608

- **LI GONG: "ENCLAVES: ENABLING SECURE COLLABORATION OVER THE INTERNET" IEEE JOURNAL ON SELECTED AREAS IN COMMUNICATIONS, IEEE INC. NEW YORK, US, vol. 15, no. 3, 1 April 1997 (1997-04-01), pages 567-575, XP000683948 ISSN: 0733-8716**

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Printed by Jouve, 75001 PARIS (FR)

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Description

[0001] The present invention relates to a communication method for synchronously processing data between a plurality of devices and an electronic device therefor. In particular, the present invention relates to a communication method and an electronic device that have been modified so as to synchronize data in a wireless or wired network such that a network configuration is dynamically changed.

[0002] In recent years, apart from a personal computer, in a portable information processing terminal such as a portable cellular phone, a palm top computer or a wrist watch, personal data such as a telephone number (address) directory, schedule data, a task list, an E-mail can be managed and stored. Using this function, data is shared by using duplicate data in order to use the same data at home or outside as well as in office between electronic devices such as a personal computer or a portable information processing terminal. As a technique for keeping coincidence of a plurality of shared data, a data synchronization processing is known. For example, in the case where an attempt is made to share personal data such as an address directory or a schedule between a personal computer and a portable information processing terminal, duplication of data is created, and original data is held in the host and the duplicate data is held in each device other than the host. In the case where a change occurs with these items of data, the changed data is exchanged between these devices, whereby data consistency is maintained. This method is referred to as data synchronization.

[0003] As a typical computer program for data synchronization, Intelli Sync (Intelli Sync User's Guide Rev 3.1 Puma TECHNOLOGY 1999) is known. This enables data synchronization between personal computers or between a personal computer and a portable information processing terminal. This program enables data synchronization between two personal computers, one personal computer and one portable information processing terminal, or one personal computer and two portable information processing terminals.

[0004] In the case of this system, however, a device serving as a server must be participated in data synchronization processing. In the case where three or more devices share data, there applies a restriction that data synchronization cannot be performed between two devices other than server. Therefore, for example, in the case where a personal computer connected to a network is used as a server, thereby causing two portable information processing terminals to include the duplicate data, even if an attempt is made to use duplicate data after updated in one portable information processing terminal by the other portable information processing terminal outside, data synchronization processing cannot be performed by these portable information processing terminals other than server. Stated another way, the conventional data synchronization processing is performed between the server and the client in a one-to-one manner. It is not possible to perform the data synchronization processing in a one-to-plural manner.

[0005] Furthermore, in general, it is required to provide communication settings for a data synchronization party, settings regarding type of synchronization data, or setting of a method of solving a problem during data conflict. These settings are conventionally provided by a user operating an input device of a personal computer or portable information processing terminal through the setting screen displayed on a display device of the personal computer or portable information processing terminal and inputting data. This means that at least the display device and input device of the portable terminal device are required. Therefore, in the conventional method, because of a restriction specific to a device such as a wrist watch including device size, for example, it is very difficult to provide settings of data synchronisation in a device having only a limited input device or display device.

[0006] Accordingly, it is an object of the present invention to provide a communication method and electronic device that enables data synchronization between arbitrary devices without requiring a server.

[0007] EP-A-0926608 discloses a method of maintaining mutual consistency between copies of data stored at nodes in a network, the nodes comprising a server node, and a number of client nodes at remote locations, such as laptop computers linked by cellular telephone connections, the nodes being connected intermittently.

[0008] Following a reconnection between the remote client node and another of the nodes, timestamp information on objects cached at the other node, is sent to the remote client node. At the remote client node, the timestamp information is compared with corresponding information relating to the local copy, to determine if each of the cached objects is more up to date than the local copy. The cached objects are updated based on the local copy, according to the result of the comparison. This peer to peer resynchronisation means that the server need not monitor and control the process, so the system is more easily scaled up to handle more clients.

[0009] The document "Enclaves enabling secure collaboration over the internet", Li Gong, IEEE journal of selected areas in communications, IEEE Inc. New York, vol. 15, n. 3, 1 April 1997, discloses a group of collaborators which can dinamically form a secure virtual subnet wherein priorities are assigned to the group members for scure co-edition of files.

[0010] The invention provides a data synchronisation method as defined in Claims 1 and 22, and an electronic device and a slave device as defined in Claims 12 and 13 respectively.

[0011] Advantageous embodiments thereof are defined in the respective dependent claims.

[0012] According to the present invention, there is provided a communication method for synchronising data between a plurality of arbitrary devices using a wireless or wired network, the communication method comprising

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a member registration step and a data synchronisation step. In the member registration step, a device specified as a master by a user transmits to a device specified as a slave by the user a certificate indicating that the slave belongs to a data synchronisation group that performs a data synchronisation processing and a priority to be used when the slave performs the data synchronisation processing, and then, the slave is registered as a member of the data synchronisation group. In the data synchronisation step, it is determined using the certificate whether or not one slave and one or more other slaves capable of making wireless or wired communication belong to the same data synchronisation group, and the data synchronisation processing is performed through wireless or wired communication in accordance with the priority between the slaves which are determined to belong to the same data synchronization group.

[0013] In this communication method, apart from the data synchronization step of actually processing data synchronization, the member registration step is provided for the purpose of specifying a target device for data synchronization. At this member registration step, the certificate and priority are transmitted from a device specified as the master to a device specified as the slave, whereby the slave can be registered as a member of the data synchronization group. The certificate and priority are provided to each member, whereby data synchronization can be easily performed between slaves even if the master is absent, as long as these devices are registered in the same data synchronization group.

[0014] In this case, as to whether or not the slaves capable of making wireless or wired communication belong to the same group, it is determined by exchanging the certificate between the slaves. Thus, even if a master does not exist, data synchronization can be performed reliably and safely between the slaves. In the case where a conflict.occurs during data synchronization processing between slaves, such conflict can be solved by the priority assigned to each slave at the member registration step. Therefore, each slave may hold only the certificate and priority assigned to each slave itself, making it unnecessary to set data or the like concerning a communication party for data synchronization. Hence, a device having only its limited input device and display device can be used as a device targeted for synchronization. Further, as in a wired or wireless network such that a network configuration is dynamically changed, even in a case of use under environment that makes it difficult to provide data for statically specifying a communication party for data synchronization, a device that is such data synchronization party can be reliably specified.

[0015] The data synchronization step can be performed between one master and one or more arbitrary slaves having a certificate indicating that these slaves belong to the same group as well as between slaves.

[0016] In addition, there is no need to specify a master and a slave by devices, and an arbitrary device can be specified as a master or slave of the data synchronization group by data targeted for data synchronization. One device may function as a slave of the data synchronization group for one set of data or may function as a master of the data synchronization group for another set of data. Alternatively, one device may function as a slave of two data synchronization groups corresponding to two sets of different data.

[0017] In the case where a master and a slave are thus specified individually by data targeted for synchronization, the member registration step is also executed between a device specified as a master of a data synchronization group for the data targeted for data synchronization processing and a device specified as a slave of the master. Thus, for transmission of the certificate and priority as well, a master that is a transmission source and a slave that is a transmission destination are set by data, and the certificate and priority are set by data accordingly.

[0018] In addition to the aforementioned member registration step and data synchronization step, a master privilege transfer step may be provided, whereby only the master's function can be transferred to another device while the function and configuration of the current data synchronization group are maintained intact. Hence, a newly purchased device can be used as a master, and a slave can be temporarily used as a master outside.

[0019] In addition, it is preferable that a priority exchange step of exchanging a priority between slaves be further provided. In this manner, the priority registered in the member registration step can be changed later, and data synchronization processing can be achieved more flexibly between slaves.

[0020] The master privilege transfer step and priority exchange step as well are preferably performed after it has been determined that there does not exist any device other than two devices set in a mode for executing the above steps.

[0021] In order to easily change a member of the data synchronization group or the like, it is preferable to further provide a member registration releasing step of releasing a master or a slave from the data synchronization group. The slave releasing step may be performed by that slave device solely. However, the master releasing step is desirably executed together with the member registration releasing step of a slave communicable with the master. In this manner, a plurality of devices including a master can be released from the data synchronization group with one operation.

[0022] In addition, a conventional data synchronizing method assumes one-to-one cable connection, one-to-one connection with the server by modem, or one-to-one connection with the server by infrared-ray radiation. This is because a communication party for data synchronization can be uniquely specified.

[0023] However, if the data synchronization is performed in a bus type wired network or a wireless network free of directivity, unlike a case of one-to-one connection,

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it is required to uniquely identify a party for data synchronization from the devices in a network by any method. In addition, in the case of a wireless or wired network such that a network configuration is dynamically changed, the network address of each device is not fixed, and a network address is often assigned during network connection or the like. Thus, the network address of a communication party cannot be used as static identification information for specifying a communication party for data synchronization. Therefore, in a wire or wireless network such that a configuration is dynamically changed as well, it is required to introduce a new technology for making it possible to uniquely identify a party for data synchronization.

[0024] Although it is not presumed in one-to-one connection, in a bus type wired network or a wireless network free of directivity, there is a possibility that a device other than device for data synchronization, for example, a malicious third party exists in the same network, especially in a wireless network. Thus, it is required to ensure data security, and at the same time, to prevent data leak due to computer hacking or the like. In particular, in a wireless network, there is high possibility that a device is merely disposed within the reach of wireless communication, whereby the device can be easily participated in the network. Thus, data security is important. In addition, without maliciousness, there is a danger that data contained in a device other than that targeted for synchronization, the device existing within the reach of wireless communication, is mistakenly or unintentionally changed by data synchronization processing between devices via wireless communication.

[0025] According to the present invention, such an undesired data synchronization is prevented from being occurred since the party for data synchronization can be easily identified by exchanging the certificate between the devices.

[0026] This summary of the invention does not necessarily describe all necessary features so that the invention may also be a sub-combination of these described features.

[0027] The invention can be more fully understood from the following detailed description when taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a view illustrating a member registration step and a data synchronization step that are employed in a communication method according to one embodiment of the present invention;

FIG. 2 is a view showing an example of data set of each device employed according to the present embodiment;

FIG. 3 is a block diagram depicting the configuration of each device employed according to the present embodiment;

FIG. 4 is a view showing an example when functions provided to each device employed according to the present embodiment are classified by communication mode;

FIG. 5 is a view showing master and slave data exchange during data synchronization member registration according to the present embodiment;

FIG. 6 is a flow chart showing procedures for master processing during data synchronization member registration according to the present embodiment;

FIG. 7 is a flow chart showing procedures for slave processing during data synchronization member registration according to the present embodiment;

FIG. 8 is a view showing an example of communication mode during certificate data exchange and synchronizing process in the present embodiment;

FIG. 9 is a view showing another example of communication mode during certificate data exchange and synchronizing process in the present embodiment;

FIG. 10 is a view showing an example of processing at the time of data conflict in the present embodiment;

FIG. 11 is a flow chart showing procedures for master declaration processing in the present embodiment;

FIG. 12 is a flow chart showing procedures for slave processing in data synchronization member release processing according to the present embodiment;

FIG. 13 is a flow chart showing procedures for master processing in data synchronization member release processing according to the present embodiment;

FIG. 14 is a view showing master and slave data exchange in master privilege transfer processing according to the present embodiment;

FIG. 15 is a flow chart showing procedures for master processing during master privilege transfer processing according to the present embodiment;

FIG. 16 is a flow chart showing procedures for slave processing during master privilege transfer processing according to the present embodiment;

FIG. 17 is a view showing data exchange between devices during priority exchange in the present embodiment;

FIG. 18 is a flow chart showing procedures for device processing in priority exchange processing according to the present embodiment;

FIG. 19 is a timing chart showing set mode and execute mode applied to the present embodiment;

FIG. 20 is a view showing an example of an interface of a wrist watch to which the communication method according to the present embodiment is applied; and

FIG. 21 is a view showing an example of an interface of a portable information terminal to which the communication method according to the present embodiment is applied.

[0028] A preferred embodiment of a communication method for data synchronization processing according to the present invention will now be described with reference to the accompanying drawings.

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First Embodiment

[0029] Hereinafter, an embodiment of a method and apparatus for synchronously processing data according to the present invention will be described with reference to the accompanying drawings.

Data Synchronization Group

[0030] Data synchronization denotes processing for, in the case where part of duplicated data is asynchronously updated independently relevant to plural sets of the duplicated data, entirely synchronizing the plural sets of these duplicated data. For example, assume that a set of data (data set) that a device A has is duplicated in a device B. Synchronization processing corresponds to processing for synchronizing data sets of the devices A and B each other. If a partial data field of the data set that the device A has is changed, a partial data field of the data set that the device B has is updated during next synchronization processing.

[0031] If the same data field of the data sets of the devices A and B is changed during and after the previous synchronization processing, in order to synchronize these data fields, it is required to select which of the data field values has a higher priority. When the data in the same data field is changed with a plurality of devices during or after synchronization processing, it is referred to as data conflict.

[0032] In the present invention, unlike a conventional method, data synchronization processing between information devices is not performed by one-to-one processing between a server and a client. This processing is performed based on a data synchronization group constructed exclusively for synchronization processing. Of the information devices capable of making data communication wirelessly or using a wire, a group configured between devices that performs data synchronization is referred to as a data synchronization group (or network). Namely, a data synchronization group composed of devices that should perform data synchronization processing corresponds to a data synchronization group. In this case, such data synchronization group may not be always configured by devices, and an arbitrary data synchronization group can be configured by each data set that enables data synchronization. Namely, each information device can configure the data synchronization group by the number of data sets that can be managed.

[0033] In addition, information devices may be a device employed for limited use such as wrist watch or may be a device having a plurality of functions such as personal computer. These information devices are not restricted by their sizes or the types or functions of input/output devices or display devices and the like. The data synchronization group is configured by a plurality of information devices. A device configuring one data synchronization group is referred to as a member of the data synchronization group.

[0034] A data synchronization group is a permanent concept. Data synchronization processing is performed by a member of the data synchronization group that is configured in advance, unlike a case in which a data synchronization group is configured every time data synchronization processing is performed.

Data Synchronization Group Communication

[0035] A communication method in a data synchronization group comprises a member registration step and a data synchronization step. FIG. 1 shows an example.

[0036] The member registration step is a step to be performed when a member is added to a data synchronization group. At this member registration step, a certificate and a priority are transmitted from a device specified as a master by a user to a device that the user want to newly register as a slave. The certificate indicates that a device receiving it belongs to the same data synchronization group (data synchronization network) as the master. That is, the certificate corresponds to a group ID or the like. The priority is used when a device receiving it performs data synchronization processing, and is employed to solve data conflict.

[0037] The data synchronization step is a step that performs data synchronization processing between a plurality of arbitrary members configuring a data synchronous group.

[0038] In FIG. 1, M denotes a master of a data synchronization group. The master M is a core of the data synchronization group. Only one master exist in one data synchronization group, and has a privilege of adding a member to the data synchronization group. S_1 to S_4 denote slaves of the data synchronization group. One or more slaves exist in one data synchronization group. Data synchronization member registration is performed between the slave and the master M in the data synchronization group, whereby the slave becomes a member of the data synchronization group.

[0039] A master and a slave may not be always specified by devices, and an arbitrary device can be specified as a master or slave of the data synchronization group corresponding to the data sets. Thus, one device may function as a slave of the data synchronization group relevant to one set of data or may function as a master of the data synchronization group relevant to another set of data. Alternatively, one device may function as each of the slaves of the two data synchronization groups corresponding to two different types of data.

Member Registration Step

[0040] The member registration step is executed by making one-to-one communication between a device that is a master of a data synchronization group and a slave that newly participates in the data synchronization group. Two members configure the data synchronization group at a stage at which a first slave S_1 is registered in

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the master M. Subsequently, the member registration step is sequentially performed similarly between the master M and each of the slaves S_2 to S_4 to be newly registered, whereby the number of members configuring the data synchronization group increases one by one. The member registration step is not performed every data synchronization. Once a device is registered as the member, such registered device is continuously a member of the data synchronization group unless the device has been released explicitly. Data synchronization processing can be executed any time between the members in the same data synchronization group.

Data Synchronization Step

[0041] At the data synchronization step, data is synchronized between the members that belong to a data synchronization group. Here, all the members may perform data synchronization processing at one time or arbitrary members may perform data synchronization processing. In addition, the master M may be or may not be participated in data synchronization processing. According to the present invention, data synchronization processing can be performed between slaves. A plurality of synchronizing processes configured by other members can be performed independently at an arbitrary time, and a plurality of these synchronizing processes may be performed simultaneously in another place.

[0042] For example, as shown in FIG. 1, in the case where only the master M and the slave S_1 configure a data synchronization group, the data synchronization.step is executed between these two devices, namely between the master M and the slave S_1. Alternatively, in a state in which a slave S_2 is newly registered, the data synchronization step can be executed between the master M and slave S_1, between the master M and slave S_2, between the slave S_1 and the slave S_2, or between the master M and the slaves S_1 and S_2. Hereinafter, the synchronization step is executed similarly between arbitrary two devices irrespective of the master or slave.

Member Configuration

[0043] Now, the data and functional structures set to each of the master and slave devices will be described with reference to FIG. 2 and FIG. 3.

[0044] Set data for setting the data synchronization group that each device stores, includes master/slave specification data, identification data, certificate data, priority data, and a counter value.

[0045] The master/slave specification data is like a flag, and its initial value is blanked. When a device is registered as a master or slave, the corresponding flag is set.

[0046] The identification data denotes data for uniquely specifying a member in one data synchronization group, and is used as a key for generating certificate data. The synchronization group is defined by data type, and thus, the identification data differs depending on type of data set in one device. The identification data is generated in each device when one device is registered as a slave of a data synchronization group or when a device is operated as a master by a master declaration described later.

[0047] The certificate data corresponds to the aforementioned certificate, and is employed to certify that one device belongs to one data synchronization group.

[0048] For example, during data synchronization assume that it is authenticated by a public key encryption system as to whether or not devices belong to the same data synchronization group and encryption of synchronization data after authenticated. The identification data and the certificate data are employed as follows in an authentication and encryption system.

[0049] First, each of the master and slave generates a secret key and a public key. A pair of these secret key and public key corresponds to the identification data of each device. When the identification data is transmitted to another device, only the public key that is part of the identification data is transmitted. During data synchronization group registration, when a slave passes a public key as the identification data to a master, the master returns this public key of the slave as a certificate after the public key has been encrypted by own secret key. In this manner, the slave has own secret key and public key; and a certificate certified by the master and the public key of the master. Here, this certificate and the public key of the master are referred to as certificate data.

[0050] During actual authentication and encryption, when a device performing authentication receives a certificate from the counterpart, this certificate is decrypted by own public key of the master. If the certificate is correctly decrypted, it means that the device of the counterpart belongs to the same data synchronization group. Then, the public key of the counterpart is extracted from the decrypted data, and the synchronization data is encrypted by the extracted public key of the counterpart, and is transmitted, whereby synchronization data can be transmitted safely.

[0051] The certificate data may certify reliably that each device belongs to a data synchronization group. The data may be generated by other well known various methods without being limited to the aforementioned method.

[0052] The priority data is used to solve conflict of data synchronization as described previously. The data is used to determine a precedence (namely, priority) for solving such data conflict.

[0053] The counter value is data used to count the number of slaves registered by the master and determine the priority of that slave. The highest priority of the master is "1". The counter value is counted up every time a slave is registered, and the priorities "2", "3", ... are assigned to the slaves in order of registration. This counter is used by the master only.

[0054] As described above, the data synchronization

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group is configured by each data set. Thus, the master/slave specification data, certificate data, identification data, priority data, and counter value are provided and managed by each data set. That is, in a device having a plurality of data sets, the certificate data, identification data, priority data, and counter value are not managed in one-dimensional manner, and are manages in two-dimensional manner, namely, by each data set, as shown in FIG. 2. FIG. 2 shows an example when a device belongs to three data synchronization groups corresponding to three types of data sets, i.e., "address directory", "time", and "E-mail", respectively. In this case, in a device having these three types of data sets, whether the device operates as a master or slave by each data set is managed. The counter value is valid only for a data set of the data synchronization group that operates a master. In addition, the aforementioned member registration step is performed by data synchronization group, the certificate data, identification data, priority data, and counter value are independent of each other by each data set, respectively. The secret key and public key configuring identification data are generated by the member registration step by employing random numbers, for example. The value of the identification data is continuously maintained until it has been removed from the data synchronization group in which a device is registered as a member at the member registration step.

[0055] In this manner, in the case where set data on a data synchronization group is managed by each data set, when one performs each of the functions including data synchronization member registration, data synchronization processing, master declaration, data synchronization member releasing, master privilege transfer, and priority exchange, a step is executed such that a user can select a target data set from among the data sets in the row direction shown in FIG. 2 in order to specify what is a data set targeted for processing.

[0056] FIG. 3 shows the functional configuration of each device. This network configuration is provided as an example when a device can be configured as a master and a slave.

[0057] As shown in FIG. 3, each device includes a communication device 11, a communication controller 12, a device input/output device 13, a device input/output controller 14, an authentication unit 15, a data synchronization group setting and management unit 16, a data synchronization processing unit 17, and a synchronous data storage device 18.

[0058] The communication device 11 makes communication with another device via a wireless or wired communication. This device 11 transmits data to another device, and receives data from such another device. As a wireless communication, there can be used an electric wave communication, free of directivity such as "Bluetooth", for example. In addition, a bus type LAN such as "Ethernet" can be used as a wired network. In either of the wireless and wired communication, the network configuration may not be statically determined. The present invention is applicable to a network such that the network configuration is dynamically changed.

[0059] The communication controller 12 controls data reception and/or transmission. The controller 12 includes a function for checking data and a request received by the communication device 11; a function for transmitting and receiving a processing request and response from the device input/output controller 14; a function for making a data transmission and reception request for the communication device 11; and a function for transmitting and receiving a request and a response among the authentication unit 15, data synchronization group setting and management unit 16, and data synchronization processing unit 17, respectively.

[0060] The device input/output device 13 is a user interface, and is an input device or a display device of own device.

[0061] The device input/output controller 14 controls data request and transmission and/or reception relevant to the device input/output device 13. The controller 14 includes a function for checking data and a request received by the device input/output device 13; a function for making a processing request for the communication controller 12; a function for receiving the processing request from the communication controller 12; a management function for writing, reading, deleting data relevant to the synchronization data storage device 18; and a function making a request for and a response to the data synchronization group setting and management unit 16.

[0062] The authentication unit 15 authenticates certificate data received from another device in response to an authentication request from the communication controller 12 by correlating the data with certificate data of the own device, the data being owned by a certificate data management controller 161 through the data synchronization group setting and management unit 16. The unit 15 determines whether or not another device belongs to its data synchronization group, i.e., whether or not both of the own and other devices belong to the same data synchronization group.

[0063] The data synchronization group setting and management unit 16 generally manages settings of the data synchronization group. The unit 16 includes a certificate data management controller 161 and a priority management controller 162. The data synchronization group setting and management unit 16 manages own settings by using the certificate data management controller 161 and the priority management controller 162. The unit 16 transfers data or a processing request to the communication controller 12, authentication unit 15, device input/output controller 14, data synchronization processing unit 17, priority management controller 162, and certificate data management controller 161.

[0064] The certificate data management controller 161 has a region for storing certificate data certified by a master of the own device and a region for storing identification data that is a source of the certificate data. The controller 161 manages certificate data and identification data for

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generating such certificate data. The controller 161 includes functions for generating, deleting, and setting the certificate data and the identification that is a source of the certificate data according to a request from the data synchronization group setting and management unit 16.

[0065] The priority management controller 162 has a region for storing priority data on own device; a region for storing a counter value changed when a priority is issued in a master; and a counter device. The controller 162 includes a function for processing requests for generating, setting, deleting, and transferring priority data from the data synchronization group setting and management unit 16; and a function for resetting and incrementing the counter device.

[0066] The data synchronization controller 17 performs synchronization processing for a data set targeted for synchronization (synchronization data). The controller 17 includes a function for reading, writing, and deleting data relevant to the synchronization data storage device 18; a function for solving data conflict in view of the priority of own device and that of another synchronization device; and a function for processing a request from the communication controller 12 and delivering data.

[0067] The synchronization data storage device 18 stores synchronization data, and has a region for storing data.

[0068] The configuration of this device is provided as an example when a device can be configured as a master and a slave. This configuration may include a device (member) that can be configured as a slave only or a device (member) that can be configured as a master only. In this case, there can be provided a configuration in which functions or configurations required for a slave and a master are eliminated. For example, a certificate data producing function and a counter device and its control function and the like may be provided to only a device that can operate as a master, and is not required for a device that functions as a slave only.

[0069] Now, data synchronization group management and operation will be described here.

[0070] First, all functions owned by each device in a data synchronization group will be described with reference to FIG. 4.

[0071] A device that can configure a data synchronization group includes a total of six functions. The device includes a function to be processed without making communication with another device; a function requiring one-to-one communication between one device and another device; and a function requiring communication between one device to a plurality of devices (actually, made of a plurality of one-to-one communications). The "master declaration" function is a stand alone function that is processed without making communication with another device. The "data synchronization member registration", "master privilege transfer", and "priority exchange" functions are processed through one-to-one communication. The "data synchronization" function is performed between two or more devices. The "data synchronization member releasing" function is a stand along function in a slave, and a function that is processed through communication with one or more slaves in a master. Hereinafter, these functions will be described in detail. These functions can be performed by data synchronization group. When a function is read, it is required to specify an identification code of the data synchronization group.

(1) Data Synchronization Member Registration

[0072] In the case where a new member is added to a data synchronization group, "data synchronization member registration" processing is performed. This processing is adopted to achieve the aforementioned member registration step. The processing is performed by making data communication between a master of a data synchronization group and a member to be newly added as a slave. The master and newly registered member must be communicable with each other via a wireless or wired communication channel while power is supplied. The user calls the "data synchronization member registration" function each in the master and the member to be registered. Subsequently, each of the master and the member to be registered is placed in a member registration mode. In order to enter the member registration mode, the user interaction and exclusive control for another device are used such that the user holds down the registration button in each of the master and the new member, for example, and registration is permitted only when only two devices in the member registration mode exist, and security authentication during registration is provided. It is possible to determine whether or not only two devices in the member registration mode exist by checking a response to a broadcast from the master, for example. This prevents accidental registration of a device owned by a malicious third party within the reach of electric waves.

[0073] The effective communication range means that a device is within the reach of wireless communication in a wireless network. In a wired network, this range means a limited network area such as sub-network, for example, in which broadcasting is effective. Namely, in the range which has a possibility that a third party receives the communication, under the condition that there exists any device other than only two devices, i.e., a device targeted for member registration and a master, which are set in the member registration mode, data synchronization member registration is started.

[0074] Next, a function for registering a data synchronization member will be described in detail. In FIG. 5, there is shown master and slave communication processing to be performed together with synchronization member registration.

[0075] First, both of the master M and the slave S transmit to the counterpart a request for registering a data synchronization member, and then, the master notifies its identity to the slave. In this state, the master has all set data, but the slave has only identification data. When the slave receives the notification, it transmits the iden-

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tification data to the master. The master transmits to the slave the certificate data for this slave generated using the identification data and the priority data, and communication processing is completed.

[0076] Now, the processing step in each device will be described in detail. In FIG. 6, there is shown the step of master processing when a master device registers a slave device as a member of the data synchronization group. A description is given with reference to FIG. 3.

[0077] First, when a user call of the "data synchronization member registration" function is transmitted to the device input/output controller 14 (step S11), the current setting of the data synchronization group (whether the own device is a master or slave) is determined at the data synchronization group setting and management unit 16 (step S12). If the own device is set as a master by a master declaration function described later, the user is prompted for a request for executing registration processing. When it is set as a slave, processing is terminated. In the case where nothing is set (i.e., blank data is specified), the device operates as a newly registered member described later (FIG. 7).

[0078] In the case where the own device is set as a master, when the device input/output device 13 receives a request for executing registration processing from the user (step S13), the communication device 11 transmits a request for registering a data synchronization member in a broadcasting manner (step S14). Then, the communication device 11 waits for a registration request from a new member. Although not shown, in the case where a registration request is not made for a predetermined time, processing terminates with time out. When a registration request from a new member is received (step S15), the registered device determines whether or not only two devices requires the registration, i.e., the own device and a new member (step S16). Namely, after a request for registering a data synchronization member has been transmitted between the own device and the counterpart, if only one counterpart transmits such request for registering a data synchronization member, it is determined that only two device, i.e., the own device and new member participate the registration.

[0079] In the case where any device other than only two devices, i.e., the own device and new member participate the registration (NO at the step S16), processing is terminated. In the case where only two devices participate the registration (YES at step S16), the communication device 11 notifies its identity to the new member (step S17). Then, when identification data that is a source of certificate data from the new member is received by the communication device 11 (step S18), the data synchronization group setting and management unit 16 generates the certificate data and the priority data to be passed to the new member, based on this data (steps S19 and S20). Further, the value of the counter that counts the number of registered devices is incremented by one (step S21).

[0080] Last, the communication device 11 transmits the generated certificate data and the priority data to the new member (steps S22 and S23). Although the counter value is used as the priority data, the priority may be determined in any system as long as a precedence can be defined by generating different values every issue, thereby making it possible to uniquely judge the priority among these generated values.

[0081] Now, in FIG. 7, there is shown the step of processing a new member when a desired device (member) newly participating in a data synchronization group is registered as a data synchronization group member by a master device. A description will be described with reference to FIG. 3.

[0082] When the device input/output device 13 receives the user request for "data synchronization member registration", as in the case with FIG. 6, the current data synchronization group setting is determined by the data synchronization group setting and management unit 16. In the case where the own device is set as a master, the aforementioned "data synchronization member registration" (FIG. 6) is performed. In the case where the own device is set as a slave, processing terminates. If a data synchronization group is not set (blank data is specified as a master or slave), the user is prompted for request for executing registration processing. When the user makes a request for executing registration processing to the device input/output device 13 (step S31), the communication device 11 receives a registration request from the master (step S32), and transmits such registration request to the master (step S33). Although not shown, in the case where there exists no response from the master within a predetermined period of time, processing terminates with time out. After the registration request has been transmitted to the master, the registered device determines whether or not only two devices, i.e., the own device and master participate the registration (step S34). In the case where only the two devices participate the registration, the own device waits for the counterpart master notification. In this manner, it is determined that the counterpart is a master (step S35), the data synchronization setting and management unit 16 generates identification data that is a source of the certificate data (step S36), and transmits the data to the master (step S37).

[0083] When the communication device 11 waits for the certificate data and priority data from the master, and receives them, the certificate data and priority data are set through the data synchronization group setting and management unit 16, and registration processing completes (steps S38 and S39).

[0084] In registration processing of a data synchronization member, it is required to share a data set of the same type between the master issuing the certificate data and priority and the new member to be registered. In the case where an attempt is made to register data sets of their different types, it is required to disable registration. This collation step can be performed by checking whether or not identifiers 01, 02, and 03 are assigned in advance

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to an address directory, a time, and schedule, for example, during "transmission of a request for registering a data synchronization member" (step S14) and during "transmission of a request for registering a data synchronization member" (step S33), transmitting these identifiers between the master and the new member, and checking whether or not the identifiers are identical to each other.

[0085] Once it is guaranteed that a master and a slave that belong to a data synchronization group and a slave have a data set of the same type, it is authenticated as to whether or not the master and the slave belong to the same data synchronization group when another function is used. Thus, there is no possibility that data sets of the different types coexist. Even in a device having a plurality of data sets, the data sets in that device configure, respectively, other completely independent data synchronization groups, the data sets of different types and processing do not coexist.

(2) Data synchronization processing

[0086] Now, data synchronization processing will be described here.

[0087] When a master in a data synchronization group transmits certificate data and priority data to each member by data synchronization member registration processing, actual data synchronization processing can be performed between arbitrary members (even without intervening a master) by using at least these two sets of data.

[0088] During synchronization processing, the members belonging to the same data synchronization group first authenticate their identities each other, and then, perform data synchronization. Sets of data that do not conflict with each other are merged, respectively. In the case where a conflict occurs with some sets of data, the data with the highest priority is employed as data for solving a conflict.

[0089] As shown in FIG. 8, assume that a data synchronization group is configured by five members A, B, C, D, and E, wherein the member A is a master.

[0090] In the case where data synchronization processing is performed when all the members are present, one member transmits own certificate data to another member, receives certificate data from the counterpart, and authenticates their identity with each other. In transmission and authentication of certificate data, there is provided a method for all members transmitting/receiving certificate data to/from all the counterparts, thereby individual members using their received certificate data to authenticate their identities. Namely, among the members A to E, certificate data transmission/reception and authentication may be performed according to the number of combinations of different two members.

[0091] Alternatively, as shown in FIG. 9, certificate data transmission/reception and authentication may be performed only between a member with the highest priority (the member A here) and another member. Namely, there is provided a method in which the pairs of members such as A and B, A and C, and A and D, and A and E (the member A serves as a server), thereby performing authentication. After each of the members A to E has been authenticated to be a member of the same data synchronization group, in actual data synchronization processing, a member with the highest priority (the member A here) transmits/receives synchronization data in a data field to/from all other members, checks a conflict, solves such conflict based on the priority, and changes data so that the member can sequentially process the synchronization data in the next data field.

[0092] A conflict during data synchronization processing occurs, as shown in FIG. 10, in the case where the members A, C, and E have not been changed relevant to a data field 'x' but data owned by the members B and D is updated since previous synchronization processing. Means for solving such data conflict is to employ data owned by the member B with the highest priority. This is because, although the member A has the highest priority of the five, data is changed in the members B and D only. Even if data is not changed, a conflict during synchronization processing may be solved using the data owned by the member A with the highest priority.

[0093] Next, assume that only the members A, B, and C in this data synchronization group perform data synchronization. Such situation can occur when the members D and E are not turned ON or when only the members A, B, and C are carried to the outside, and data synchronization is performed outside. Authentication and data synchronization are performed in the same manner as described above. Then, assume that data owned by the members B and C conflict with each other (that is, assume that the data in the same data field owned by the members B and C has been updated during and after the previous synchronization). Such conflict is solved by using the data of a member having the highest priority of the members B and C. As a result, the data owned by the members A, B, and C are synchronized with each other. Assume that the remaining members D and E performs data synchronization in another place. As is the case with the members A, B, and C, if a conflict occurs, such conflict is solved by using the data with the highest priority of the members D and E, and the members D and E undergoes data synchronization.

[0094] As described above, data synchronization processing can be performed between slaves as well as between one master and one or more arbitrary slaves, each of which has a certificate indicating that they belong to the same data synchronization group that performs data synchronization processing. In this case as well, certificate data is transmitted between devices capable of making wireless or wired communication, whereby it is determined that these devices belong to the same data synchronization group. Thus, data synchronization can be performed safely by using only the certificate data without having specific data for uniquely specifying the

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counterpart.

[0095] Data synchronization processing can be performed as follows, for example.

(a) A device set in a data synchronization processing mode transmits a data synchronization processing request in a broadcasting manner to other devices that exist within a communicable range;
(b) A certificate is transmitted between these devices, and it is authenticated as to whether or not they belong to the same data synchronization group each other; and
(c) When the above devices belong to the same data synchronization group, data synchronization of the corresponding data sets is executed in accordance with each priority.

[0096] In the case of data synchronization processing, unlike registration processing of a data synchronization member as described in FIG. 6 and FIG. 7, there does not apply a restriction that only two devices, i.e., a master and a member targeted for new registration. Data synchronization processing can be performed between two or more arbitrary devices that exist within a communicable range provided they belong to the same data synchronization group. All the devices to be synchronized may be set in a data synchronization processing mode; only one device may be set in a data synchronization processing mode by the user, and another device receiving a data synchronization processing request from that device may automatically enter the data synchronization processing mode according to that request.

[0097] In addition, in actual data synchronization processing, the user may specify a data set targeted for data synchronization processing in the data sets for which data synchronization groups are set. Alternatively, it is determined as to whether devices belong to the same data synchronization group relevant to all the data sets for which the data synchronization groups are set, whereby these synchronizing processes are executed simultaneously relevant to the data sets which belong to the same data synchronization group. Authentication data exists by each data set for which the data synchronization group is set. Thus, all the authentication data is exchanged each other, for example, thereby making it possible to check a data synchronization group to which both of the counterpart device and the own device belong. Of course, the identifier assigned to each data set is transmitted, whereby a data synchronization group to be authenticated may be specified.

(3) Master Declaration

[0098] Now, a "master declaration" function for setting the own device as a master of a data synchronization group will be described here.

[0099] In the case where a data synchronization group is newly constructed, it is required to determine a member as a master of the network. The "master declaration" function is provided to achieve this. The "master declaration" can provide setting such that only a member having a data set, which does not belong to any data synchronization group, can be a master of a data synchronization group that the member will construct. That is, a device that has already been set as a slave cannot be changed to a master. This setting is provided by a stand alone, and communication with another member is not performed.

[0100] In the existing data synchronization group, the "master declaration" cannot be performed by changing to a master a member that does not belong to the data synchronization group or a member that has been set as a slave or temporarily executing "data synchronization member releasing" for a slave to remove the slave from the data synchronization group, thereafter adding it as a master again. This is required to ensure security. In the latter case, there is defined another new data synchronization group in which a member performing "master declaration" is set as a master. The "master declaration" is used any time only when a new data synchronization group is constructed.

[0101] In FIG. 11, there is shown the processing step of "master declaration" in which a new member is set as a master of a new data synchronization group by the "master declaration".

[0102] When the user first makes an operation for calling the "master declaration" function for a data set through the device input/output device 13 (step S41), the data synchronization group setting and management unit 16 checks the current setting of the own device in the data synchronization group (step S42). In the case where the device has been set as a master or slave, processing is terminated. If no data synchronization group is defined (i.e., if blank data is specified as a master or slave), the data synchronization group setting and management unit 16 generates identification data on a data synchronization group (step S43), and generates authentication data based on the generated identification data (step S44).

[0103] Further, in the data synchronization group setting and management unit 16, a priority counter is reset, and the initial value of the counter is set as priority data indicative of own priority (steps S45 and S46). Then, the counter is incremented, and processing is terminated.

(4) Data Synchronization Member Releasing

[0104] "Data synchronization member releasing" is performed when a registered device is released from a data synchronization group. This operation differs depending on a master and a slave, and thus, a description will be given separately.

[0105] First, a description will be given with respect to a case in which a slave is released from a data synchronization group. This function is used when a slave participating in a data synchronization group is used while the slave is excluded from the member of the synchro-

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nization group or when a slave device is discarded. The "data synchronization member releasing" is a stand-alone operation, and communication with a master or another device is not required. The existing data synchronization group is not affected by this function. The priority data owned by the released slave will be vacant because it is not reused in "data synchronization member registration". However, this does not mean that consistency of the data synchronization group is not destroyed.

[0106] In FIG. 12, there is shown the processing step when "data synchronization member releasing" is performed in a slave.

[0107] First, when a user make a request for "data synchronization member releasing" for the device input/output device 13 relevant to a data set (step S51), the data synchronization group setting and management unit 16 determines the current setting of the own device in the data synchronization group (step S52). When the own device is a slave, the data synchronization group setting and management unit 16 deletes the corresponding priority data, certificate data, and identification data (steps S53, S54, and S55). This releasing is performed by each synchronization group, and thus, network identification data is also specified when the releasing function is called.

[0108] In the case where a master is released from a data synchronization group, if a slave currently communicable with the master exists when "data synchronization member releasing" is performed, this slave is also released from the data synchronization group. This is because the master generally dismembers a slave without transferring its master privilege when the master desired to release the slave from the data synchronization group. In addition, only a communicable slave is released from the data synchronization group simultaneously because it is not assumed that all members in the data synchronization group are always present by the fact that the master cannot grasp all the members in the data synchronization group and the fact the slave is placed in another place due to purchase of a new device, discarding, faults, theft or the like. In this case, a slave that does not exist on the spot still participates in the previous data synchronization group, and data synchronization can be performed between the slaves that do not exist on the spot. However, in this case, since a master does not exist any longer, a data synchronization group member cannot be increased by newly performing data synchronization member registration.

[0109] In FIG. 13, there is shown the processing step when "data synchronization member releasing" is performed in a master. When a user makes a request for "data synchronization member releasing" relevant to a data set to the device input/output device 13, as described in FIG. 12, the data synchronization group setting and management unit 16 determines the current data synchronization group. In the case where the own device is a master, this device searches for a currently communicable slave (step S61). This may be determined according to a response from the slave relevant to data transmitted in a broadcasting manner. Then, the own device transmits a request for "data synchronization member releasing" and the master certificate data to a slave within the currently communicable range (steps S62 and S63).

[0110] The slave receiving this request performs authentication by using the master certificate data, and then, resets own setting as in "data synchronization member releasing" in the slave.

[0111] The master is then deletes the priority data, certificate data, identification data, and counter values of the own device, the counter is reset, and processing is terminated (steps S64 to S67).

(5) Master Privilege Transfer

[0112] The "master privilege transfer" function allows a data synchronization group to continuously exist intact in the existing data synchronization group, and allows the current master to transfer only the master's privilege to another member (slave). This function is used when one attempt to transfer a master privilege to another device while maintaining the functions and configuration of the data synchronization group, including cases in which where one attempts to specify a newly purchased device as a master of the existing data synchronization group; a master device is discharged; one attempts to change the current master device to a new device; and, when a desk top personal computer that is not mobile is specified as a master, one attempt to temporarily perform "data synchronization member registration" outside. This means that the slave and master privileges are exchanged in the existing data synchronization group. Alternatively, the master privilege may be transferred to a member that is not included in a data synchronization group by automatically exchange the privileges in combination with "data synchronization member registration".

[0113] In this process, the "master privilege transfer" function is called by a master and each slave device that transfers the master privilege. In a method similar to the "data synchronization member registration", the set data held by the master is transferred to a slave, and the set data held by the slave is transferred to the master. The data held by each of the master and slave is exchanged intact. Individual members do not have data concerning another device each other, and thus, these individual members do not affect those in another data synchronization group. Thus, processing can be performed safely and simply as in the "data synchronization member registration".

[0114] Now, the "master privilege transfer" function will be described in detail,

[0115] Here, master and slave communication processing to be performed together with the "master privilege transfer" processing will be described with reference to FIG. 14.

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[0116] First, both of the master and the slave transmit a master privilege transfer request to each other. When both of them receive this request, they transmit certificate data for device authentication. After authentication processing, the master transmits the identification data, priority data, and counter value to the slave. Alternatively, the slave transmits the priority data and identification data, and communication processing is completed.

[0117] Now, the processing steps in each device will be described in detail. FIG. 15 shows the processing steps in a master device having the "master privilege transfer" function. A description will be given with reference to FIG. 3.

[0118] When the device input/output device 13 receives the "master privilege transfer" request from the user (step S71), the data synchronization group setting and management unit 16 judges the current setting of the own device in the data synchronization group (step S72). When the device is a master, the device input/output device 13 continuously waits for a request for executing processing from the user. When the device input/output device 13 receives a request for executing processing (step S73), the communication device 11 transmits a request for master privilege transfer processing in a broadcasting manner (step S74). Then, the communication device 11 waits a request for such transfer processing from the counterpart device. When such request from the counterpart device arrives (step S75), the communication device 11 and the communication controller 12 determine whether or not only the own device and the counterpart device are executable the master privilege transfer processing (step S76). In the case of affirmative determination (YES at the step S76), the communication device 11 transmits certificate data to the counterpart device (step S77). The sequence of the steps of transferring certificate data and determining the number of executable devices may be reversed. When the communication device 11 receives certificate data from the counterpart device (step S78), the authentication unit 15 and data synchronization group setting and management unit 16 authenticate the counterpart device, and determines that the counterpart device exists in the same data synchronization group as the master (step S79). If authentication fails, processing terminates (NO at the step S79). When authentication is successful (YES at the step S79), the data synchronization group setting and management unit 16, communication controller 12, and communication device 11 transmit the identification data, priority data, and counter value owned by the own device to the slave (steps S80, S81, and S82). Then, the communication device 11 receives the priority data and identification data from the slave (steps S83 and S84). The data synchronization group setting and management unit 16 sets the priority data, certificate data, and identification data received from the slave as own priority data, certificate data, and identification data (step S85), and resets the counter. Then, processing terminates (step S86). In this manner, a device that has been a master is specified as a slave device.

[0119] The timings of transmitting the priority data, counter value, certificate data, and identification data owned by the own device (steps S77, S80, S81, and S82) and those of receiving the priority data, certificate data, and identification data from a slave (steps S78, S83, and S84) may be in accordance with an arbitrary sequence.

[0120] Slave operations are generally similar to master operation. The processing steps are shown in FIG. 16.

[0121] When the device input/output device 13 receives a "master privilege transfer" request from the user, as described in FIG. 15, the data synchronization group setting and management unit 16 judges the current setting of the own device in the data synchronization group. In the case where this setting is not provided, processing terminates. When the device is a master, the aforementioned master operation is performed. In the case where it is determined as a slave, the device input/output device 13 waits for a request for executing master privilege transfer processing from the user. When the user executes master privilege transfer processing for the device input/output device 13 (step S91), the communication device 11 receives a master privilege transfer request from a master (step S92), and transmits the master privilege transfer request to the master (step S93). Then, at the step S94, the communication device 11 and the communication controller 12 check the number of devices that are executable for master privilege transfer processing. In the case where only one device other than own device is executable (YES at the step S94), it goes to the following steps.

[0122] First, the certificate data is exchanged with the master (steps S95 and S96). Then, the authentication unit 15 and the data synchronization group setting and management unit 16 authenticates the counterpart (step S97). After authentication, in the case where the communication counterpart is not a master of the data synchronization group to which the own device belong (NO at the step S97), processing terminates. In the case where the counterpart is the master (YES at the step S97), the priority data, counter value, and identification data owned by the master is received from the communication device 11 (steps S99, S100, and S101). Then, after the priority data and identification data owned by the own device have been transferred from the communication device 11 (steps S101 and S102), the data synchronization setting and management unit 16 sets the received master's identification data, certificate data, priority data, and counter value as own data (steps S103 and S104), and processing terminates.

[0123] The data synchronization group master can be set by each data set. In the case where a master device has a plurality of data sets, the master privilege transfer processing may be performed for only set data concerning a specific data set specified by the user. Of course, if a slave device specified as a transfer destination has a plurality of data sets, the master privileges concerning all the data sets owned by the master device can be trans-

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ferred to one slave device in all.

(6) Priority Exchange

[0124] A "priority exchange" function exchanges the priorities owned by two slaves with each other. If a conflict occurs during data synchronization, such conflict is solved by using data on a member with its higher priority. The priority is assigned from the master in registration order. Thus, there can occur a case in which the user wants to cause the data on a slave registered later to precede the data on a slave registered previously. Although the priority may be selected during data synchronization member registration, the master or slave requires a display interface for selecting the priority. Here, devices are numbered in registration order for the purpose of simplification of processing so that priorities can be exchanged. At the time of "priority exchange" as well, as is the case with "data synchronization member registration" or "master privilege transfer", processing is performed only when only two devices are set.

[0125] Now, the communication processing step when the priorities are exchanged between slaves will be described with reference to FIG. 17.

[0126] First, slaves that want to exchange priorities transmit a priority exchange request to each other. When one slave receives such request, both of them transmit certificate data to each other. After it has been determined that the slaves belong to the same data synchronization group, both exchange priority data, and communication processing terminates.

[0127] In FIG. 18, there is shown the processing step of "priority exchange" in each slave device that exchanges the priority.

[0128] When the device input/output device 13 receives a "priority exchange" request from the user (step S101), the data synchronization group setting and management unit 16 judges the current setting of the own device in the data synchronization group. In the case where the setting is not provided or in the case of a master, processing terminates. In the case of a slave, the device input/output device 13 waits for a request for executing processing from the user. When the device input/output device 13 receives a request for executing processing (step S103), the communication device 11 transmits a request for processing "priority exchange" in a broadcasting manner, and waits for such request for processing "priority exchange" from the counterpart that exchange the priority. Then, when the communication device 11 receives a request for processing "priority exchange" from the counterpart (step S105), the communication controller 12 determines the number of devices that are currently executable for "priority exchange" (step S105) by using the data from the communication device 11 (step S106). In the case where only one device other than the own device is executable for "priority exchange" (YES at the step S106), the data synchronization group setting and management unit 16, communication controller 12, and communication device 11 receive and/or transmit certificate data from and/or to each other (steps S107 and S108). If three or more devices are executable within a communicable range (NO at the step S106), processing is terminated.

[0129] After certificate data has been transmitted and/or received, the authentication unit 15 and the data synchronization group setting and management unit 16 authenticate the communication counterpart based on the authentication data received at the communication device 11 (step S109). When it is authenticated that the counterpart device is a member of the same synchronization group (YES at the step S109), the own device transmits own priority data, and receives the counterpart's priority data (steps S110 and S111). Then, the data synchronization group setting and management unit 16 rewrites its own priority with the received priority, and terminates processing (step S112).

[0130] In the case where a device functions as a slave of the data synchronization group, the device having a plurality of data sets, the processing shown in FIG. 18 may be performed for a data set in which priority exchange is specified by the user.

(7) Method for Setting a Device

[0131] During each of the "data synchronization member registration", "priority exchange", and "master privilege transfer" processes, it is required to ensure safety of data communication to be performed together with setting. Therefore, prior to exchange actually set data, two devices targeted for setting are moved to be requested for executing processing. Then, after it is determined as to whether or not only two devices are requested for executing processing in a communicable range, it is required to determine whether or not such setting is continued. A series of these processes will be described in more detail.

[0132] In connection to these processes, each device has a set mode and an execute mode. The set mode serves to specify call functions including "data synchronization member registration", "priority change", and "master privilege transfer". The execute mode serves to start actual processing of a function called by the set mode, and make data communication with the set counterpart as required. Therefore, this execute mode means a request for executing processing.

[0133] In the case where a user attempts to perform "data synchronization member registration", "priority change", or "master privilege transfer", as shown in FIG. 19, the user moves two devices targeted for setting (devices 1 and 2) to the set mode. Then, each device determines which function is called, and determines whether or not the called function is valid in current setting of the own device. For example, in the case where the user attempts to perform "data synchronization member registration", the user determines that the called function is the "data synchronization member registration", and de-

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termines whether or not the own device is a mater, slave or none. When the called function is valid, it can go to the execute mode. User's operation is required for the current mode to go to the execute mode.

[0134] The user simultaneously moves two devices to the execute mode relevant to the same function (strictly, an error Δt of about 1 second is permitted). At a stage before communication with the counterpart is established in the execute mode, each device waits for data indicating the execute mode from another device. After each device has received the data, each device transmits it to a transmission channel. During this data transmission, a data broadcasting transmission may be repeated with predetermined time intervals, for example. When each device receives data indicating the execute mode of the counterpart, after it is determined that there exists no other device that enters this mode and the devices 1 and 2 communicate with each other, communication of set data is started. In communication of the set data, data is encrypted to ensure security by using an encryption system such as the aforementioned public key encryption system. In the case where there exists any other device entering the execute mode, communication regarding the set data is not performed, and processing is interrupted and terminated.

[0135] A method of configuring a data synchronization group and the functions of each device has been described hereinbefore. Now, a specific example of providing devices configuring a data synchronization group will be described here.

[0136] FIG. 20 shows an example when a system for this communication method is applied to a wrist watch, and FIG. 21 shows an example when this system is applied to a portable information processing terminal.

[0137] In the wrist watch shown in FIG. 20, sections associated with data synchronization are two buttons that exist at the left of a character board and four display sections at the upper part of a clock display section. The two buttons include an upper left button employed to instruct a request for executing each function for setting a data synchronization group and for instructing the start of data synchronization processing; and a lower left button for selecting each function for setting a data synchronization group. The display sections include a mode display section for displaying each function for setting a data synchronization group; a display section for displaying a character M or S that represents a master or slave; a display section indicating a numeric value of priority data; and a display section indicating whether or not a data synchronization group is currently set. For a description of use, procedures for executing two typical functions, "data synchronization member registration" and "data synchronization processing" will be discussed here.

[0138] First, the "data synchronization member registration" will be described here. The lower left button is used to call a "data synchronization member registration" mode. The mode display section displays that the "data synchronization member registration" function has been called. When this call is valid, the user holds down the upper left button, and executes a request for "data synchronization member registration." In this example, if this wrist watch is registered as a member by a given master, the similar procedures are performed in the master as well. When the aforementioned "data synchronization member registration" processing is successful while both devices execute the request, registration processing completes. In the case of "data synchronization processing", the upper left button is first pressed, whereby a function for starting synchronization processing is executed. If one or more devices belong to the same synchronization group that exists in a communicable range, and that can execute synchronization processing, data synchronization processing is actually started. The start of data synchronization processing may be executed by any one device calling the corresponding function or may be executed by all the devices calling the data synchronization processing start functions simultaneously, all of these devices being actually targeted for data synchronization processing at this time.

[0139] A data set that the wrist watch has is generally limited to time data (clock data). Thus, a device targeted for data synchronization processing with the wrist watch is a device that belongs to a data synchronization group concerning time data (clock data) in the devices that exist in a range communicable with the wrist watch.

[0140] In FIG. 21, there is shown an example of the screen for setting data synchronization of a portable information processing terminal. Shown here is an example of the screen for setting data synchronization concerning time data. This screen is composed of a "set menu" for calling each function provided at the upper left part; a display section that is set to display the current settings; and an execute button for starting data synchronization processing, the button being provided at the lower left. In the case where an attempt is made to perform data synchronization with a device that exists in the range communicable with the portable information processing terminal, belongs to the same data synchronization group capable of executing synchronization processing, a synchronization button at the lower right is pressed, whereby the data synchronization processing is called. In addition, the "data synchronization member registration" is selected from the set menu, whereby the data synchronization member registration screen is displayed. The execute button provided on this screen is held down, whereby the function for data synchronization member registration can be executed in the same manner as in the foregoing example of the wrist watch.

[0141] As has been described above, according to the communication method of the present embodiment, there is no need to provide set data concerning a communication counterpart for data synchronization. Basically, data synchronization processing can be performed safely and reliably by a certificate (certificate data) and a priority. Thus, data synchronization processing can be performed between arbitrary slaves without requiring a

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master. In particular, the present invention is preferable to application to a device that makes wireless communication outside. Moreover, synchronization processing of a data set that belongs to the same data synchronization group is automatically executed with another device that exists in a communicable range by instructing the start of synchronization processing. Therefore, in a device having only a limited user interface such as wrist watch or portable cellular phone, the device being difficult in setting concerning a communication counterpart as well, data synchronization can be easily performed by data synchronization group such that a group member is dynamically changed.

[0142] For example, although each embodiment has been described singly, a plurality of embodiments may be combined with each other as required. The communication method according to the present embodiment can be achieved by a computer program. Thus, the computer program is recorded in a computer readable recording medium such as CD-ROM, and then, is introduced into the computer or the computer program is recorded into the recording medium such as ROM, and then, is merely incorporated into an electronic device, making it possible to achieve an effect similar to the present embodiment using a general electronic device.

[0143] As has been described above, according to the present invention, it is possible to provide a communication method and electronic device that enables data synchronization between arbitrary devices without requiring a server. It is possible to perform data synchronization with a device that does not have a limited input device and a display device. It is possible to make communication for data synchronization safely between arbitrary devices in a wired or wireless network such that a network configuration dynamically changes. In exchanging set data between devices, only specific two devices perform setting operations simultaneously after the presence of two set devices has been guaranteed, whereby setting can be done safely.

Claims

1. A data synchronisation method comprising the steps of:

   transmitting from a master device to a slave device a certificate indicating that the slave device belongs to a data synchronisation group to which the master device belongs and a priority to be used for solving conflict of data during data synchronisation, thereby registering the slave device as a member of the data synchronisation group to which the master device belongs;
   determining whether or not a first slave device and a second slave device which is capable of communicating with the first slave device belong to the same data synchronisation group by using the certificate;
   and performing data synchronisation between the first slave device and the second slave device based on the priority if the first slave device and the second slave device belong to the same data synchronisation group.

2. The method according to Claim 1, wherein said registering is performed after it is confirmed that there is no device other than said master device and said slave device capable of communicating with said master device and set in a registration mode.

3. The method according to Claim 1, wherein said data synchronisation is performed between one master device and one or more slave devices which belong to the same synchronisation group or between at least two slave devices which belong to the same synchronisation group.

4. The method according to Claim 1, wherein said master device and slave device store plural types of data and belong to plural data synchronisation groups defined for each of said plural types of data.

5. The method according to Claim 4, wherein said registering is performed by transmitting said certificate and said priority from the master device belonging to a given synchronisation group defined for a given type of data to the slave device belonging to the given synchronisation group, said certificate and said priority being set depending on the given type of data.

6. The method according to Claim 1, further comprising transmitting data required to operate as the master device from said master device to a slave device which is targeted to transfer a master privilege, thereby transferring the master privilege to the slave device.

7. The method according to Claim 6, wherein said master privilege transferring is performed after it is confirmed that there is no slave device other than said master device and said slave device capable of communicating with said master device and set in a master privilege transfer mode.

8. The method according to Claim 1, further comprising exchanging the priority between slave devices that belong to the same data synchronisation group.

9. The method according to Claim 8, wherein said priority exchanging is performed after it is confirmed that there is no slave device other than said master device and said slave device capable of communicating with said master device and set in a priority exchanging mode.

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10. The method according to Claim 1, further comprising releasing said master device or said slave device from the data synchronisation group, wherein, if said master device is released, said master device transmits a releasing instruction to a slave device which is capable of communicating with said master device to release said slave device as well as said master device.

11. A method according to claim 4, wherein said registering is performed by transmitting said certificate and said priority from the master device set by a user for a given type of data to the slave device set by the user for the given type of data, said certificate and said priority being set depending on the type of data.

12. An electronic device comprising:

a master unit, when an own device is set by a user as a master, configured to transmit to a slave device a certificate indicating that the slave device belongs to a data synchronization group to which the master device belongs and a priority to be used for solving conflict of data during data synchronisation, thereby registering the slave device as a member of the data synchronization group to which the master device belongs;
a slave unit, when the own device is set by the user as the slave, configured to receive from the master unit the certificate and the priority; and
a data synchronization unit (16, 17) configured to determine whether or not the own device and another device which is capable of communicating with the own device belong to the same data synchronization group by using the certificate, and perform data synchronization between the own device and the other device based on the priority if the own device and the other device belong to the same data synchronization group.

13. A slave device comprising:

a receiver (11, 12) configured to receive, from a master device for a data synchronization group, a certificate indicating that the slave device belongs to the data synchronization group to which the master device belongs and a priority to be used for solving conflict of data during data synchronisation;
a memory (18) configured to store the received certificate and the priority;
a certification unit (15) configured to determine, when a synchronization request from another device is received, whether or not the other device and the slave device belong to the same data synchronization group by using the certificate stored in the memory; and
a synchronization unit (17) configured to perform data synchronization between the other device and the slave device based on the priority stored in the memory when the certification unit determines that the other device and the slave device belong to the same data synchronization group.

14. The device according to claim 13, wherein said memory (18) is configured to store the received certificate and the priority after it is confirmed that there is no device other than said master device and said slave device, capable of communicating with said master device and set in a registration mode.

15. The device according to claim 13, wherein said other device comprises a master device or one or more slave devices.

16. The device according to claim 13, wherein said master device and slave device are adapted to store plural types of data and belong to plural data synchronization groups defined for each of said plural types of data.

17. The device according to claim 16, wherein said memory (18) is configured to store said certificate and said priority from the master device belonging to a given synchronization group defined for a given type of data, said certificate and said priority being set depending on the given type of data.

18. The device according to claim 13, wherein the receiver (11, 12) is configured to receive data required to operate as the master device from said master device, thereby transferring a master privilege to the slave device.

19. The device according to claim 18, wherein said master privilege transferring is performed after it is confirmed that there is no slave device other than said master device and said slave device capable of communicating with said master device and set in a master privilege transfer mode.

20. The device according to claim 13, further comprising an exchanging unit configured to exchange the priority between another slave device that belongs to the same data synchronization group.

21. The device according to claim 20, wherein said priority exchanging is performed after it is confirmed that there is no slave device other than said master device and said slave device capable of communicating with said master device and set in a priority exchanging mode.

22. A data synchronization method for a slave device comprising the steps of:

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receiving from a master device for a data synchronization group, a certificate indicating that the slave device belongs to the data synchronization group to which the master device belongs and a priority to be used for solving conflict of data during data synchronization;
storing the received certificate and the priority;
determining, when a synchronization request from another device is received, whether or not the other device and the slave device belong to the same data synchronization group by using the stored certificate; and
performing data synchronization between the other device and the slave device based on the stored priority when it is determined that the other device and the slave device belong to the same data synchronization group.

23. The method according to claim 22, comprising the step of storing the received certificate and the priority after it is confirmed that there is no device other than said master device and said slave device capable of communicating with said master device and set in a registration mode.

24. The method according to claim 22, wherein said other device comprises: a master device or one or more slave devices.

25. The method according to claim 22, wherein said master device and said slave device belong to plural data synchronization groups and comprising storing, in said master device and said slave device, plural types of data defined for each of said plural data synchronization groups.

26. The method according to claim 25, comprising storing said certificate and said priority from the master device belonging to a given synchronization group defined for a given type of data, said certificate and said priority being set depending on the given type of data.

27. The method according to claim 22, comprising receiving data required for a slave device to operate as the master device from said master device, for transferring a master privilege to the slave device.

28. The method according to claim 27, wherein transferring of said master privilege is performed after it is confirmed that there is no slave device other than said master device and said slave device capable of communicating with said master device and set in a master privilege transfer mode.

29. The method according to claim 22, further comprising exchanging the priority between another slave device that belongs to the same data synchronization group.

30. The method according to claim 29, wherein exchanging of priority is performed after it is confirmed that there is no slave device other than said master device and said slave device capable of communicating with said master device and set in a priority exchanging mode.

31. A carrier medium carrying computer readable instructions for controlling a computer to carry out a method of any one of claims 1 to 11 and 22 to 30.

Revendications

1. Procédé de synchronisation de données, comprenant les étapes consistant à :

transmettre d'un dispositif maître à un dispositif esclave un certificat indiquant que le dispositif esclave appartient à un groupe de synchronisation de données auquel appartient le dispositif maître et une priorité à utiliser pour résoudre un conflit de données pendant la synchronisation de données, enregistrant ainsi le dispositif esclave comme un membre du groupe de synchronisation de données auquel appartient le dispositif maître ;
déterminer si oui ou non un premier dispositif esclave et un deuxième dispositif esclave, qui est capable de communiquer avec le premier dispositif esclave, appartiennent au même groupe de synchronisation de données en utilisant le certificat ; et
effectuer la synchronisation de données entre le premier dispositif esclave et le deuxième dispositif esclave sur la base de la priorité si le premier dispositif esclave et le deuxième dispositif esclave appartiennent au même groupe de synchronisation de données.

2. Procédé selon la revendication 1, dans lequel ledit enregistrement est effectué après qu'il a été confirmé qu'il n'existe aucun dispositif autre que ledit dispositif maître et ledit dispositif esclave capable de communiquer avec ledit dispositif maître et paramétré en mode d'enregistrement.

3. Procédé selon la revendication 1, dans lequel ladite synchronisation de données est effectuée entre un seul dispositif maître et un ou plusieurs dispositifs esclaves qui appartiennent au même groupe de synchronisation ou entre au moins deux dispositifs esclaves qui appartiennent au même groupe de synchronisation.

4. Procédé selon la revendication 1, dans lequel ledit

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dispositif maître et ledit dispositif esclave stockent plusieurs types de données et appartiennent à plusieurs groupes de synchronisation de données définis pour chacun desdits plusieurs types de données.

5. Procédé selon la revendication 4, dans lequel ledit enregistrement est effectué en transmettant ledit certificat et ladite priorité du dispositif maître appartenant à un groupe de synchronisation donné défini pour un type donné de données au dispositif esclave appartenant au groupe de synchronisation donné, ledit certificat et ladite priorité étant paramétrés en fonction du type donné de données.

6. Procédé selon la revendication 1, comprenant en outre la transmission de données nécessaires pour fonctionner comme le dispositif maître, dudit dispositif maître à un dispositif esclave qui est ciblé pour transférer un privilège de maître, transférant ainsi le privilège de maître au dispositif esclave.

7. Procédé selon la revendication 6, dans lequel ledit transfert de privilège de maître est effectué après qu'il a été confirmé qu'il n'existe aucun dispositif esclave autre que ledit dispositif maître et ledit dispositif esclave capable de communiquer avec ledit dispositif maître et paramétré en mode de transfert de privilège de maître.

8. Procédé selon la revendication 1, comprenant en outre l'échange de la priorité entre des dispositifs esclaves qui appartiennent au même groupe de synchronisation de données.

9. Procédé selon la revendication 8, dans lequel ledit échange de priorité est effectué après qu'il a été confirmé qu'il n'existe aucun dispositif esclave autre que ledit dispositif maître et que ledit dispositif esclave, capable de communiquer avec ledit dispositif maître et paramétré en mode d'échange de priorité.

10. Procédé selon la revendication 1, comprenant en outre la libération dudit dispositif maître ou dudit dispositif esclave du groupe de synchronisation de données, dans lequel, si ledit dispositif maître est libéré, ledit dispositif maître transmet une instruction de libération à un dispositif esclave qui est capable de communiquer avec ledit dispositif maître pour libérer ledit dispositif esclave ainsi que ledit dispositif maître.

11. Procédé selon la revendication 4, dans lequel ledit enregistrement est effectué en transmettant ledit certificat et ladite priorité du dispositif maître paramétré par un utilisateur pour un type donné de données au dispositif esclave paramétré par l'utilisateur pour le type donné de données, ledit certificat et ladite priorité étant paramétrés en fonction du type de données.

12. Dispositif électronique, comprenant :

une unité de maître, quand un dispositif lui-même est paramétré par un utilisateur comme maître, configurée pour transmettre à un dispositif esclave un certificat indiquant que le dispositif esclave appartient à un groupe de synchronisation de données auquel appartient le dispositif maître et une priorité à utiliser pour résoudre un conflit de données pendant la synchronisation de données, enregistrant ainsi le dispositif esclave comme un membre du groupe de synchronisation de données auquel appartient le dispositif maître ;
une unité d'esclave, quand le dispositif lui-même est paramétré par l'utilisateur comme esclave, configurée pour recevoir de l'unité de maître le certificat et la priorité ; et
une unité de synchronisation de données (16, 17) configurée pour déterminer si oui ou non le dispositif lui-même et un autre dispositif, qui est capable de communiquer avec le dispositif lui-même, appartiennent au même groupe de synchronisation de données en utilisant le certificat, et pour effectuer une synchronisation de données entre le dispositif lui-même et l'autre dispositif sur la base de la priorité si le dispositif lui-même et l'autre dispositif appartiennent au même groupe de synchronisation de données.

13. Dispositif esclave, comprenant :

un récepteur (11, 12) configuré pour recevoir, d'un dispositif maître pour un groupe de synchronisation de données, un certificat indiquant que le dispositif esclave appartient au groupe de synchronisation de données auquel appartient le dispositif maître et une priorité à utiliser pour résoudre un conflit de données pendant la synchronisation de données ;
une mémoire (18) configurée pour stocker le certificat reçu et la priorité ;
une unité de certification (15) configurée pour déterminer, quand une demande de synchronisation d'un autre dispositif est reçue, si oui ou non l'autre dispositif et le dispositif esclave appartiennent au même groupe de synchronisation de données en utilisant le certificat stocké dans la mémoire ; et
une unité de synchronisation (17) configurée pour effectuer la synchronisation de données entre l'autre dispositif et le dispositif esclave sur la base de la priorité stockée dans la mémoire quand l'unité de certification détermine que l'autre dispositif et le dispositif esclave appar-

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tiennent au même groupe de synchronisation de données.

14. Dispositif selon la revendication 13, dans lequel ladite mémoire (18) est configurée pour stocker le certificat reçu et la priorité après qu'il a été confirmé qu'il n'existe aucun dispositif autre que ledit dispositif maître et ledit dispositif esclave, capable de communiquer avec ledit dispositif maître et paramétré en mode d'enregistrement.

15. Dispositif selon la revendication 13, dans lequel ledit autre dispositif comprend un dispositif maître ou un ou plusieurs dispositifs esclaves.

16. Dispositif selon la revendication 13, dans lequel lesdits dispositifs maître et esclave sont adaptés pour stocker plusieurs types de données et appartiennent à plusieurs groupes de synchronisation de données définis pour chacun desdits plusieurs types de données.

17. Dispositif selon la revendication 16, dans lequel ladite mémoire (18) est configurée pour stocker ledit certificat et ladite priorité provenant du dispositif maître appartenant à un groupe de synchronisation donné défini pour un type donné de données, ledit certificat et ladite priorité étant paramétrés en fonction du type donné de données.

18. Dispositif selon la revendication 13, dans lequel le récepteur (11, 12) est configuré pour recevoir des données nécessaires pour fonctionner comme le dispositif maître dudit dispositif maître, transférant ainsi un privilège de maître au dispositif esclave.

19. Dispositif selon la revendication 18, dans lequel ledit transfert de privilège de maître est effectué après qu'il a été confirmé qu'il n'existe aucun dispositif esclave autre que ledit dispositif maître et ledit dispositif esclave capable de communiquer avec ledit dispositif maître et paramétré en mode de transfert de privilège de maître.

20. Dispositif selon la revendication 13, comprenant en outre une unité d'échange configurée pour échanger la priorité entre un autre dispositif esclave qui appartient au même groupe de synchronisation de données.

21. Dispositif selon la revendication 20, dans lequel ledit échange de priorité est effectué après qu'il a été confirmé qu'il n'existe aucun dispositif esclave autre que ledit dispositif maître et ledit dispositif esclave capable de communiquer avec ledit dispositif maître et paramétré en mode d'échange de priorité.

22. Procédé de synchronisation de données pour un dispositif esclave comprenant les étapes consistant à :

recevoir d'un dispositif maître pour un groupe de synchronisation de données, un certificat indiquant que le dispositif esclave appartient au groupe de synchronisation de données auquel appartient le dispositif maître et une priorité à utiliser pour résoudre un conflit de données pendant la synchronisation de données ;
stocker le certificat reçu et la priorité ;
déterminer, quand une demande de synchronisation d'un autre dispositif est reçue, si oui ou non l'autre dispositif et le dispositif esclave appartiennent au même groupe de synchronisation de données en utilisant le certificat stocké ; et
effectuer la synchronisation de données entre l'autre dispositif et le dispositif esclave sur la base de la priorité stockée quand il est déterminé que l'autre dispositif et le dispositif esclave appartiennent au même groupe de synchronisation de données.

23. Procédé selon la revendication 22, comprenant l'étape consistant à stocker le certificat reçu et la priorité après qu'il a été confirmé qu'il n'existe aucun dispositif autre que ledit dispositif maître et que ledit dispositif esclave, capable de communiquer avec ledit dispositif maître et paramétré en mode d'enregistrement.

24. Procédé selon la revendication 22, dans lequel ledit autre dispositif comprend : un dispositif maître ou un ou plusieurs dispositifs esclaves.

25. Procédé selon la revendication 22, dans lequel ledit dispositif maître et ledit dispositif esclave appartiennent à plusieurs groupes de synchronisation de données et comprenant le stockage, dans ledit dispositif maître et ledit dispositif esclave, de plusieurs types de données définis pour chacun desdits plusieurs groupes de synchronisation de données.

26. Procédé selon la revendication 25, comprenant le stockage dudit certificat et de ladite priorité dudit dispositif maître appartenant à un groupe de synchronisation donné défini pour un type donné de données, ledit certificat et ladite priorité étant paramétrés en fonction du type donné de données.

27. Procédé selon la revendication 22, comprenant la réception de données nécessaires pour qu'un dispositif esclave fonctionne comme le dispositif maître dudit dispositif maître, pour transférer un privilège de maître au dispositif esclave.

28. Procédé selon la revendication 27, dans lequel le transfert dudit privilège de maître est effectué après

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qu'il a été confirmé qu'il n'existe aucun dispositif esclave autre que ledit dispositif maître et que ledit dispositif esclave capable de communiquer avec ledit dispositif maître et paramétré en mode de transfert de privilège de maître.

29. Procédé selon la revendication 22, comprenant en outre l'échange de la priorité entre un autre dispositif esclave qui appartient au même groupe de synchronisation de données.

30. Procédé selon la revendication 29, dans lequel l'échange de priorité est effectué après qu'il a été confirmé qu'il n'existe aucun dispositif esclave autre que ledit dispositif maître et que ledit dispositif esclave capable de communiquer avec ledit dispositif maître et paramétré en mode d'échange de priorité.

31. Moyen de support supportant des instructions lisibles par ordinateur pour commander un ordinateur pour qu'il exécute un procédé selon l'une quelconque des revendications 1 à 11 et 22 à 30.

Patentansprüche

1. Ein Datensynchronisationsverfahren umfassend die Schritte:

Übertragen eines Zertifikats von einem Haupt- bzw. Master-Gerät zu einem Folge- bzw. Slave-Gerät, wobei das Zertifikat andeutet, dass das Slave-Gerät zu einer Datensynchronisationsgruppe gehört, zu der das Master-Gerät gehört, sowie einer Priorität, die während der. Datensynchronisation zum Lösen von Datenkonflikten einzusetzen ist, wodurch das Slave-Gerät als ein Mitglied der Datensynchronisationsgruppe, zu der das Master-Gerät gehört, registriert wird;
Bestimmen ob oder nicht ein erstes Slave-Gerät und ein zweites Slave-Gerät, das in der Lage ist, mit dem zu derselben Datensynchronisationsgruppe gehörenden, ersten Slave-Gerät unter Verwendung des Zertifikats zu kommunizieren;
und Ausführen einer Datensynchronisation zwischen dem ersten Slave-Gerät und dem zweiten Slave-Gerät gestützt auf die Priorität, falls das erste Slave-Gerät und das zweite Slave-Gerät zu derselben Datensynchronisationsgruppe gehören.

2. Das Verfahren nach Anspruch 1, wobei das Registrieren ausgeführt wird, nachdem bestätigt worden ist, dass es kein anderes Gerät als das erste Master-Gerät und das Slave-Gerät gibt, das in der Lage ist, mit dem Master-Gerät zu kommunizieren, und in einen Registrierungsmode eingestellt ist.

3. Das Verfahren nach Anspruch 1, wobei die Datensynchronisation zwischen einem Master-Gerät und einem oder mehreren Slave-Geräten, die zu derselben Synchronisationsgruppe gehören, oder zwischen wenigstens zwei Slave-Geräten, die zu derselben Synchronisationsgruppe gehören, ausgeführt wird.

4. Das Verfahren nach Anspruch 1, wobei das Master-Gerät und Slave-Geräte vielfache Datentypen speichern und zu mehreren Datensynchronisationsgruppen, die jeweils für die vielfachen Datentypen definiert sind, gehören.

5. Das Verfahren nach Anspruch 4, wobei das Registrieren ausgeführt wird, indem das Zertifikat und die Priorität von dem Master-Gerät, das zu einer gegebenen Synchronisationsgruppe gehört, die für einen gegebenen Datentyp definiert ist, zu dem Slave-Gerät, das zu der gegebenen Synchronisationsgruppe gehört, wobei das Zertifikat und die Priorität in Abhängigkeit vom gegebenen Datentyp eingestellt werden.

6. Das Verfahren nach Anspruch 1, ferner umfassend das Übertragen von Daten, die zum Operieren als das Master-Gerät des Master-Geräts erforderlich sind, zu einem Slave-Gerät, das darauf gerichtet ist, ein Master-Privileg zu übertragen, wodurch das Master-Privileg auf das Slave-Gerät übertragen wird.

7. Das Verfahren nach Anspruch 6, wobei das Übertragen des Master-Privilegs ausgeführt wird, nachdem bestätigt worden ist, dass es kein anderes Slave-Gerät verschieden von dem Master-Gerät und dem Slave-Gerät gibt, das in der Lage ist, mit dem Master-Gerät zu kommunizieren, und in einen Master-Privileg-Übertragungsmodus eingestellt ist.

8. Das Verfahren nach Anspruch 1, ferner umfassend Austauschen der Priorität zwischen zu der gleichen Datensynchronisationsgruppe gehörenden Slave-Geräten.

9. Das Verfahren nach Anspruch 8, wobei das Austauschen der Priorität ausgeführt wird, nachdem bestätigt worden ist, dass es kein Slave-Gerät verschieden von dem Master-Gerät und dem Slave-Gerät gibt, das in der Lage ist, mit dem Master-Gerät zu kommunizieren, und in einen Prioritätsaustauschmodus eingestellt ist.

10. Das Verfahren nach Anspruch 1, ferner umfassend Freigeben des Master-Geräts oder Slave-Geräts aus der Datensynchronisationsgruppe, wobei, wenn das Master-Gerät freigegeben wird, das Master-Ge-

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rät eine Freigabeanweisung an ein Slave-Gerät überträgt, welches in der Lage ist, mit dem Master-Gerät zu kommunizieren, um sowohl das Slave-Gerät als auch das Master-Gerät freizugeben.

11. Ein Verfahren nach Anspruch 4, wobei das Registrieren ausgeführt wird, indem das Zertifikat und die Priorität von dem durch einen Benutzer für einen gegebenen Datentyp eingestellten Master-Gerät übertragen wird, an das von dem Benutzer für einen gegebenen Datentyp eingestellte Slave-Gerät, wobei das Zertifikat und die Priorität in Abhängigkeit von dem Datentyp eingestellt werden.

12. Ein elektronisches Gerät umfassend:

eine Haupt- bzw. Master-Einheit, wenn ein eigenes Gerät durch einen Benutzer als ein Master eingestellt ist, konfiguriert zum Übertragen eines Zertifikat zu einem Slave-Gerät, wobei das Zertifikat andeutet, dass das Slave-Gerät zu einer Datengruppe gehört, zu der das Master-Gerät gehört, sowie einer Priorität, die zum Lösen von Datenkonflikten während der Datensynchronisation einzusetzen ist, wodurch das Slave-Gerät als ein Mitglied der Datensynchronisationsgruppe, zu der das Master-Gerät gehört, registriert wird;
eine Slave-Einheit, wenn das eigene Gerät durch den Benutzer als der Slave eingestellt wird, konfiguriert, zum Empfangen des Zertifikats und der Priorität von der Master-Einheit; und
eine Datensynchronisationseinheit (16, 17), konfiguriert zum Bestimmen unter Verwendung des Zertifikats, ob oder nicht das eigene Gerät und ein anderes Gerät, das in der Lage ist, mit dem eigenen Gerät zu kommunizieren, zu der gleichen Datensynchronisationsgruppe gehört, und Ausführen der Datensynchronisation zwischen dem eigenen Gerät und dem anderen Gerät gestützt auf die Priorität, falls das eigene Gerät und das andere Gerät zu der gleichen Datensynchronisationsgruppe gehören.

13. Ein Slave-Gerät umfassend:

einen Empfänger (11, 12), von einem Master-Gerät für eine Datensynchronisationsgruppe konfiguriert zum Empfangen eines Zertifikats, das andeutet, dass das Slave-Gerät zu der Datensynchronisationsgruppe gehört, zu der das Master-Gerät gehört, sowie einer Priorität, die zum Lösen von Datenkonflikten während der Datensynchronisation einzusetzen ist;
einen Speicher (18), konfiguriert zum Speichern des empfangenen Zertifikats und der Priorität;
eine Zertifizierungseinheit (15), konfiguriert zum Bestimmen, unter Verwendung des in dem Speicher gespeicherten Zertifikats, wenn eine Synchronisationsanfrage von einem anderen Gerät empfangen wird, ob oder nicht das andere Gerät und das Slave-Gerät zu derselben Datensynchronisationsgruppe gehören; und
eine Synchronisationseinheit (17), konfiguriert zum Ausführen von Datensynchronisation, gestützt auf der in dem Speicher gespeicherten Priorität, zwischen dem anderen Gerät und dem Slave-Gerät, wenn die Zertifizierungseinheit feststellt, dass das andere Gerät und das Slave-Gerät zu der gleichen Datensynchronisationsgruppe gehören.

14. Das Gerät nach Anspruch 13, wobei der Speicher (18) konfiguriert ist zum Speichern des empfangenen Zertifikats und der Priorität, nachdem bestätigt worden ist, dass es kein Gerät verschieden von dem Master-Gerät und dem Slave-Gerät gibt, das in der Lage ist, mit dem Master-Gerät zu kommunizieren, und in einen Registrierungsmodus eingestellt ist.

15. Das Gerät nach Anspruch 13, wobei das andere Gerät ein Master-Gerät oder eine oder mehrere Slave-Geräte umfasst.

16. Das Gerät nach Anspruch 13, wobei das Master-Gerät und das Slave-Gerät dazu angepasst sind, vielfältige Datentypen zu speichern und zu vielfältigen, jeweils für die vielfältigen Datentypen definierten Datensynchronisationsgruppen zu gehören.

17. Das Verfahren nach Anspruch 16, wobei der Speicher (18) konfiguriert ist zum Speichern des Zertifikats und der Priorität von dem Master-Gerät, das zu einer gegebenen, für einen gegebenen Datentypen definierten Synchronisationsgruppe gehört, wobei das Zertifikat und die Priorität in Abhängigkeit von dem gegebenen Datentyp eingestellt werden.

18. Das Gerät nach Anspruch 13, wobei der Empfänger (11, 12) konfiguriert ist zum Empfangen von Daten, die zum Operieren als das Master-Gerät des Master-Geräts benötigt werden, wodurch ein Master-Privileg auf das Slave-Gerät übertragen wird.

19. Das Gerät nach Anspruch 18, wobei das Übertragen des Master-Privilegs ausgeführt wird, nachdem bestätigt worden ist, dass es kein Slave-Gerät verschieden von dem Master-Gerät gibt, und dass das Slave-Gerät in der Lage ist, mit dem Master-Gerät zu kommunizieren, und in einen Master-Privileg-Übertragungsmodus eingestellt ist.

20. Das Gerät nach Anspruch 13, ferner umfassend eine Austauscheinheit, konfiguriert zum Austauschen der Priorität zwischen einem anderen, zu der gleichen

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Datensynchronisationsgruppe gehörenden Slave-Gerät.

21. Das Gerät nach Anspruch 20, wobei das Austauschen der Priorität ausgeführt wird, nachdem bestätigt worden ist, dass es kein Slave-Gerät verschieden von dem Master-Gerät und dem Slave-Gerät gibt, das in der Lage ist, mit dem Master-Gerät zu kommunizieren, und in einen Prioritätsaustauschmodus eingestellt ist.

22. Ein Datensynchronisationsverfahren für ein Slave-Gerät, umfassend die Schritte:

Empfangen eines Zertifikats von einem Haupt- bzw. Master-Gerät für eine Datensynchronisationsgruppe, wobei das Zertifikat andeutet, dass das Slave-Gerät zu der Datensynchronisationsgruppe gehört, zu der das Master-Gerät gehört, sowie einer Priorität, die zum Lösen von Datenkonflikten während der Datensynchronisation einzusetzen ist;
Abspeichern des empfangenen Zertifikats und der Priorität;
Bestimmen, unter Verwendung des gespeicherten Zertifikats, wann eine Synchronisationsanfrage von einem anderen Gerät empfangen wird, ob oder nicht das andere Gerät und das Slave-Gerät zu der gleichen Datensynchronisationsgruppe gehören; und Ausführen einer Datensynchronisation zwischen dem anderen Gerät und dem Slave-Gerät gestützt auf die gespeicherte Priorität, wenn bestimmt worden ist, dass das andere Gerät und das Slave-Gerät zu dergleichen Datensynchronisationsgruppe gehören.

23. Das Verfahren nach Anspruch 22, umfassend den Schritt des Abspeicherns des empfangenen Zertifikats und der Priorität, nachdem bestätigt worden ist, dass es kein Gerät anders als das Master-Gerät und das Slave-Gerät gibt, das dazu in der Lage ist, mit dem Master-Gerät zu kommunizieren, und in einen Registrierungsmodus eingestellt ist.

24. Das Verfahren nach Anspruch 22, wobei das andere Gerät ein Master-Gerät und eine oder mehrere Slave-Geräte umfasst.

25. Das Verfahren nach Anspruch 22, wobei das Master-Gerät und die Slave-Geräte zu mehreren Datensynchronisationsgruppen gehören, und das umfasst Speichern in dem Master-Gerät und dem Slave-Gerät von vielfältigen, für jedes der vielfältigen Datensynchronisationsgruppen definierten Typen von Daten.

26. Das Verfahren nach Anspruch 25, umfassend Speichern des Zertifikats und der Priorität, die von dem zu einer gegebenen, für einen gegebenen Datentyp definierten Synchronisationsgruppe gehörenden Master-Gerät, wobei das Zertifikat und die Priorität in Abhängigkeit von dem gegebenen Datentyp eingestellt werden.

27. Das Verfahren nach Anspruch 22, umfassend Empfangen von Daten, die für ein Slave-Gerät benötigt werden zum Operieren als das Master-Gerät von dem Master-Gerät, zum Übertragen eines Master-Privilegs auf das Slave-Gerät.

28. Das Verfahren nach Anspruch 27, wobei das Übertragen des Master-Privilegs ausgeführt wird, nachdem bestätigt worden ist, dass es kein anderes Slave-Gerät verschieden von dem Master-Gerät und dem Slave-Gerät gibt, das in der Lage ist, mit dem Master-Gerät zu kommunizieren, und in einen Master-Privileg-Übertragungsmodus eingestellt ist.

29. Das Verfahren nach Anspruch 22, ferner umfassend das Austauschen der Priorität zwischen einem anderen, zu der gleichen Datensynchronisationsgruppe gehörenden Slave-Gerät.

30. Das Verfahren nach Anspruch 29, wobei das Austauschen der Priorität ausgeführt wird, nachdem bestätigt worden ist, dass es kein Slave-Gerät gibt verschieden von dem Master-Gerät und dem Slave-Gerät, das in der Lage ist, mit dem Master-Gerät zu kommunizieren, und in einen Prioritätsaustauschmodus eingestellt ist.

31. Ein Speichermedium, das computerlesbare Anweisungen trägt zum Steuern eines Computers, um ein Verfahren nach einem der Ansprüche 1 bis 11 und 22 bis 30 auszuführen.

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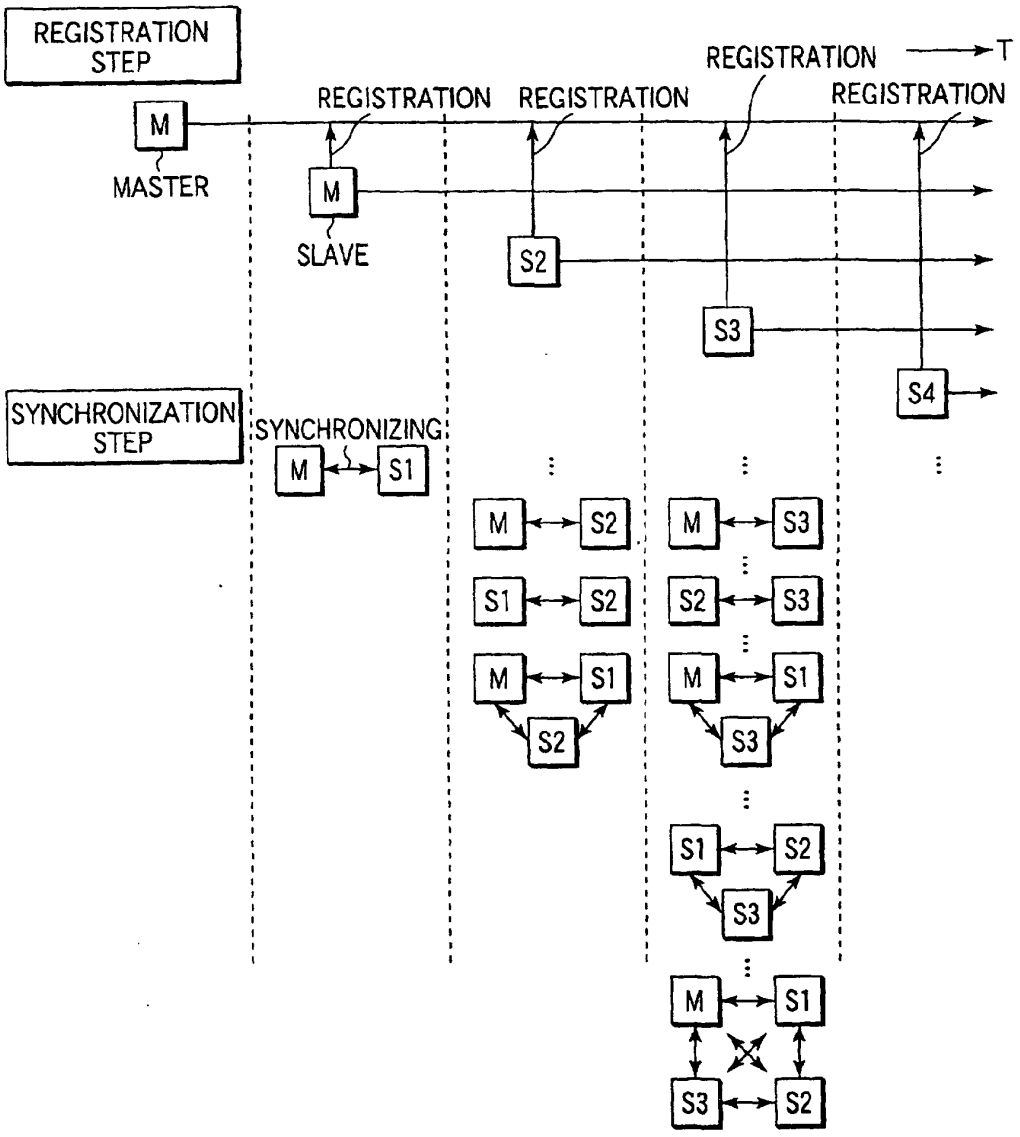
REGISTRATION STEP
REGISTRATION
REGISTRATION
REGISTRATION
REGISTRATION
T
M
MASTER
M
SLAVE
S2
S3
S4
SYNCHRONIZATION STEP
SYNCHRONIZING
M
S1
M
S2
M
S3
S1
S2
S2
S3
M
S1
M
S1
S2
S3
S1
S2
S3
M
S1
S3
S2

FIG. 1

TYPE OF DATA SET	MASTER/ SLAVE	PRIORITY DATA	CERTIFICATE DATA	IDENTIFICATION DATA	COUNTER VALUE
ADDRESS DIRECTORY	MASTER	1	01101110	10101010	12
TIME	SLAVE	5	00111010	01010101	———
SCHEDULE	———	———	———	———	———
TASK LIST	———	———	———	———	———
E-MAIL	SLAVE	8	11010011	11110100	———
⋮	⋮	⋮	⋮	⋮	⋮

FIG. 2

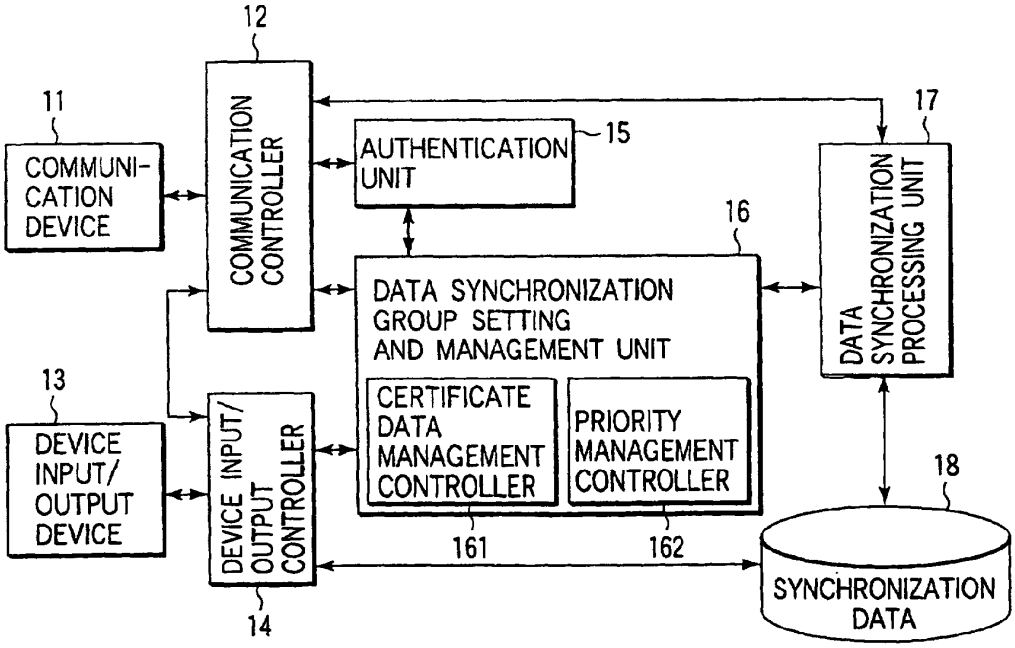

FIG. 3

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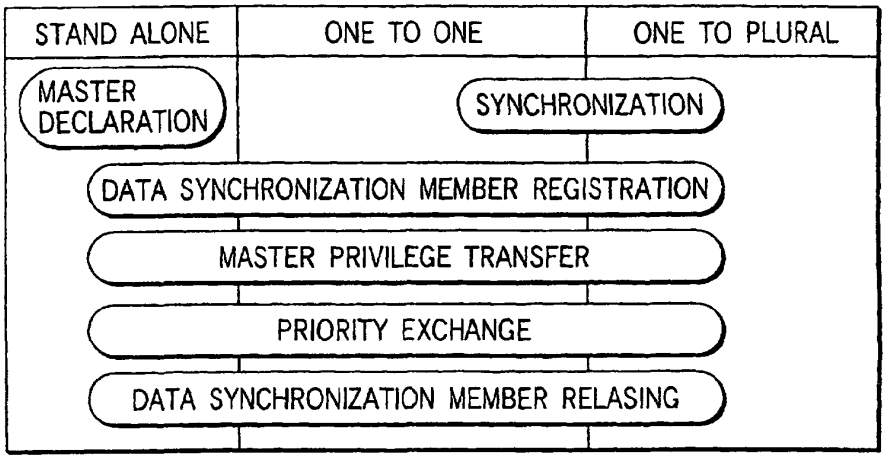
STAND ALONE
ONE TO ONE
ONE TO PLURAL
MASTER DECLARATION
SYNCHRONIZATION
DATA SYNCHRONIZATION MEMBER REGISTRATION
MASTER PRIVILEGE TRANSFER
PRIORITY EXCHANGE
DATA SYNCHRONIZATION MEMBER RELASING

FIG. 4

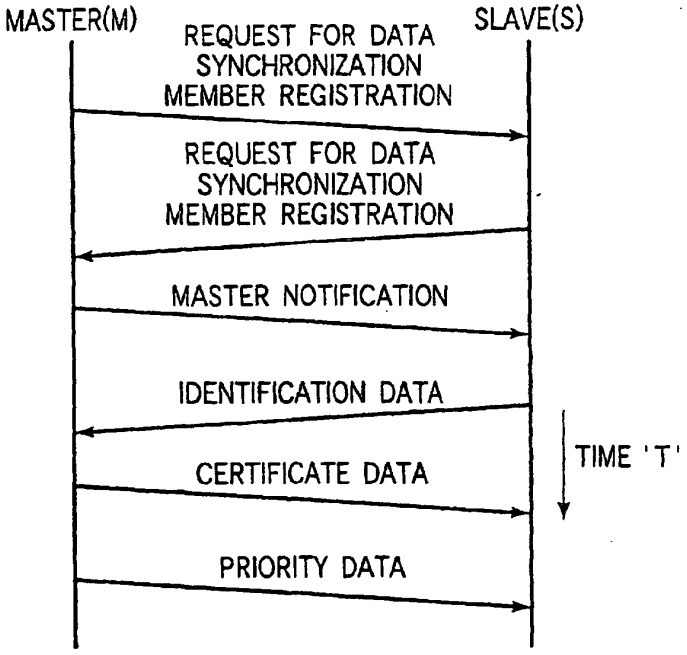
MASTER(M)
SLAVE(S)
REQUEST FOR DATA SYNCHRONIZATION MEMBER REGISTRATION
REQUEST FOR DATA SYNCHRONIZATION MEMBER REGISTRATION
MASTER NOTIFICATION
IDENTIFICATION DATA
CERTIFICATE DATA
PRIORITY DATA
TIME 'T'

FIG. 5

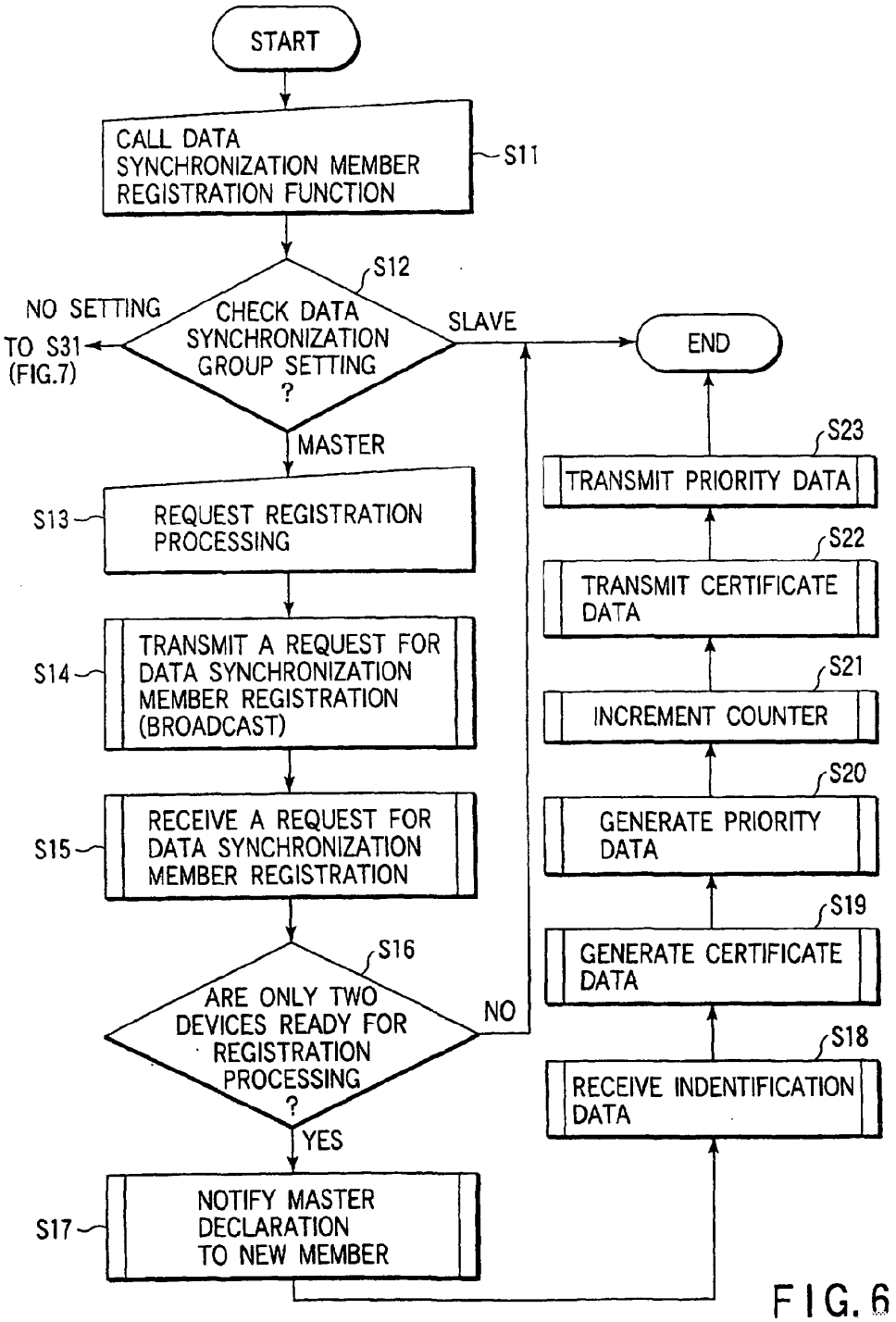

FIG. 6

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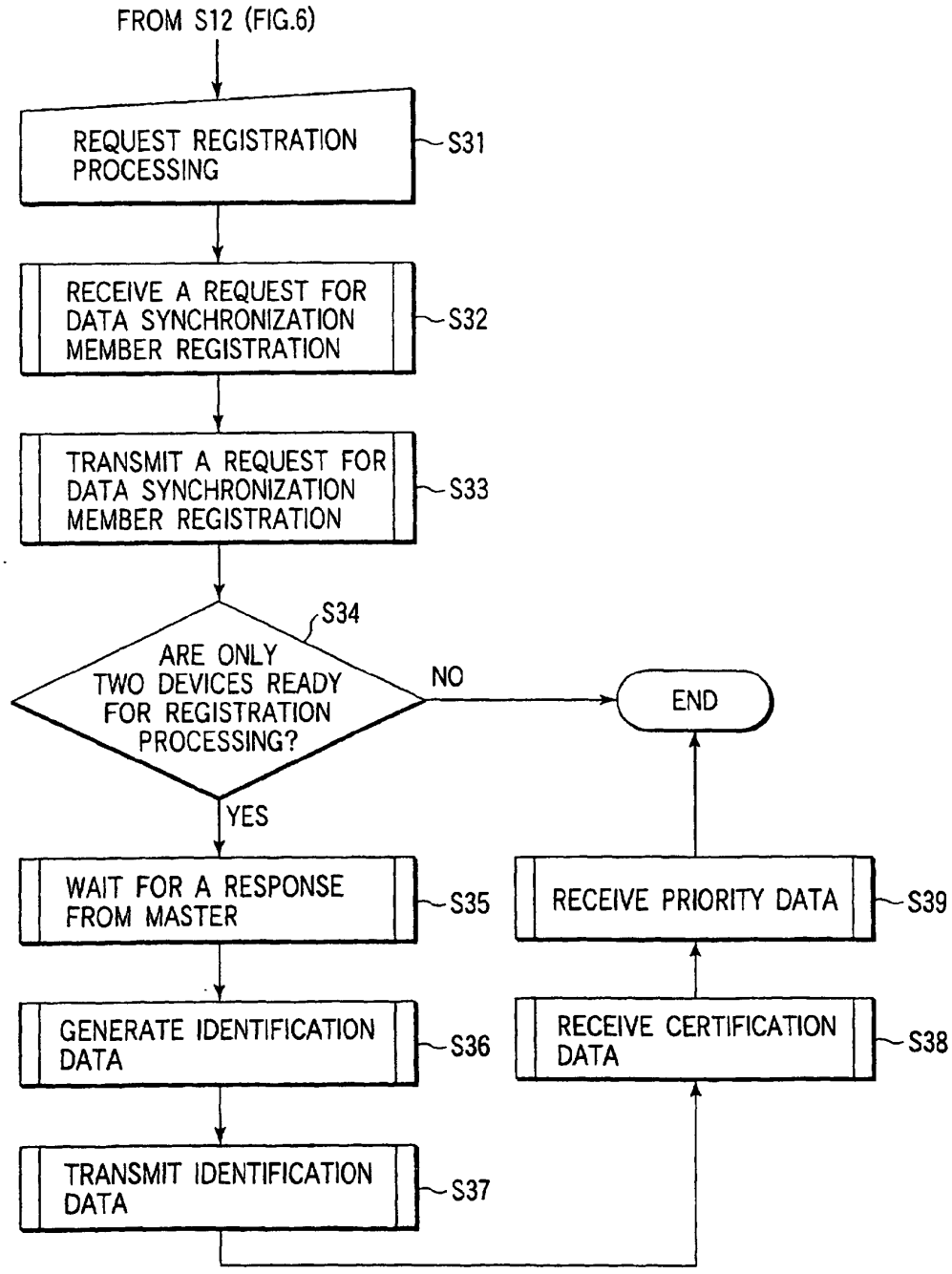

FIG. 7

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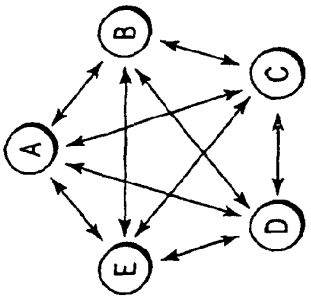

FIG. 8

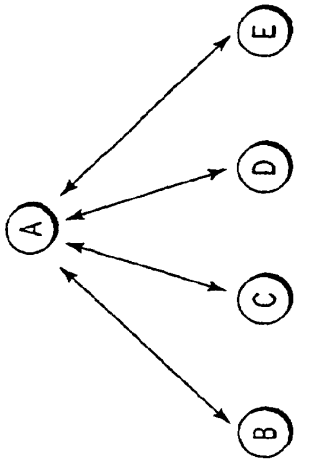

FIG. 9

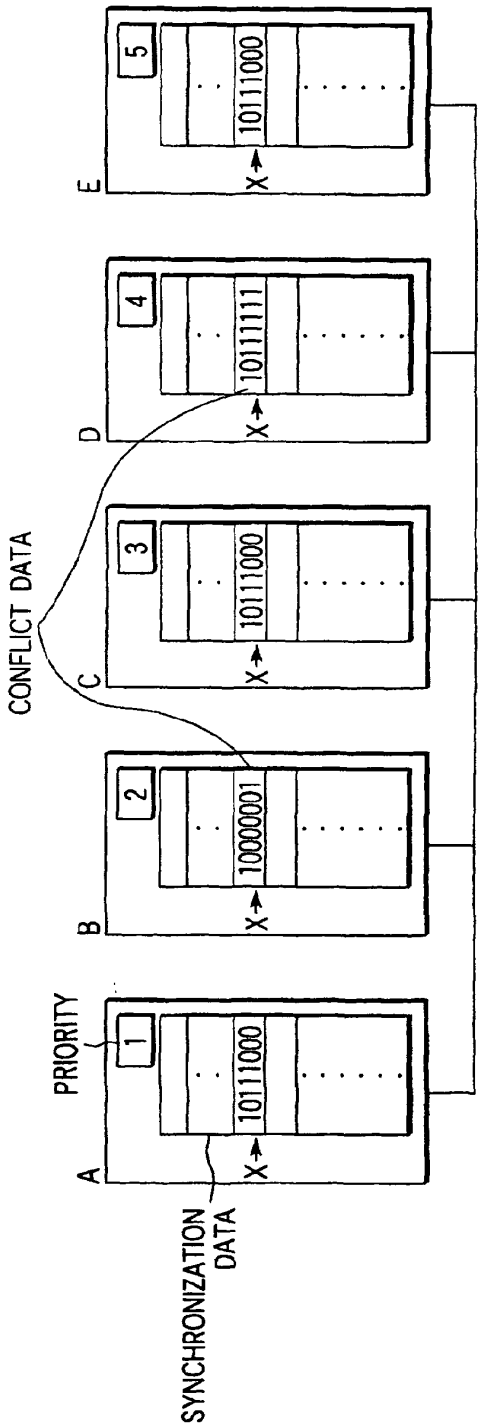

FIG. 10

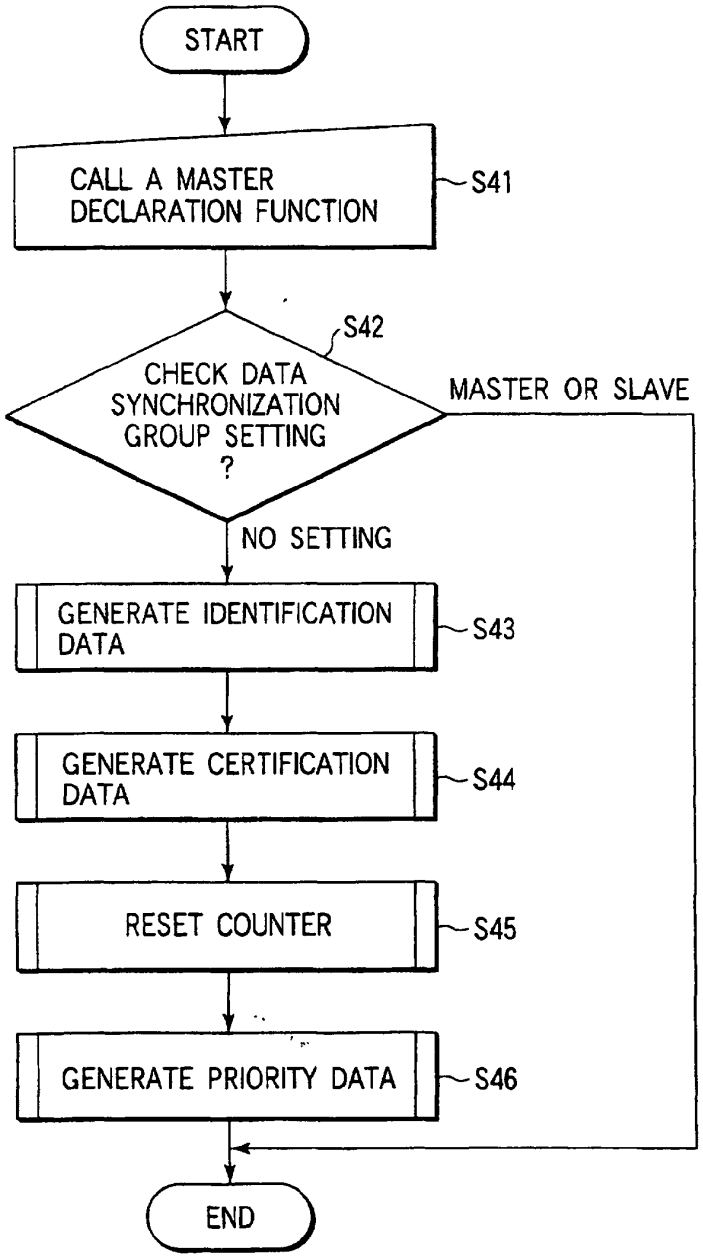

FIG. 11

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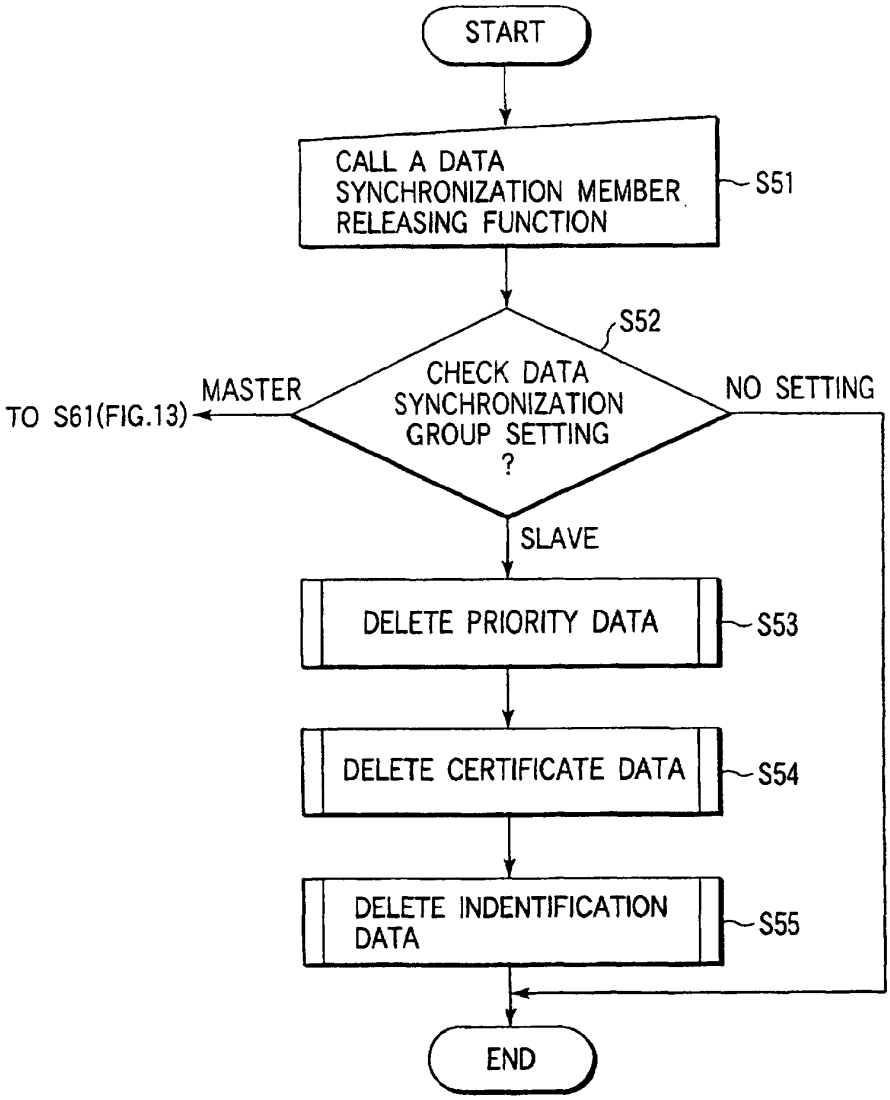
START
CALL A DATA SYNCHRONIZATION MEMBER RELEASING FUNCTION
S51
S52
CHECK DATA SYNCHRONIZATION GROUP SETTING ?
MASTER
TO S61(FIG.13)
NO SETTING
SLAVE
DELETE PRIORITY DATA
S53
DELETE CERTIFICATE DATA
S54
DELETE INDENTIFICATION DATA
S55
END

FIG. 12

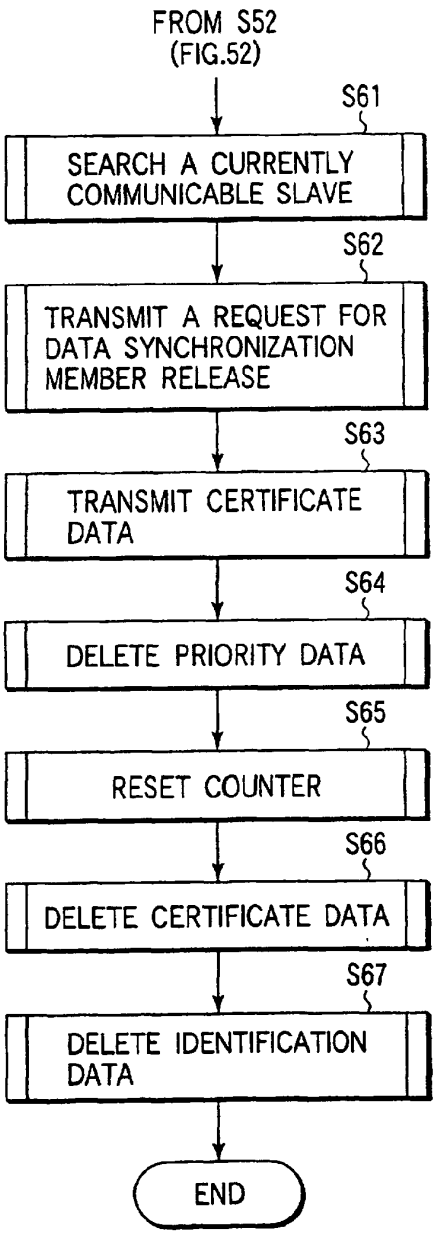
FROM S52
(FIG.52)
S61
SEARCH A CURRENTLY COMMUNICABLE SLAVE
S62
TRANSMIT A REQUEST FOR DATA SYNCHRONIZATION MEMBER RELEASE
S63
TRANSMIT CERTIFICATE DATA
S64
DELETE PRIORITY DATA
S65
RESET COUNTER
S66
DELETE CERTIFICATE DATA
S67
DELETE IDENTIFICATION DATA
END

FIG. 13

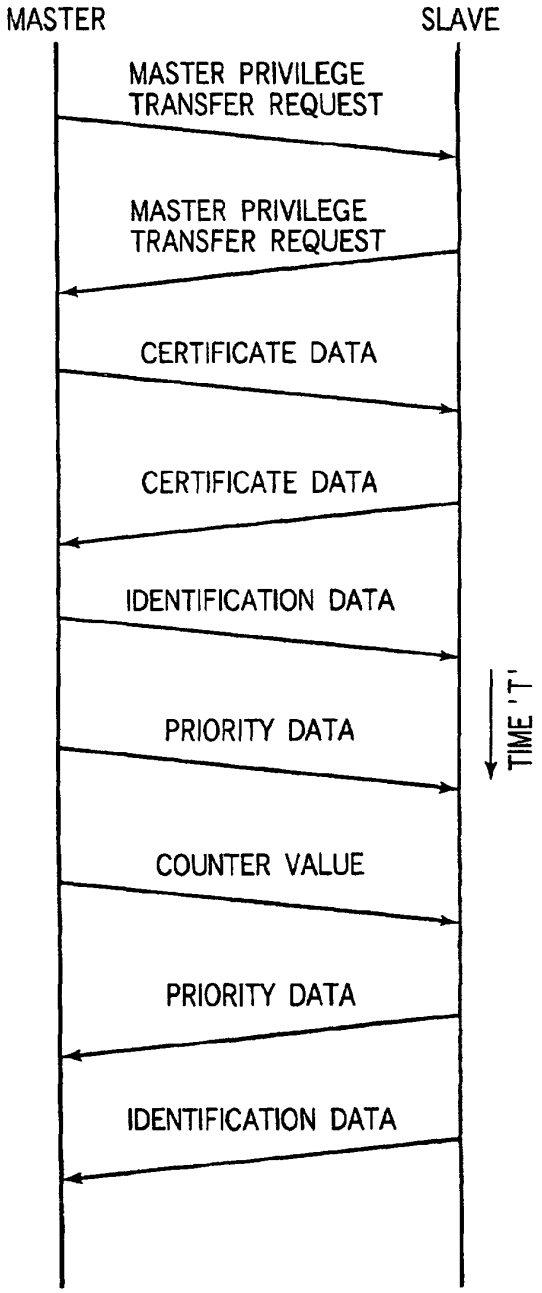
MASTER
SLAVE
MASTER PRIVILEGE TRANSFER REQUEST
MASTER PRIVILEGE TRANSFER REQUEST
CERTIFICATE DATA
CERTIFICATE DATA
IDENTIFICATION DATA
PRIORITY DATA
TIME 'T'
COUNTER VALUE
PRIORITY DATA
IDENTIFICATION DATA

FIG. 14

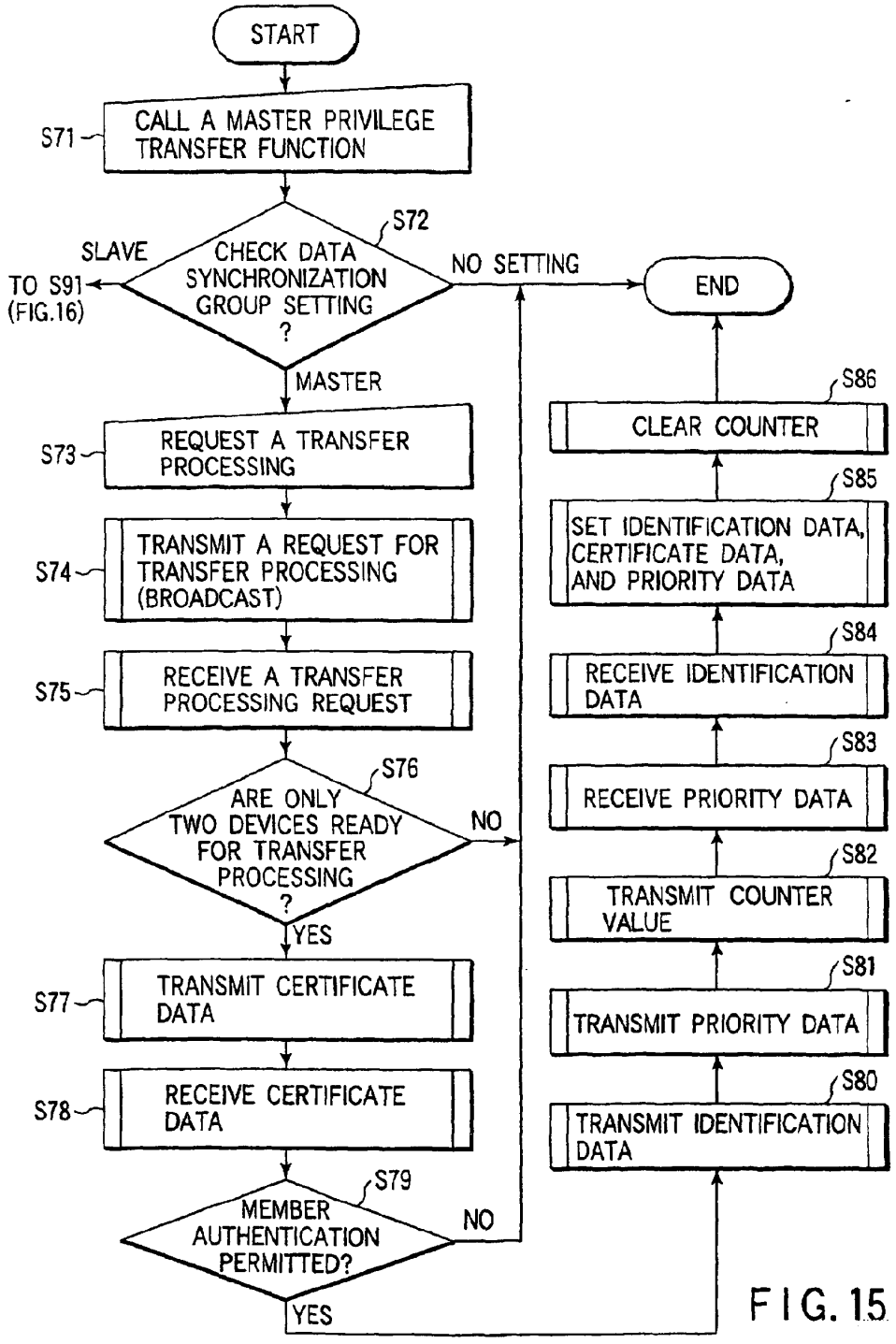

FIG. 15

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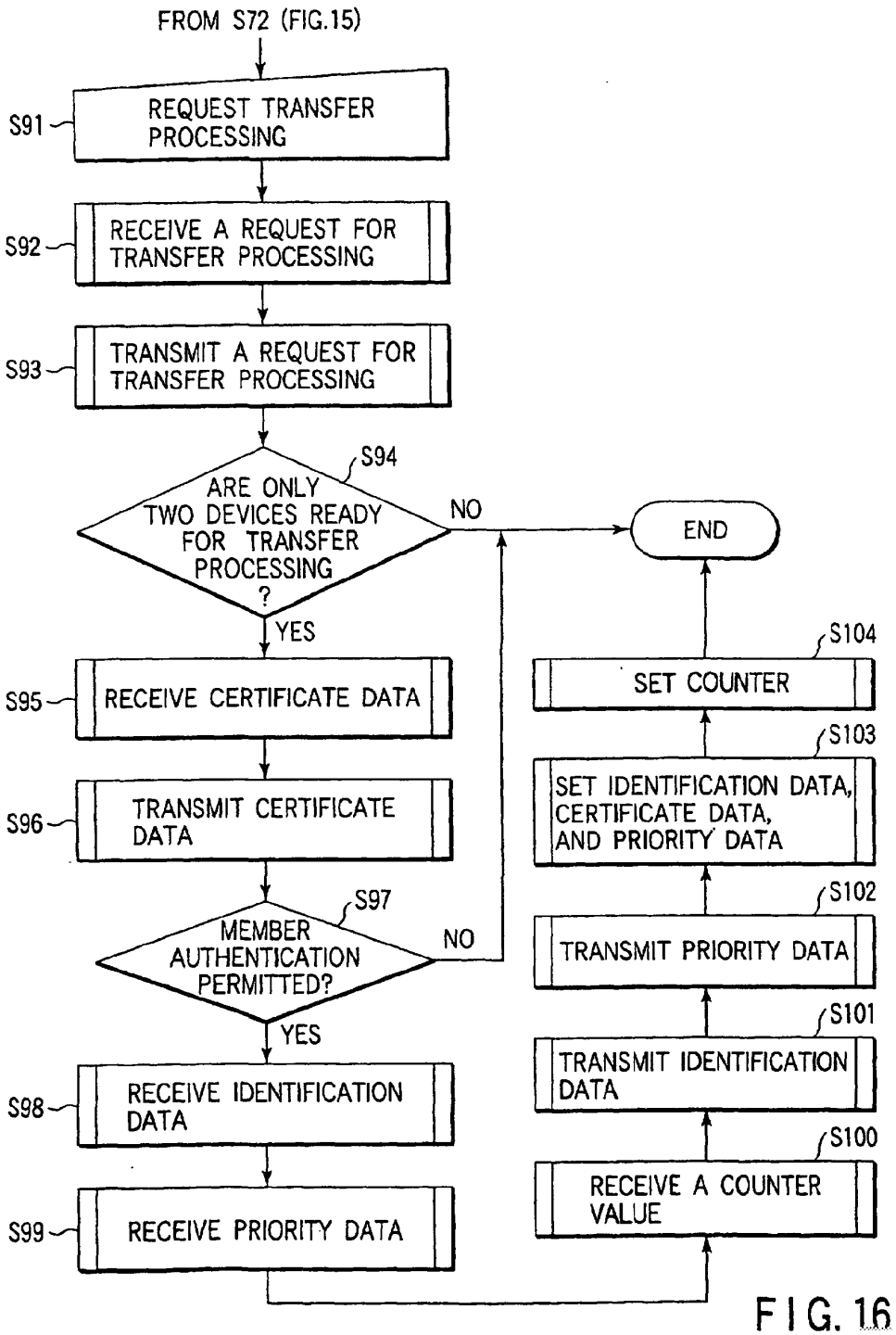

FIG. 16

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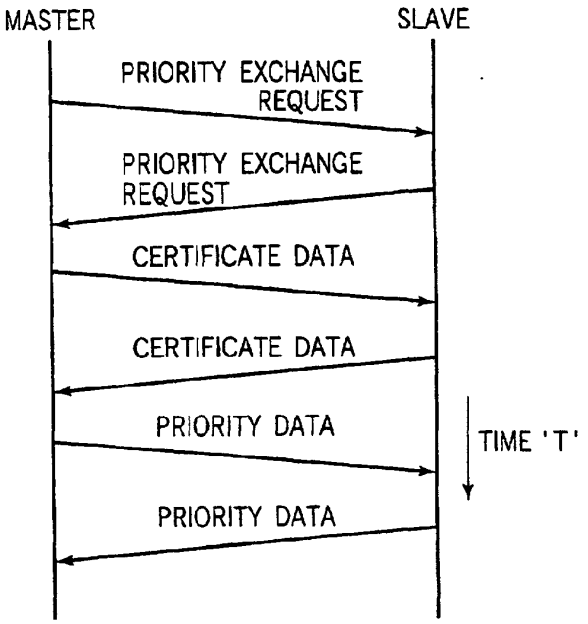
MASTER
SLAVE
PRIORITY EXCHANGE REQUEST
PRIORITY EXCHANGE REQUEST
CERTIFICATE DATA
CERTIFICATE DATA
PRIORITY DATA
PRIORITY DATA
TIME 'T'

FIG. 17

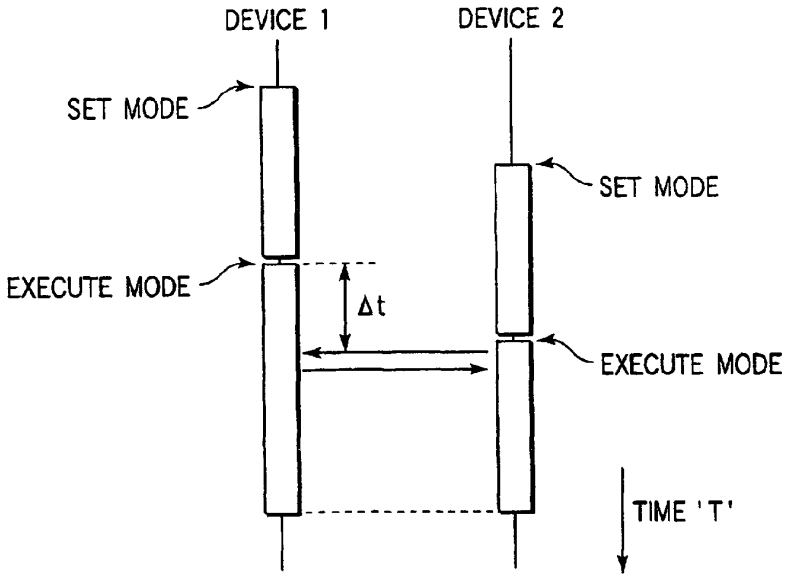
DEVICE 1
DEVICE 2
SET MODE
SET MODE
EXECUTE MODE
Δt
EXECUTE MODE
TIME 'T'

FIG. 19

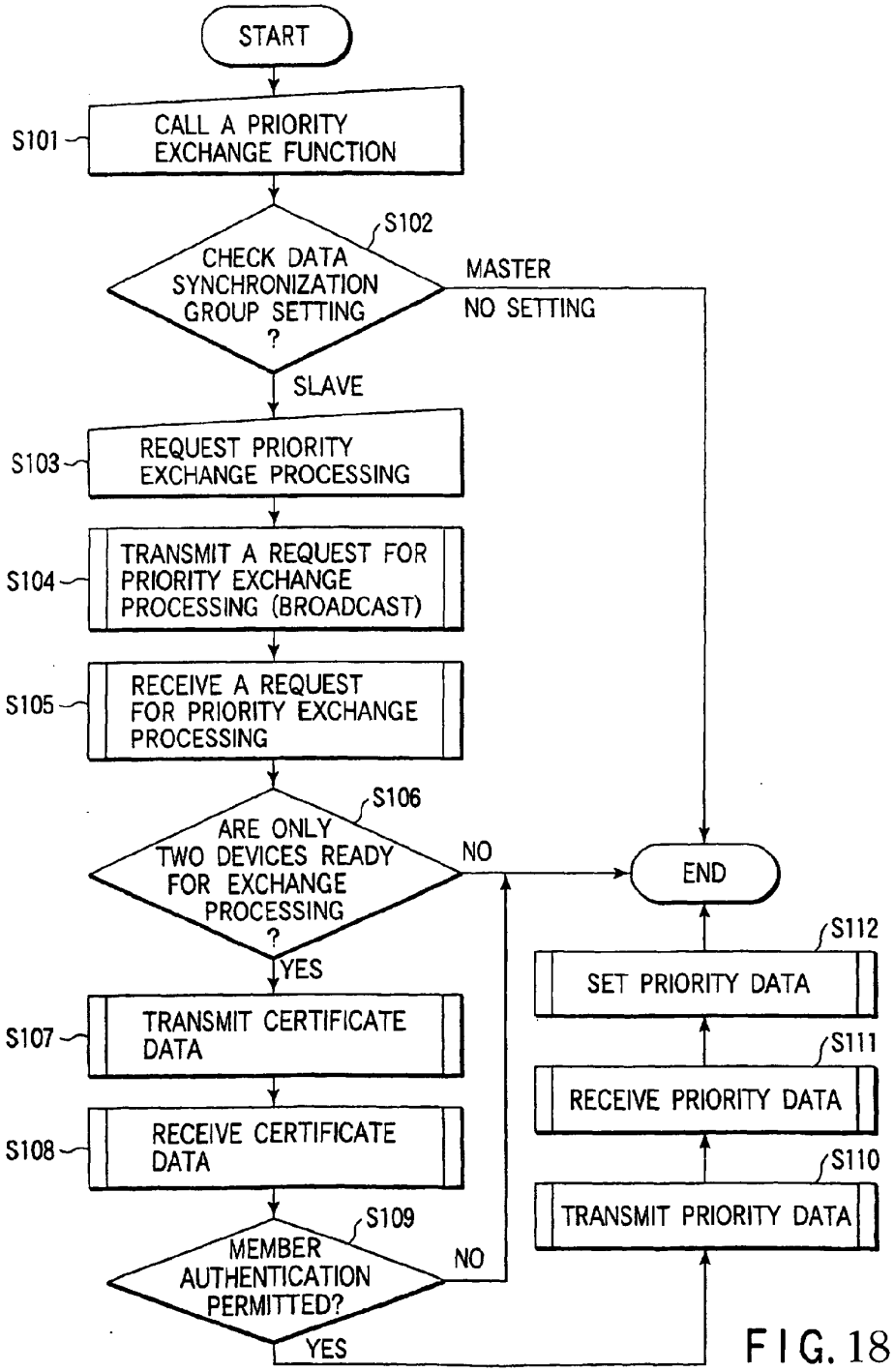
START
S101
CALL A PRIORITY EXCHANGE FUNCTION
S102
CHECK DATA SYNCHRONIZATION GROUP SETTING ?
MASTER
NO SETTING
SLAVE
S103
REQUEST PRIORITY EXCHANGE PROCESSING
S104
TRANSMIT A REQUEST FOR PRIORITY EXCHANGE PROCESSING (BROADCAST)
S105
RECEIVE A REQUEST FOR PRIORITY EXCHANGE PROCESSING
S106
ARE ONLY TWO DEVICES READY FOR EXCHANGE PROCESSING ?
NO
YES
END
S107
TRANSMIT CERTIFICATE DATA
S108
RECEIVE CERTIFICATE DATA
S109
MEMBER AUTHENTICATION PERMITTED?
NO
YES
S112
SET PRIORITY DATA
S111
RECEIVE PRIORITY DATA
S110
TRANSMIT PRIORITY DATA

FIG. 18

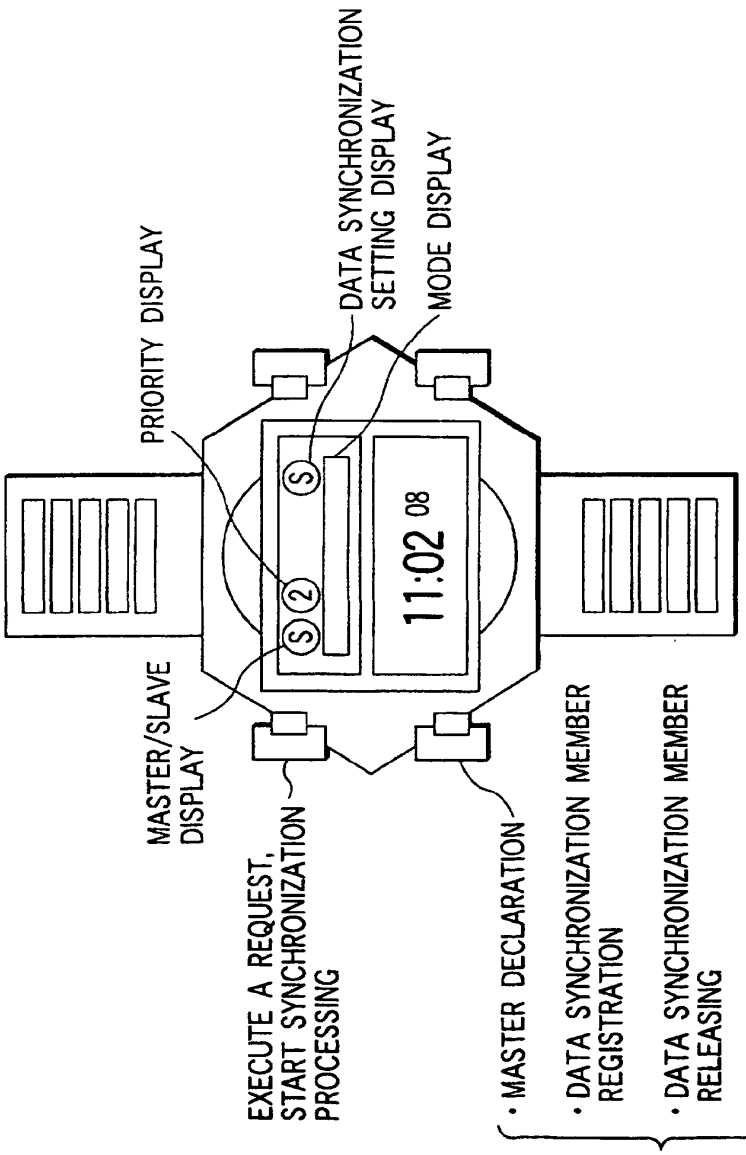
PRIORITY DISPLAY
DATA SYNCHRONIZATION SETTING DISPLAY
MODE DISPLAY
11:02 08
MASTER/SLAVE DISPLAY
EXECUTE A REQUEST, START SYNCHRONIZATION PROCESSING
• MASTER DECLARATION
• DATA SYNCHRONIZATION MEMBER REGISTRATION
• DATA SYNCHRONIZATION MEMBER RELEASING
• MASTER TRANSFERRING AND PRIORITY EXCHANGE

FIG. 20

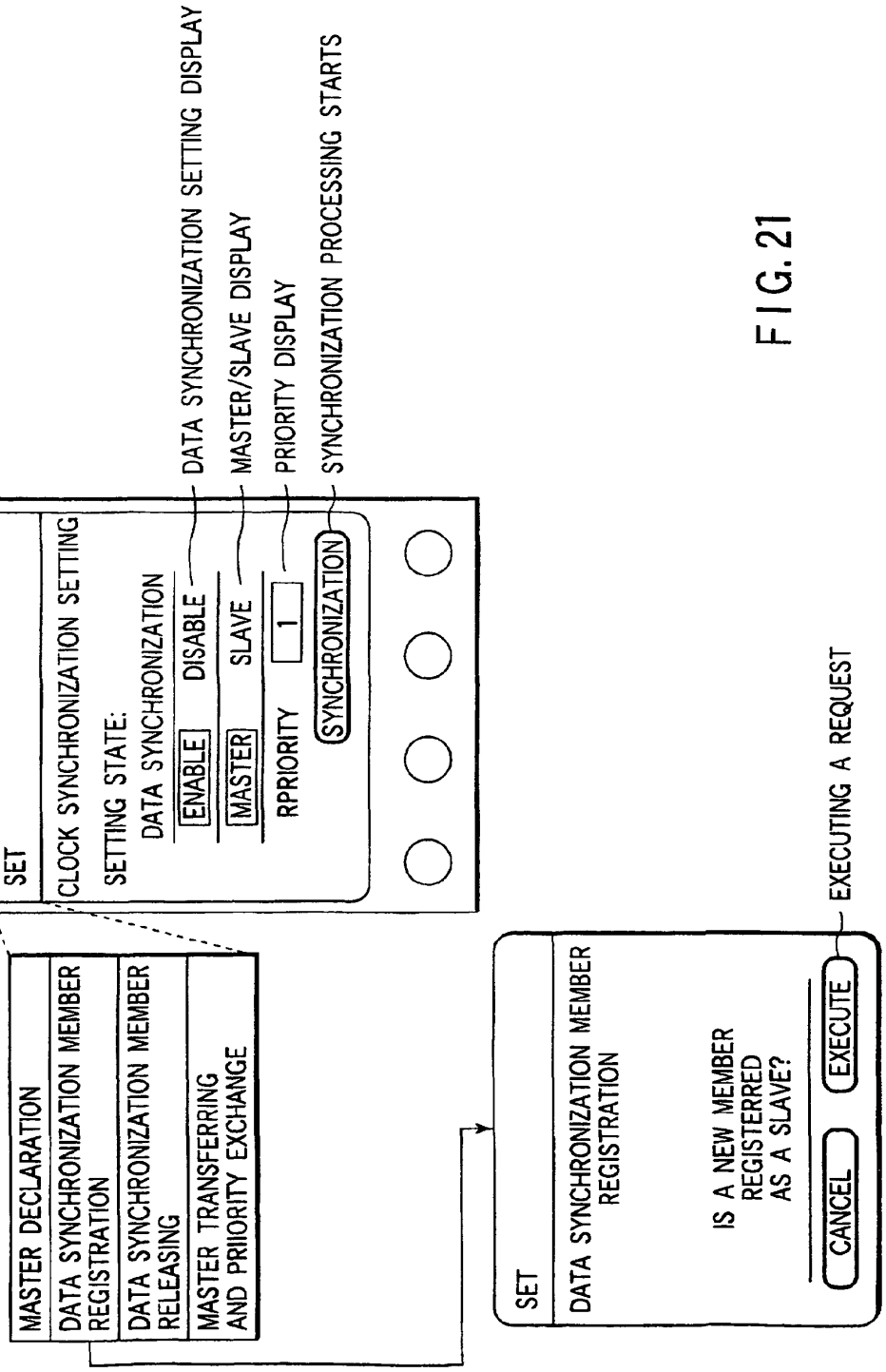
MASTER DECLARATION
DATA SYNCHRONIZATION MEMBER REGISTRATION
DATA SYNCHRONIZATION MEMBER RELEASING
MASTER TRANSFERRING AND PRIIORITY EXCHANGE
SET
CLOCK SYNCHRONIZATION SETTING
SETTING STATE:
DATA SYNCHRONIZATION
ENABLE
DISABLE
MASTER
SLAVE
RPRIORITY
1
SYNCHRONIZATION
DATA SYNCHRONIZATION SETTING DISPLAY
MASTER/SLAVE DISPLAY
PRIORITY DISPLAY
SYNCHRONIZATION PROCESSING STARTS
SET
DATA SYNCHRONIZATION MEMBER REGISTRATION
IS A NEW MEMBER REGISTERRED AS A SLAVE?
CANCEL
EXECUTE
EXECUTING A REQUEST

FIG. 21

(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 122 931 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
08.08.2001 Bulletin 2001/32

(51) Int Cl.[7]: **H04L 29/06**

(21) Application number: **01102060.9**

(22) Date of filing: **30.01.2001**

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE TR
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **07.02.2000 US 499701**

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(54) Real-time media content synchronization and transmission in packet network apparatus and method

(57) A system for transmitting and synchronizing real-time multimedia content includes a multimedia server (62) for generating a multimedia packet (64) having multimedia audio/visual information therein in a play sequence, and for transmitting the multimedia packet; a packet-based communication network (66) connected to the multimedia server (62) for receiving the multimedia packets therefrom; the network having multiple routers (68, 70) therein to route the multimedia packets to plural destinations; means for inserting total delay information (TDI) into the multimedia packets, wherein the TDI includes total end-to-end delay (TED) and cumulative network delay (CND); and plural multimedia receivers (80, 82, 84) for receiving the multimedia packets having TDI therein, wherein each multimedia receiver (80, 82, 84) includes a buffer for storing received multimedia packets, a sequencing means for retrieving stored multimedia packets from the buffer and sequencing the multimedia packets in the play sequence, and a playing mechanism for playing the retrieved, sequenced multimedia packets at time TED after the multimedia packet has been transmitted by the multimedia server (62). A method of transmitting and synchronizing real-time multimedia content includes loading multimedia audio/visual into plural multimedia packets (64); inserting total delay information (TDI) into at least one of the multimedia packets (64), wherein TDI includes total end-to-end delay (TED) and cumulative network delay (CND); transmitting the multimedia packets to plural multimedia receivers (80, 82, 84) over a packet-based network (66) in a play sequence; buffering the multimedia packets in each multimedia receiver (80, 82, 84); recalling the multimedia packets in play sequence; and playing the multimedia packets (64) at each receiver (80, 82, 84) at time TED.

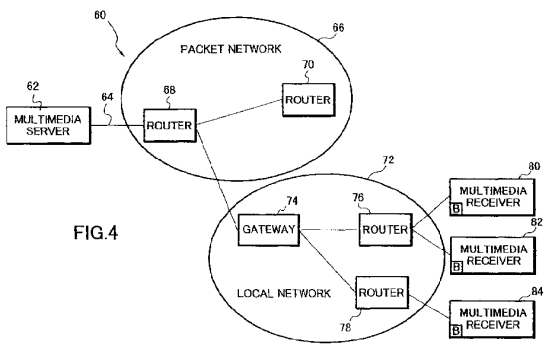

FIG.4

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Description

Field of the Invention

[0001] This invention relates to multimedia networks, and specifically to the synchronization of multicast distributed media content when played by multiple multimedia devices, e.g., monitors and audio systems.

Background of the Invention

[0002] In some situations, such as at conventions and in exhibition halls, it is required to play the same video contents synchronized at multiple video monitors. Generally, it is also required to synchronize audio and video between separately located monitors and speakers. Current real-time media transmission technology allows transferring an audio/video stream over non-guaranteed quality of service (QoS) packet networks with reasonable quality and at a lower cost than provided by higher quality networks. Thus, there will be a demand for playing multimedia contents, delivered to a plurality of receivers over packet network, in synchronized manner.

[0003] Fig. 1 depicts a prior art multimedia content delivery system, generally at 10, which uses a packet network. A multimedia server 12 generates a stream of multimedia packets 14 that contain multimedia audio/video contents. Normally, server, or source, 12 generates multimedia packets at a constant rate (packet rate); *e.g.*, one packet every 20 ms. Packet size depends on the multimedia codec, which may result in fixed size or variable sized packets. The generated multimedia packets are then transferred through a packet network 16, having plural routers, or nodes, 18, 20, 22, 24, 26, 28 and 30 therein, and are delivered to a plurality of multimedia receivers, 32, 34, 36 and 38. The mechanism for delivery to multiple devices is well known as "multicast." All the receivers that wish to receive multimedia contents from the server join a multicast group. The routers in packet network 16 are aware of the multicast group, and transfer received multimedia packet to multiple routes. Each receiver is equipped with a speaker and/or a video display, and each plays the contents in the received multimedia packet in real-time. The multimedia receivers may buffer received multimedia packets for some duration in order to absorb the variance in delay caused by the network, and to playback multimedia packets in right order.

[0004] In conventional packet network, such as an IP network, packets are queued in each router. How long a packet stays in a queue depends on the amount of traffic that a particular router is handling. Hence, each multimedia packet delivered to each multimedia receiver has an unpredictable delay. As a result, the audio/video contents may be played at multiple locations without synchronization.

[0005] As previously noted, real-time multimedia transmission technology currently allows transferring an audio/video stream over non-guaranteed quality of service (QoS) packet networks with reasonable quality. As mobile Internet access increases, with its data transfer over bandlimited communication channels, such as wireless data networks, the technology to transmit real-time multimedia packets requiring minimum bandwidth becomes essential and of increases importance.

[0006] A packet-based real-time media transmission system is illustrated in Fig. 2, generally at 40. A multimedia source, or server, 42, periodically transmits multimedia packets 44 having audio/video multimedia contents to a packet network 46. In packet network 46, each multimedia packet is routed by a plurality of network nodes, or routers, 48, 50, 52 and 54, and delivered to a receiver 56. Each multimedia packet includes timing information that is used to set timing for playback at a receiver 56. The multiple routers and receivers of Fig. 1 are not shown in Fig. 2 for the sake of clarity.

[0007] Packet network 46 causes a variable length delay in the delivery of each multimedia packet. In addition, network 46 does not guarantee the delivery of the multimedia packets in the same order as transmitted. Thus, a receiver is normally equipped with a buffer to handle delay variances and/or disorders in multimedia packet receipt. However, due to the real-time property of the contents, the receiver will discard a received multimedia packet if the delay in its arrival exceeds a certain value, or if the multimedia packet does not arrive by the time it is to be played.

[0008] Fig. 3 shows an example of packets received and played back by the receiver, where each packet contains the timing information. Line I depicts seven multimedia packets transmitted in sequential order by server 42. Line II depicts the order of receipt of the multimedia packets at a receiver. Line III depicts a play order by the receiver. The figure depicts that the multimedia packet with timing information 3 is discarded due to an excessive delay. Basically, the routers in the prior art packet network are not aware of delays in packets transmission and receipt, nor are they aware of disordering of packet transmission. Thus, each router re-directs every received real-time multimedia packet to the next router or the receiver, even if the multimedia packet may not have any chance of being played at the receiver. If a physical link between some two routers, or the physical link between the receiver and the adjacent router has limited bandwidth, the transmission of the multimedia packets which will be discarded at the receiver possibly wastes substantial portion of valuable bandwidth on the link. Delay and disordering is illustrated by the variable routing of multimedia packets from router 48 through router 50, router 52 and router 54, or directly from router 48 to router 54.

[0009] U.S. Patent No. 4,506,358, for *Time stamping for a packet switching system*, to Montgomery, granted March

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19, 1985, describes a method of measuring the network delay in a packet network by including an information field in each packet that indicates the cumulative network delay, time stamping each packet's arrival and re-transmission in each network node, and updating the information field in each network node for each packet by adding the delay occurring in each node, *i.e.*, re-transmission time - arrival time.

[0010] U.S. Patent No. 4,530,091, for *Synchronization of real-time clocks in a packet switching system*, to Crockett, granted July 16, 1985, describes a means to synchronize a remote real-time clock to a standard real-time clock via an X.25 (CCITT) network, but does not teach or suggest how to synchronize a multimedia stream, and does not consider network delay caused in a packet network.

[0011] U.S. Patent No. 4,918,687 for *Digital packet switching networks*, to Bustini *et al.*, granted April 17, 1990, describes a method to avoid consecutive packet loss by clipping voice packets whose contents indicate whether the packet is eligible for clipping, if required, in a node queue within the network.

[0012] U.S. Patent No. 5,432,790 for *Method for allocating internodal link bandwidth in a packet oriented communication network to guarantee delay quality-of-service*, to Hluchyj *et al.*, granted July 11, 1995, describes a method to allocate bandwidth on internodal links such that worst case maximum delays and worst case average delays are guaranteed while providing statistical gains in maintaining predetermined end-to-end delay QoS.

[0013] U.S. Patent No. 5,444,709 for *Protocol for transporting real time data*, to Riddle, granted August 22, 1995, describes a method to maintain the isochronous nature of the real-time data transmission by discarding data that is not timely received.

[0014] U.S. Patent No. 5,450,394 for *Delay monitoring of telecommunication networks*, to Gruber *et al.*, granted September 12, 1995, describes a means to measure a round-trip delay of network transit time, however, the delay which must be known for multimedia transmission and synchronization is a one-way network delay.

[0015] U.S. Patent No. 5,557,724 for *User interface, method, and apparatus selecting and playing channels having video, audio, and/or text streams*, to Sampat *et al.*, granted September 17, 1996, describes a user interface in a computer system to playback multimedia streams.

[0016] U.S. Patent No. 5,594,660 for *Programmable audio-video synchronization method and apparatus for multimedia systems*, to Sung *et al.*, granted January 14, 1997, describes a means to playback an audio and video stream synchronously to a single network-based receiver.

[0017] U.S. Patent No. 5,598,352 for *Method and apparatus for audio and video synchronizing in MPEG playback systems,* to Rosenau *et al.*, granted January 28, 1997, describes a means to playback an audio and video stream synchronously to a single network-based receiver.

[0018] U.S. Patent No. 5,623,483 for *Synchronization system for networked multimedia streams,* to Agrawal *et al.*, granted April 22, 1997, describes a means for a receiving device to determine the total end-to-end delay from a statistical network delay distribution and the synchronization of the two media streams from different sources through the provision of a synchronization clock located in each server and in each receiver.

[0019] U.S. Patent No. 5,629,936 for *Control of consecutive packet loss in a packet buffer*, to Lee *et al.*, granted May 13, 1997, describes a method for dropping packets to control consecutive packet loss based on a desired packet gap.

[0020] U.S. Patent No. 5,675,573 for *Delay-minimizing system with guaranteed bandwidth delivery for real-time traffic*, to Karol *et al.*, granted October 7, 1997, describes a bandwidth allocation mechanism based on individual guaranteed bandwidth requirements associated with each traffic flow.

[0021] U.S. Patent No. 5,682,384 for *Apparatus and methods achieving multiparty synchronization for real-time network application,* to Zarros, granted October 28, 1997, describes a means to playback contents from multiple sources synchronously to a single receiver on a network.

[0022] U.S. Patent No. 5,768,527 for *Device, system and method of real-time multimedia streaming,* to Zhu *et al.*, granted June 16, 1998, describes a method to recover lost packets by retransrnission.

[0023] U.S. Patent No. 5,802,060 for *Data network and a process for real time transmission of data packets in a data network*, to Fischbach *et al.*, granted September 1, 1998, describes a method to prioritize packet transmissions for stations whose network access is controlled by token exchanges.

[0024] U.S. Patent No. 5,815,634 for *Stream synchronization method and apparatus for MPEG playback system,* to Daum *et al.*, granted September 29, 1998, describes a means to playback an audio and video stream synchronously to a single network-based receiver.

[0025] U.S. Patent No. 5,844,600 for *Methods, apparatus, and systems for transporting multimedia conference data streams through a transport network,* to Kerr, granted December 1, 1998, describes a means for audio/video conferencing over an ATM network. Audio streams are combined in a network-based mixer and distributed to terminals. At each terminal, the received audio and video streams are played synchronously, however, there is no provision for synchronous play at multiple terminals on a network.

[0026] U.S. Patent No. 5,874,997 for *Measuring and regulating synchronization of merged video and audio data*, to Haigh, granted February 23, 1999, describes a means to playback an audio and video stream synchronously to a single, network-based receiver.

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[0027] The Internet Engineering Task Force (IETF) publishes requests for comments (RFC) and comments filed in response thereto.

[0028] RFC 1889: A real-time end-to-end protocol utilizing existing transport layers for data that has real-time properties.

[0029] RFC 2508: Compressing IP/UDP/RTP Headers for Low-Speed Serial Links

[0030] RFC 1144: Compressing TCP/IP Headers for Low-Speed Serial Links,

[0031] Similar to RFC 2508, but for TCP/IP packets.

Summary of the Invention

[0032] A system for transmitting and synchronizing real-time multimedia content includes a multimedia server for generating a multimedia packet having multimedia audio/visual information therein in a play sequence, and for transmitting the multimedia packet; a packet-based communication network connected to the multimedia server for receiving the multimedia packets therefrom; the network having multiple routers therein to route the multimedia packets to plural destinations; means for inserting total delay information (TDI) into the multimedia packets, wherein the TDI includes total end-to-end delay (TED) and cumulative network delay (CND); and plural multimedia receivers for receiving the multimedia packets having TDI therein, wherein each multimedia receiver includes a buffer for storing received multimedia packets, a sequencing means for retrieving stored multimedia packets from the buffer and sequencing the multimedia packets in the play sequence, and a playing mechanism for playing the retrieved, sequenced multimedia packets at time TED after the multimedia packet has been transmitted by the multimedia server. A method of transmitting and synchronizing real-time multimedia content includes loading multimedia audio/visual into plural multimedia packets; inserting total delay information (TDI) into at least one of the multimedia packets, wherein TDI includes total end-to-end delay (TED) and cumulative network delay (CND); transmitting the multimedia packets to plural multimedia receivers over a packet-based network in a play sequence; buffering the multimedia packets in each multimedia receiver, recalling the multimedia packets in play sequence; and playing the multimedia packets at each receiver at time TED.

[0033] An object of the invention is to provide synchronized A/V output at a plurality of receivers over and multimedia carrying network.

[0034] Another object of the invention is to prevent transmissions of any multimedia packets which will not be used by a receiver on the network.

[0035] These and other objects and advantages of the invention will become more fully apparent as the description which follows is read in conjunction with the drawings.

Brief Description of the Drawings

[0036] Fig. 1 depicts a prior art multimedia content delivery system.

[0037] Fig. 2 depicts a packet-based real-time multimedia content transmission system.

[0038] Fig. 3 is a block diagram of packet receipt and playback.

[0039] Fig. 4 depicts a LAN multimedia content delivery system constructed according to the invention.

[0040] Fig. 5 depicts a multimedia content delivery system wherein the video and audio streams are separately routed.

Detailed Description of the Preferred Embodiment

[0041] Synchronization and transmission of multicast multimedia, particularly over packet-based systems is an efficient and inexpensive techniques for distributing information. Prior art systems simply do not consider the problems associated with synchronizing and transmitting a multimedia data stream, from one or more sources, over a packet-based system, to multiple receivers. Although there exist a number of technologies that enable a plurality of correlated media streams, transmitted from different locations, to be played at single receiver in a synchronized manner, the known prior art does not allow media streams generated by a single source, or multiple sources, to be multicast over a packet-based network to be played synchronously at multiple locations. This invention provides a system and method to transmit and synchronously play the same audio/video stream at the different locations, and to eliminate transmission of a multimedia packet when it is apparent that the multimedia packet will not be played at its destination.

[0042] Referring now to Fig. 4, a content synchronized multimedia transmission system constructed according to the invention is depicted generally at 60. System 60 includes a multimedia server 62, which has the means to insert TED and CND information, which is defined and described later herein, into each multimedia packet 64 that passes therethrough. A packet network 66 includes two routers, 68, 70, although many more routers are likely present in such a generalized network. Router 68 is connected to a local area network (LAN) 72, which includes a gateway 74 and

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routers 76, 78. Multimedia receivers 80, 82 and 84 are connecter to LAN 72.

[0043] The method of the invention includes loading multimedia information into a series of packets 64, referred to herein as multimedia packets. Multimedia server 62 inserts fields of total end-to-end delay (TED) and cumulative network delay (CND) in each multimedia packet, referred to herein as total delay information (TDI). TED indicates the time from when the multimedia packet is transmitted from the server to when the multimedia packet is to be played at a receiver, whereas CND indicates the actual latency caused by routers in the communications network before the multimedia packet is delivered to a receiver. Multimedia server 62 determines the value of TED from network statistics. When transmitting a multimedia packet, server 62 sets the value of jitter to CND. The jitter is obtained by

$$\text{time interval of transmissions of two consequent packets - packet rate.} \quad (1)$$

For example, if the packet rate is 20 ms and a packet is actually transmitted 30 ms after the previous packet, jitter is 10 ms and the CND of the packet is set to 10 ms.

[0044] Each router in the network, regardless of whether the router is located in packet network 66 or LAN 72, measures the queuing delay of each multimedia packet caused by that router. The queuing delay is obtained from time stamps of reception and transmission of the multimedia packet. When transmitting the multimedia packet, each router updates CND by adding the queuing delay to the current CND value. If the router needs to route a received multimedia packet to multiple routes, *i.e.,* multicast, such as router 68 multicasting to router 70 and gateway 74, the multimedia packet is duplicated, and the queuing delay for the duplicated multimedia packet is handled separately from the original. There may be more than one duplicated packet, and the queuing delay is placed in each duplicated packet.

[0045] Each multimedia receiver includes a buffer "B" to store incoming multimedia packets, and recalls a multimedia packet from the buffer to play the content of a multimedia packet at (TED-CND) after its reception. Thus, a multimedia packet delivered to the multiple multimedia receivers is played at TED after transmitted at the server, regardless of the actual network delay caused in the route to each receiver.

[0046] As described in the previous example, CND contains only a queuing delay, and does not include physical latencies caused by the physical transmission between two routers. The physical latency is assumed to be small and is therefore negligible. Alternatively, a router may be provided with a known physical latency, which may be added to the queuing delay for increased accuracy.

[0047] If all the receivers are aware of the packet rate, performing the procedures described above for the first multimedia packet of the media stream is sufficient, because a receiver receiving a multimedia packet with TED and CND knows when to play the multimedia packets which follow, however, where the first multimedia packet containing TED and CND is "lost," *i.e.*, not received by one or more receivers, the server may be required to include TED and CND in the first several multimedia packets. Alternatively, the server may be required to include TED and CND until it receives an acknowledgement that a multimedia packet having TED and CND has been received by all of the receivers belonging to the multicast group.

[0048] As mentioned earlier, multimedia server 62 determines the value of TED, based on network statistics. TED may be provided to the server by a network administrator, or measured dynamically. The actual determination of TED is beyond of the scope of this invention, however, U.S. Patent No. 5,623,483 provides a technique to determine TED from the statistical distribution of network delay. The overall solution of U.S. Patent No. 5,623,483, however, is that the server and the receivers have synchronized clocks. The server specifies, in each packet, the time at which the receiver is to play the packet content. However, it is unrealistic to expect that the servers and receivers of a packet network maintain precisely the same time on their synchronized clocks.

[0049] It is foreseeable that situations may arise where queuing delays and physical latencies add up to the point where a multimedia packet reaches a receiver, and is "late." In the case of prior art systems, audible and visual discontinuities are perceptible to a user, without any means to correct this situation. The system and method of the invention have provisions to function in the case where one of the receivers detects a CND in a multimedia packet which exceeds the TED for the multimedia packet. In this case, the multimedia packet cannot be played synchronously, because the time for play of the contents of the multimedia packet has already passed. The receiver includes means to request a larger TDI, and sends a message to the server with the value CND-TED. The server then increases the value of TED, and thus TDI, for following multimedia packets.

[0050] In the embodiment shown in Fig. 4, server 62 and all the routers included in packet network 66 and LAN 72 for the multicast group supports TED and CND. As depicted in Fig. 4, all of the multimedia receivers in the multicast group are in a local area network (LAN), however, a multimedia receiver may also be connected to a router in packet network 66. A multimedia server does not have to include special hardware or software to insert TDI into the multimedia packets, as described above. Instead, a gateway, which connects the LAN to the (public) packet network, generates TDI from TED and CND for multimedia packets received from the server. The gateway must be capable of generating the value of TED, and must be supplied with the packet rate. The routers and the receivers in the LAN may perform

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the same function. Consequently, the invention may be implemented even if the entire packet network does not support the method presented here. Put another way, the means for inserting TDI may be provided by a multimedia server, a router, or a gateway.

[0051] Another embodiment, illustrated in Fig. 5, generally at 90, includes a multimedia server 92, which generates a video stream 94 and an audio stream 96, a packet network 98, having routers 100, 102, 104, 106 and 108, and a video monitor 110 and a speaker 112. Video stream 94 and audio stream 96 are to be played separately yet synchronously at video monitor 110 and at speaker 112, respectively, which are connected to packet network 98. The destination addresses of video packets and audio packets are the addresses for the video monitor and for the speaker, respectively. Server 92 includes means to insert TDI, including TED and CND, in both video and audio packets. The routers perform the same procedure as shown in the other embodiments.

[0052] The method of U.S. Patent No. 4,506,358 is different from the invention described herein in that the present invention employs an information field in each packet of a type neither taught nor suggested in the prior art, that indicates the time when the audio/video content in the packet should be played. This enables the same content to be played synchronously at multiple receivers, without the necessity of synchronized server/receiver clocks.

[0053] This invention also maximizes the efficiency of bandwidth on physical links among routers and receivers by preventing a router from transmitting multimedia packets that will not be played at the final destination, *i.e.*, a media player, or receiver, as in the case where CND > TED.

[0054] Non-viable multimedia packets may be discarded if it is determined that they are not need, or if it is determined that they will not be used. The following may be used as a stand-alone technique, or in conjunction with the synchronization technique previously described herein. A router places a time stamp and sequence number in every received multimedia packet transferred between the media source and the receiver. Let:

$t_{ts}[n]$: the time stamp of the multimedia packet with sequence number n, and

$t_p[n]$: the timing information included in the multimedia packet with sequence number n, indicating when the content in this multimedia packet is to be played at the receiver. This information provides relative timing information among series of multimedia packets and does not indicate the absolute time.

[0055] At the receipt of the first multimedia packet, having sequence number = n_0, the router stores $t_{ts}[n_0]$ and $t_p[n_0]$ in memory and re-directs the multimedia packet to the next router or the receiver. Now, let

$$T_u = t_u[n_0] \text{ and} \qquad (2)$$

$$T_p = t_p[n_0]. \qquad (3)$$

[0056] At the receipt of every following received multimedia packet with sequence number n, the router examines the values of $t_{ts}[n]$ and $t_p[n]$, and, if

$$t_{ts}[n] - T_{ts} < tp[n] - T_p + D, \qquad (4)$$

where D denotes the maximum TED allowance, including the buffering delay in the receiver, the router re-directs the multimedia packet and sets

$$T_{ts} = t_{ts}[n] \text{ and} \qquad (5)$$

$$T_p = t_p[n]; \qquad (6)$$

and determines that the multimedia packet is a viable packet. Otherwise, the router discards the multimedia packet.

[0057] The value $t_{ts}[n] - T_{ts}$ is the difference between the arrival time of the multimedia packet of interest and the latest successfully re-directed multimedia packet at the router. Similarly, $t_p[n] - T_p$ indicates the time interval at play back between these two multimedia packets. Thus, if

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$$t_{ts}[n] - T_{ts} > t_p[n] - T_p + D, \quad (7)$$

the multimedia packet with sequence number n has already consumed the entire TED allowance. In this case, there is no chance for the multimedia packet to be played at the receiver, because the multimedia packet will not arrive at the receiver before or at the time it is to be played. By eliminating unnecessary transmission of such a multimedia packet, referred to herein as a non-viable packet, the bandwidth on the physical link between this router and the next entity, regardless of whether the next entity is a router or a receiver, may be utilized efficiently. The router thus includes means to determine whether a multimedia packet is a viable multimedia packet, in which case the multimedia packet is transmitted; or whether the multimedia packet is a non-viable multimedia packet, in which case the multimedia packet is discarded.

[0058] The value of D at any router may be provided by: (1) being hard-coded on the node's software or hardware; (2) being manually configured by a system administrator; or (3) being provided in every real-time multimedia packet by the multimedia server. The value is determined by the required QoS and must be greater than the buffering delay in the receiver. D will be a small value for delay-sensitive applications, such as two-way voice conversation. The receiver may negotiate the value of D with the media source using common communication protocols.

[0059] The transmission method of the invention functions with IP/UDP/RTP header compressor, specified in RFC 2508, wherein the header information of real-time multimedia packets is compressed by a differential coding scheme. The compressor, which may be implemented in a transmitting portion of a router, provides a means to identify a specific real-time media stream between a media source and a receiver, among other traffic. Because of differential coding, the compressor is required to examine the timing information in the header of real-time multimedia packets in any packet-based network, and the extra processing power required to implement the method of the invention is minimal.

[0060] Thus, a system and method for transmitting and synchronizing real-time, multimedia packet-based content over a packet-based network has been disclosed. Although several variations of the system and method of the invention have been disclosed, it will be appreciated that further variations and modification may be made thereto without departing from the scope of the invention as defined in the appended claims.

Claims

1. A system (60) for transmitting and synchronizing real-time multimedia content, comprising:

   a multimedia server (62) for generating a multimedia packet (64) having multimedia audio/visual information therein in a play sequence, and for transmitting said multimedia packet (64);
   a packet-based communication network (66) connected to said multimedia server (62) for receiving said multimedia packets therefrom; said network having multiple routers (68, 70) therein to route said multimedia packets (64) to plural destinations;
   means for inserting total delay information (TDI) into said multimedia packets (64), wherein said TDI includes total end-to-end delay (TED) and cumulative network delay (CND); and
   plural multimedia receivers (80, 82, 84) for receiving said multimedia packets (64) having TDI therein, wherein each multimedia receiver (80, 82, 84) includes a buffer for storing received multimedia packets, a sequencing means for retrieving stored multimedia packets from said buffer and sequencing said multimedia packets in said play sequence, and a playing mechanism for playing the retrieved, sequenced multimedia packets at time TED after said multimedia packet (64) has been transmitted by said multimedia server.

2. The system (60) of claim 1 wherein said means for inserting is located in said multimedia server (62).

3. The system (60) of claim 1 wherein said means for inserting is located in a router (68, 70).

4. The system (60) of claim 1 which further includes a local area network (LAN) (72) located between said packet-based network (66) and at least some of said multimedia receivers (80, 82, 84), wherein said LAN (72) includes a gateway (74).

5. The system (60) of claim 4 wherein said means for inserting is located in said gateway (74).

6. The system (60) of claim 1 wherein at least one of said routers (68, 70) includes duplication means for duplicating multimedia packets (64), wherein said means for inserting is located in said router (68, 70), and wherein said router

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(68, 70) inserts TDI into each duplicated multimedia packet.

7. The system (60) of claim 1 which further includes means to determine whether a multimedia packet (64) is a viable packet or whether a multimedia packet is a non-viable packet, and wherein said non-viable packets are discarded.

8. The system (60) of claim 1 wherein said multimedia receivers (80, 82, 84) includes means to request a larger TDI from said means for inserting.

9. A method of transmitting and synchronizing real-time multimedia content, comprising:

loading multimedia audio/visual into plural multimedia packets (64);
inserting total delay information (TDI) into at least one of the multimedia packets (64), wherein TDI includes total end-to-end delay (TED) and cumulative network delay (CND);
transmitting the multimedia packets (64) to plural multimedia receivers (80, 82, 84) over a packet-based network (66) in a play sequence;
buffering the multimedia packets (64) in each multimedia receiver (80, 82, 84);
recalling the multimedia packets (64) in play sequence; and
playing the multimedia packets (64) at each receiver (80, 82, 84) at time TED.

10. The method of claim 9 wherein said inserting includes inserting TDI in a multimedia server (62).

11. The method of claim 9 wherein said inserting includes inserting TDI in a router (68, 70) located in the packer-based network (66).

12. The method of claim 9 wherein said inserting includes inserting TDI in a gateway (74) located in a local area network (LAN) (72) which is located between the packet-based network (66) and a multimedia receiver (80, 82, 84).

13. The method of claim 9 which includes duplicating a multimedia packet (64) for multicasting to plural multimedia receivers (80, 82, 84), and wherein said duplicating includes inserting TDI into at some of the duplicated multimedia packets.

14. The method of claim 9 which includes discarding a multimedia packet (64) if at any time during said transmitting CND>TED.

15. The method of claim 14 which includes increasing the value of TED if CND>TED.

16. The method of claim 9 which includes determining whether a multimedia packet (64) is a viable packet or a non-viable packet, and which further include discarding any non-viable packets.

17. A method of transmitting and synchronizing real-time multimedia content, comprising:

determining whether a multimedia packet (64) is a viable packet or a non-viable packet; and
discarding any non-viable packets.

18. The method of claim 17 which further includes:

loading multimedia audio/visual into plural multimedia packets (64);
inserting total delay information (TDI) into at least one of the multimedia packets (64), wherein TDI includes total end-to-end delay (TED) and cumulative network delay (CND);
transmitting the multimedia packets (64) to plural multimedia receivers (80, 82, 84) over a packet-based network (66) in a play sequence;
discarding a multimedia packet (64) if at any time during said transmitting CND>TED;
buffering the multimedia packets (64) in each multimedia receiver (80, 82, 84);
recalling the multimedia packets (64) in play sequence; and
playing the multimedia packets (64) at each receiver (80, 82, 84) at time TED.

19. The method of claim 18 wherein said inserting includes inserting TDI in a multimedia server (62).

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20. The method of claim 18 wherein said inserting includes inserting TDI in a router (68, 70) located in the packet-based network (66).

21. The method of claim 18 wherein said inserting includes inserting TDI in a gateway (74) located in a local area network (LAN) (72) which is located between the packet-based network (66) and a multimedia receiver (80, 82, 84).

22. The method of claim 18 which includes duplicating a multimedia packet (64) for multicasting to plural multimedia receivers (80, 82, 84), and wherein said duplicating includes inserting TDI into at some of the duplicated multimedia packets.

23. The method of claim 18 which includes increasing the value of TED if CND>TED.

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FIG.1
(PRIOR ART)

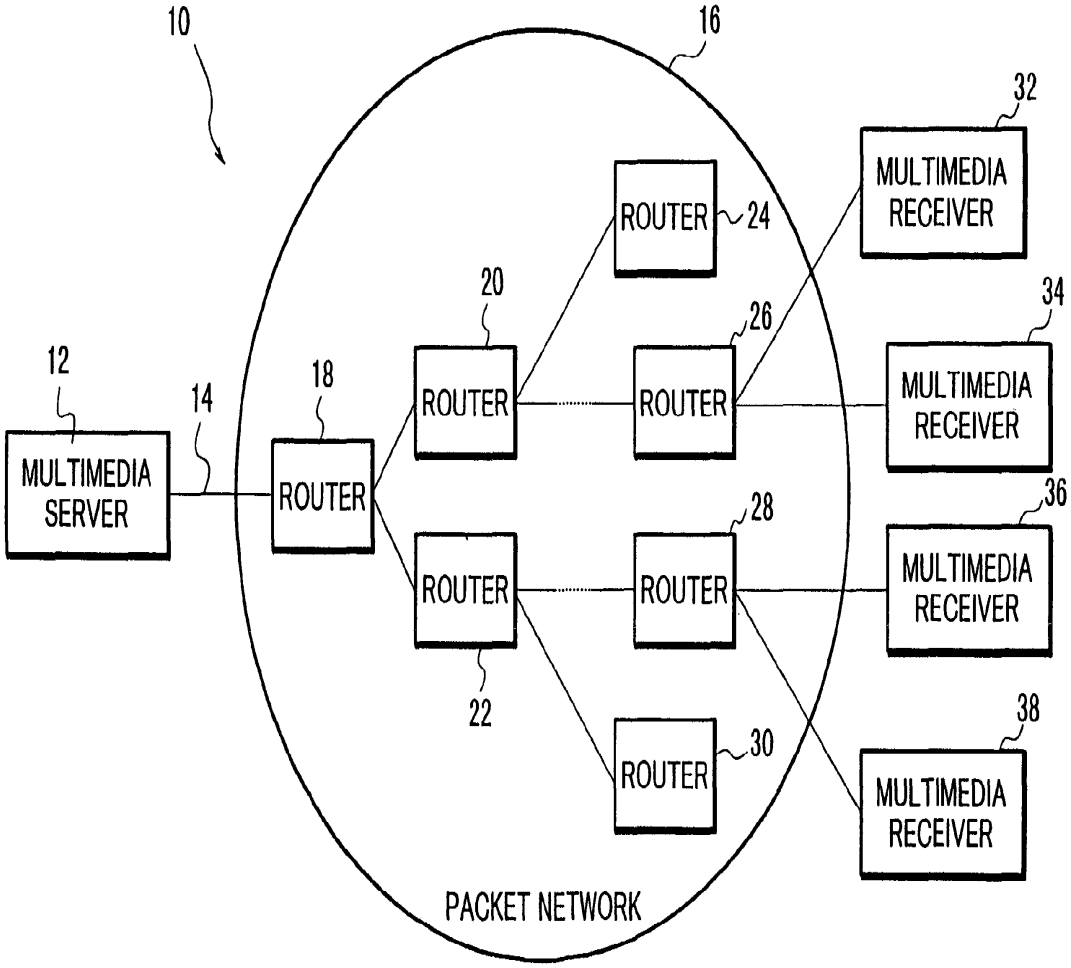

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FIG.2

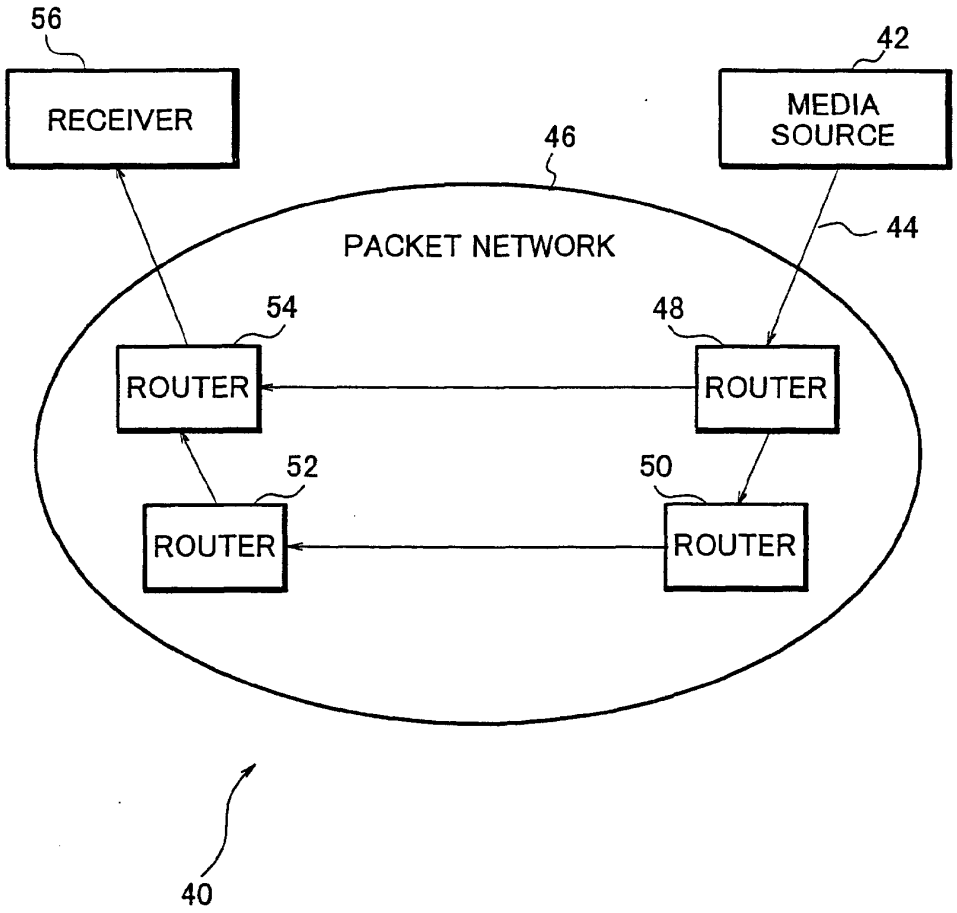
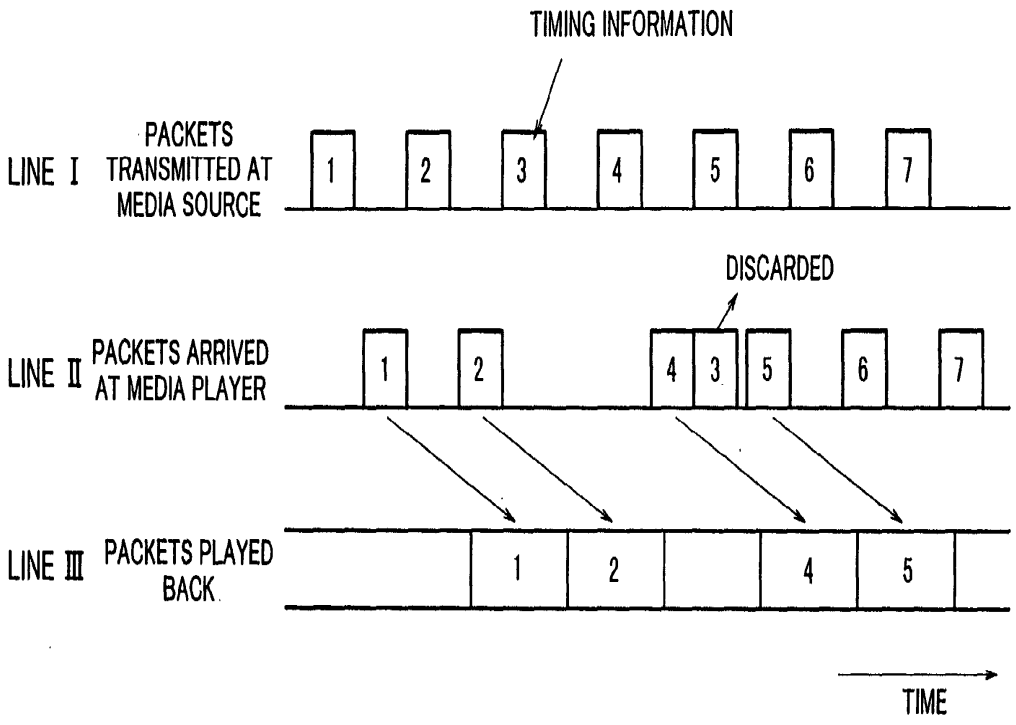

56
RECEIVER
42
MEDIA SOURCE
46
PACKET NETWORK
44
54
48
ROUTER
ROUTER
52
50
ROUTER
ROUTER
40

FIG.3



12

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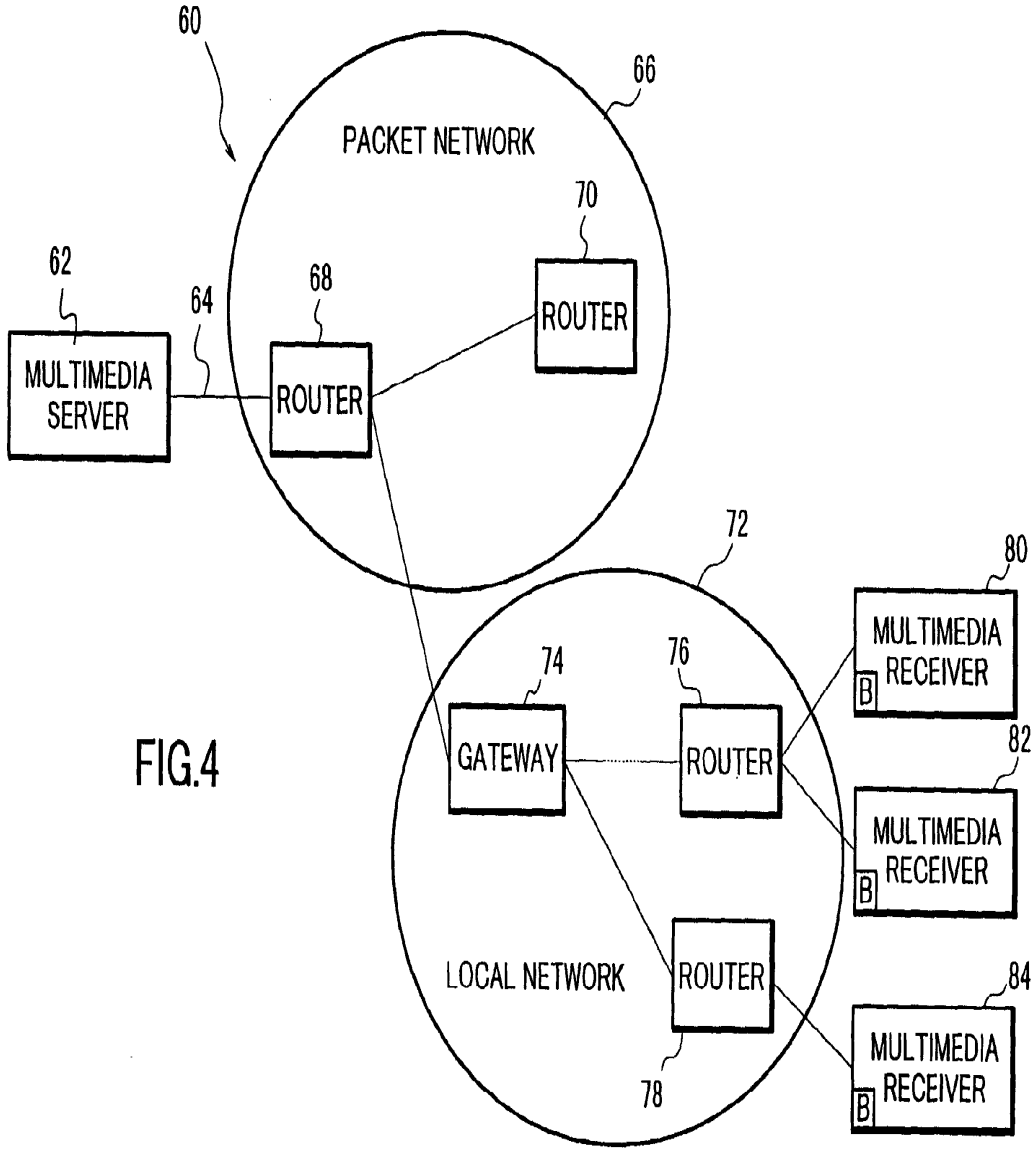
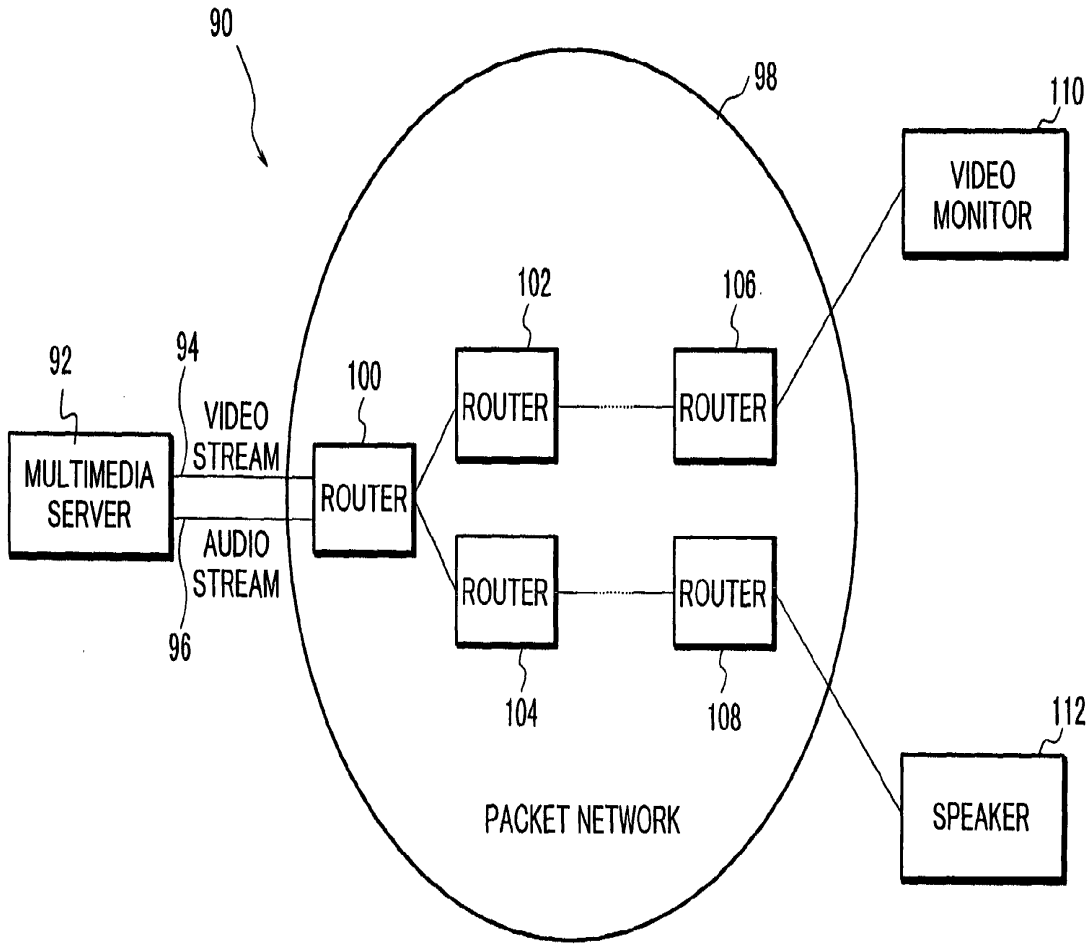

60
66
PACKET NETWORK
70
62
68
64
ROUTER
MULTIMEDIA SERVER
ROUTER
72
80
MULTIMEDIA RECEIVER
B
74
76
GATEWAY
ROUTER
82
MULTIMEDIA RECEIVER
B
LOCAL NETWORK
ROUTER
84
MULTIMEDIA RECEIVER
B
78

FIG.4

FIG.5



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(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 2 713 281 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
02.04.2014 Bulletin 2014/14

(51) Int Cl.:
G06F 15/16 *(2006.01)* ***G06F 9/48*** *(2006.01)*

(21) Application number: **13184747.7**

(22) Date of filing: **02.07.2004**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IT LI LU MC NL PL PT RO SE SI SK TR

(30) Priority: **28.07.2003 US 490768 P**
01.04.2004 US 816217

(62) Document number(s) of the earlier application(s) in accordance with Art. 76 EPC:
13155130.1 / 2 648 111
04778540.7 / 1 654 614

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Remarks:
•This application was filed on 17-09-2013 as a divisional application to the application mentioned under INID code 62.
•Claims filed after the date of filing of the application (Rule 68(4) EPC).

(54) System and method for synchronizing operations among a plurality of independently clocked digital data processing devices

(57) A system is described for maintaining synchrony of operations among a plurality of devices that have independent clocking arrangements. The system includes a task distribution device that distributes tasks to a synchrony group comprising a plurality of devices that are to perform the tasks distributed by the task distribution device in synchrony. The task distribution device distributes each task to the members of the synchrony group over a network. Each task is associated with a time stamp that indicates a time, relative to a clock maintained by the task distribution device, at which the members of the synchrony group are to execute o the task. Each member of the synchrony group periodically obtains from the task distribution device an indication of the current time indicated by its clock, determines a time differential between the task distribution device's clock and its respective clock and determines therefrom a time at which, according to its respective clock, the time stamp indicates that it is to execute the task.

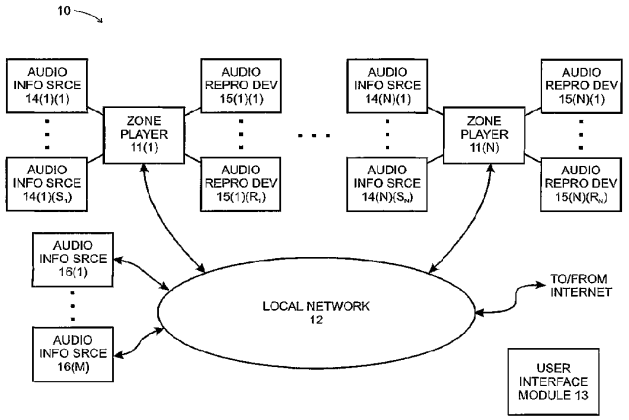

FIG. 1

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