506148180 07/10/2020

PATENT ASSIGNMENT COVER SHEET

Electronic Version v1.1
Stylesheet Version v1.2

EPAS ID: PAT6194912

SUBMISSION TYPE:	NEW ASSIGNMENT
NATURE OF CONVEYANCE:	CHANGE OF NAME

CONVEYING PARTY DATA

Name	Execution Date
VPN MULTICAST TECHNOLOGIES LLC	08/31/2016

RECEIVING PARTY DATA

Name:	MEETRIX IP, LLC
Street Address:	12100 WILSHIRE BOULEVARD SUITE 127
City:	SAN JOSE
State/Country:	CALIFORNIA
Postal Code:	95118

PROPERTY NUMBERS Total: 7

Property Type	Number
Patent Number:	7444425
Patent Number:	7664056
Patent Number:	8339997
Patent Number:	8477778
Patent Number:	9094525
Patent Number:	9253332
Patent Number:	9843612

CORRESPONDENCE DATA

Fax Number:

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

Email: mcatelani@anixa.com
Correspondent Name: MIKE CATELANI
Address Line 1: 3150 ALMADEN EXPRESSWAY SUITE 250
Address Line 4: SAN JOSE, CALIFORNIA 95118

NAME OF SUBMITTER:	MIKE CATELANI
SIGNATURE:	/MIKE CATELANI/
DATE SIGNED:	07/10/2020
	This document serves as an Oath/Declaration (37 CFR 1.63).

Total Attachments: 3

source=Change_Name_Meetrix_IP#page1.tif
source=Change_Name_Meetrix_IP#page2.tif
source=Change_Name_Meetrix_IP#page3.tif

Form 424
(Revised 05/11)

Submit in duplicate to:
Secretary of State
P.O. Box 13697
Austin, TX 78711-3697
512 463-5555
FAX: 512/463-5709
Filing Fee: See instructions

Certificate of Amendment

This space reserved for office use.

FILED
In the Office of the
Secretary of State of Texas

SEP 0 1 2016

Corporations Section

Entity Information

The name of the filing entity is:

VPN Multicast Technologies, LLC

State the name of the entity as currently shown in the records of the secretary of state. If the amendment changes the name of the entity, state the old name and not the new name.

The filing entity is a: (Select the appropriate entity type below.)

- ☐ For-profit Corporation
- ☐ Nonprofit Corporation
- ☐ Cooperative Association
- ☑ Limited Liability Company
- ☐ Professional Corporation
- ☐ Professional Limited Liability Company
- ☐ Professional Association
- ☐ Limited Partnership

The file number issued to the filing entity by the secretary of state is: 802075884

The date of formation of the entity is: 10/03/2014

Amendments

1. Amended Name

(If the purpose of the certificate of amendment is to change the name of the entity, use the following statement)

The amendment changes the certificate of formation to change the article or provision that names the filing entity. The article or provision is amended to read as follows:

The name of the filing entity is: (state the new name of the entity below)

Meetrix IP, LLC

The name of the entity must contain an organizational designation or accepted abbreviation of such term, as applicable.

2. Amended Registered Agent/Registered Office

The amendment changes the certificate of formation to change the article or provision stating the name of the registered agent and the registered office address of the filing entity. The article or provision is amended to read as follows:

RECEIVED

SEP 0 1 2016

Secretary of State

Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1005 – 003

Registered Agent
(Complete either A or B, but not both. Also complete C.)

☑ A. The registered agent is an organization (cannot be entity named above) by the name of:

Capitol Corporate Services

OR

☐ B. The registered agent is an individual resident of the state whose name is:

First Name	*M.I.*	*Last Name*	*Suffix*

The person executing this instrument affirms that the person designated as the new registered agent has consented to serve as registered agent.

C. The business address of the registered agent and the registered office address is:

Street Address (No P.O. Box)	*City*	*State*	*Zip Code*
206 E 9th Street, Suite 1300	Austin	TX	78701-4411

3. Other Added, Altered, or Deleted Provisions

Other changes or additions to the certificate of formation may be made in the space provided below. If the space provided is insufficient, incorporate the additional text by providing an attachment to this form. Please read the instructions to this form for further information on format.

Text Area (The attached addendum, if any, is incorporated herein by reference.)

☐ **Add** each of the following provisions to the certificate of formation. The identification or reference of the added provision and the full text are as follows:

☐ **Alter** each of the following provisions of the certificate of formation. The identification or reference of the altered provision and the full text of the provision as amended are as follows:

☐ **Delete** each of the provisions identified below from the certificate of formation.

Statement of Approval

The amendments to the certificate of formation have been approved in the manner required by the Texas Business Organizations Code and by the governing documents of the entity.

Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1005 – 004

Effectiveness of Filing (Select either A, B, or C.)

A. ☑ This document becomes effective when the document is filed by the secretary of state.

B. ☐ This document becomes effective at a later date, which is not more than ninety (90) days from the date of signing. The delayed effective date is: _____

C. ☐ This document takes effect upon the occurrence of a future event or fact, other than the passage of time. The 90th day after the date of signing is: _____

The following event or fact will cause the document to take effect in the manner described below:

Execution

The undersigned signs this document subject to the penalties imposed by law for the submission of a materially false or fraudulent instrument and certifies under penalty of perjury that the undersigned is authorized under the provisions of law governing the entity to execute the filing instrument.

Date: 8/31/16

By: Henry P Herms
Henry P Herms (Aug 31, 2016)

Signature of authorized person

Henry P Herms

Printed or typed name of authorized person (see instructions)

Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1005 – 005

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 Western District of Texas, Austin Division on the following

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

DOCKET NO.	DATE FILED	U.S. DISTRICT COURT
1:18-CV-309-RP	4/13/2018	Western District of Texas, Austin Division

PLAINTIFF	DEFENDANT
Meetrix IP, LLC	Cisco Systems, Inc.

	PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1	8339997		
2	9094525		
3	9253332		
4	9843612		
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
Final Judgment Attached

CLERK	(BY) DEPUTY CLERK	DATE
Jeannette J. Clack		04/22/2019

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**

FILED

2019 APR 22 PM 2:54

CLERK US DISTRICT COURT
WESTERN DISTRICT OF TEXAS
BY _____ DEPUTY

IN THE UNITED STATES DISTRICT COURT
FOR THE WESTERN DISTRICT OF TEXAS
AUSTIN DIVISION

MEETRIX IP, LLC, PLAINTIFF,	§	
	§	
V.	§	CAUSE NO. 1:18-CV-309-LY
	§	
CISCO SYSTEMS, INC., DEFENDANT.	§	

FINAL JUDGMENT

Before the court is the above entitled cause of action. On April 19, 2019, the parties filed an Agreed Motion to Dismiss with Prejudice (Doc. #36), which the court granted by separate order. Accordingly, the court renders the following Final Judgment pursuant to Federal Rule of Civil Procedure 58.

IT IS HEREBY ORDERED that the case hereby **CLOSED.**

SIGNED this 22nd day of April, 2019.

LEE YEAKEL
UNITED STATES DISTRICT JUDGE

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 Western District of Texas, Austin Division on the following

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

DOCKET NO.	DATE FILED	U.S. DISTRICT COURT
1:18-CV-309-RP	4/13/2018	Western District of Texas, Austin Division

PLAINTIFF	DEFENDANT
Meetrix IP, LLC	Cisco Systems, Inc.

	PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1	~~See Attached~~ e		
2	9253332		
3	9094525		
4	8339997		
5	9843612		

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

DECISION/JUDGEMENT

CLERK	(BY) DEPUTY CLERK	DATE
Jeannette J. Clack		APR 13 2018

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

Trials@uspto.gov
571-272-7822

Paper 8
Entered: May 7, 2019

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

CISCO SYSTEMS, INC.,
Petitioner

v.

MEETRIX IP, LLC,
Patent Owner.

Case IPR2019-00539 (Patent 9,253,332 B2)
Case IPR2019-00540 (Patent 9,253,332 B2)
Case IPR2019-00541 (Patent 9,094,525 B2)
Case IPR2019-00542 (Patent 9,094,525 B2)
Case IPR2019-00543 (Patent 9,843,612 B2)
Case IPR2019-00544 (Patent 9,843,612 B2)[1]

Before KEVIN F. TURNER, GREGG I. ANDERSON, and SCOTT B. HOWARD, *Administrative Patent Judges*.

ANDERSON, *Administrative Patent Judge*.

DECISION
Granting Joint Motion to Terminate
37 C.F.R. § 42.72

---

[1] The parties are not authorized to use this caption. The parties should use the caption applicable to the specific case.

INTRODUCTION

Per our email dated April 19, 2019, we authorized the filing of a motion to terminate the above identified proceedings ("'539 IPR," "'540 IPR," "'541 IPR," "'542 IPR," "'543 IPR," and "'544 IPR" respectively, collectively "Settled IPRs"). Settled IPRs, Ex. 3001. The '539 and '540 IPRs challenge claims of U.S. Patent No. 9,253,332. The '541 and '542 IPRs challenge claims of U.S. Patent No. 9,094,525. The '543 and '544 IPRs challenge claims of U.S. Patent No. 9,843,612. Per our authorization, on May 3, 2019, Cisco Systems, Inc. ("Petitioner") and Meetrix IP LLC. ("Patent Owner") filed a Joint Motion to Dismiss the Petition ("Joint Motion") for each proceeding. Settled IPRs, Paper 6. Concurrently with the filing of the Joint Motion, the parties filed a Joint Request to Treat Settlement Agreement as Business Confidential Information Pursuant to 35 U.S.C. § 317(b) ("Joint Request"). Settled IPRs, Paper 7; *see also* Ex. 1048 (Settlement and License Agreement ("Settlement Agreement"), Section 7. Confidentiality).

DISCUSSION

The Joint Motion in the Settle IPRs sets forth the parties' agreement that they have settled their dispute with respect to the challenged patents and have reached agreement to seek termination the Settled IPRs. Settled IPRs, Paper 6, 2. A true and correct copy of the Settlement Agreement was filed with the Joint Motion as business confidential information pursuant to 35 U.S.C. § 317(b). *Id.*; *see* Exhibit 1048. The parties assert that there "are no collateral agreements or understandings made in connection with, or in contemplation of, the

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Exhibit 1005 – 010

termination" of the proceedings. Settled IPRs, Paper 6, 2. The parties request dismissal of the Settled IPRs. *Id.*

These proceedings are at a very early stage, no preliminary response has been filed, no institution decision has been entered, and trial has not commenced. We are persuaded that, under these circumstances, it is appropriate to dismiss all pending proceedings between the parties as identified above. *See* 37 C.F.R. § 42.72.

ORDER

Accordingly, it is:

ORDERED that the joint motion to terminate the proceedings is GRANTED, and the '539, '540, '541, '542, '543, and '544 IPR proceedings are hereby DISMISSED as to all parties;

FURTHER ORDERED that the parties' joint request to treat the Settlement Agreement confidential is GRANTED, and the specified exhibits shall be: (i) treated as business confidential information; (ii) kept separate from the files of U.S. Patent Nos. 9,253,332; 9,094,525; and 9,843,612; (iii) kept confidential from any third party; (iv) filed as "BOARD AND PARTIES ONLY" as accessible only to the Board and the parties to this proceeding; and (v) made available only to Federal Government agencies on written request, or to any person on a showing of good cause, under the provisions of 35 U.S.C. § 317(b) and 37 C.F.R. § 42.74(c); and

FURTHER ORDERED that a copy of this Order will be filed in the '539, '540, '541, '542, '543, and '544 IPR.

Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1005 – 011

Case IPR2019-00539 (Patent 9,253,332 B2)
Case IPR2019-00540 (Patent 9,253,332 B2)
Case IPR2019-00541 (Patent 9,094,525 B2)
Case IPR2019-00542 (Patent 9,094,525 B2)
Case IPR2019-00543 (Patent 9,843,612 B2)
Case IPR2019-00544 (Patent 9,843,612 B2)

PETITIONER:

David L. McCombs
Theodore M. Foster
Gregory P. Huh
HAYNES AND BOONE, LLP
david.mccombs.ipr@haynesboone.com
ipr.theo.foster@haynesboone.com
gregory.huh.ipr@haynesboone.com

Gilbert A. Greene
DUANE MORRIS, LLP
bgreene@duanemorris.com

PATENT OWNER:

Gregory S. Donahue
Andrew G. DiNovo
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gdonahue@dinovoprice.com
adinovo@dinovoprice.com
docketing@dinovoprice.com

Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1005 – 012

UNITED STATES PATENT AND TRADEMARK OFFICE
COMMISSIONER FOR PATENTS
P.O.BOX 1450
ALEXANDRIA VA 22313-1451

PRESORTED
FIRST-CLASS MAIL
U.S. POSTAGE PAID
POSTEDIGITAL
NNNNN

MARTIN & FERRARO, LLP
1557 LAKE O'PINES STREET, NE
HARTVILLE, OH 44632

Courtesy Reminder for
Application Serial No: 13/674,233

Attorney Docket No: 207.0002-03000
Customer Number: 22882
Date of Electronic Notification: 06/24/2014

This is a courtesy reminder that new correspondence is available for this application. If you have not done so already, please review the correspondence. The official date of notification of the outgoing correspondence will be indicated on the form PTOL-90 accompanying the correspondence.

An email notification regarding the correspondence was sent to the following email address(es) associated with your customer number:

MICK@KIPG.COM
mmk@kipg.com
admin@kipg.com

To view your correspondence online or update your email addresses, please visit us anytime at **https://sportal.uspto.gov/secure/myportal/privatepair.** If you have any questions, please email the Electronic Business Center (EBC) at EBC@uspto.gov or call 1-866-217-9197.

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 Western District of Texas, Austin Division on the following Trademarks or ☒ Patents. (☐ the patent action involves 35 U.S.C. § 292.):

DOCKET NO.	DATE FILED	U.S. DISTRICT COURT
1:16-CV-1034-RP	9/2/2016	Western District of Texas, Austin Division

PLAINTIFF	DEFENDANT
Meetrix IP, LLC	LogMeIn, Inc.

	PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1	9253332		
2	9094525		
3	8339997		
4			
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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
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In the above—entitled case, the following decision has been rendered or judgement issued:

DECISION/JUDGEMENT

CLERK	(BY) DEPUTY CLERK	DATE
Jeannette J. Clack		

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**

Zoho Corp. and Zoho Corp. Pvt. Ltd.

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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 Western District of Texas, Austin Division on the following

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

DOCKET NO.	DATE FILED	U.S. DISTRICT COURT
1:16-CV-1033-RP	9/2/2016	Western District of Texas, Austin Division

PLAINTIFF	DEFENDANT
Meetrix IP, LLC	Citrix Systems, Inc.

	PATENT OR TRADEMARK NO.	DATE OF PATENT OR TRADEMARK	HOLDER OF PATENT OR TRADEMARK
1	SEE ATTACHED		
2	9,253,332	Format m/d/yyyy	
3	9,094,525		
4	8,339,997		
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	
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In the above—entitled case, the following decision has been rendered or judgement issued:

DECISION/JUDGEMENT

CLERK	(BY) DEPUTY CLERK	DATE
Jeannette J. Clack		9/6/2016

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**

Zoho Corp. and Zoho Corp. Pvt. Ltd.

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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.
13/674,233	07/28/2015	9094525	207.0002-03000	5197

22882 7590 07/08/2015

MARTIN & FERRARO, LLP
1557 LAKE O'PINES STREET, NE
HARTVILLE, OH 44632

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 105 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):

Thomas Dye, Austin, TX;
VPN Multicast Technologies LLC, Plano, TX
Thomas Dundon, San Marcos, TX;

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.

Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1005 – 016

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /SN/

OMB 0651-0031

Substitute for FORM PTO-1449	Attorney Docket Number 207.0002-03000	Customer No. 22882	
INFORMATION DISCLOSURE STATEMENT IN AN APPLICATION	Applicant Thomas Dye et al.	Application Number 13/674,233	
(Use several sheets if necessary) Sheet 1 of 1	Filing Date November 12, 2012	Group Art Unit 2656	Examiner Suhan Ni

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
Change(s) applied to document, /T.W./ 7/2/2015	5,805,805	09 8/1998	Civanlar, S. et al.			
	6,041,166	3/2000	Hart, J.H. et al.			
	6,047,325	4/2000	Jain et al.			
	6,728,358	4/2004	Kwan			
	6,751,477	6/2004	Alperovich et al.			
	7,444,425	10/2008	Lehmann et al.			
	7,664,056	2/2010	Dye			
	8,339,997	12/2012	Dye			
	8,477,778	7/2013	Lehmann et al.			
	2003/0137976	7/2003	Zhu et al.			
	2003/0235338	12/2003	Dye			
	2004/0022322	2/2004	Dye			
	2011/0043601	2/2011	Dye			
	2013/0163480	6/2013	Dye			
	14/590,791	1/2015	Dye			

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION (YES/NO)

OTHER DOCUMENTS *(Including Author, Title, Date, Pertinent Pages, Etc.)*	
Lit. 1	VPN Multicast Technologies LLC v. AT&T Inc. and AT&T Corporation; Complaint; Case No. 2:14-cv-1013; October 31, 2014; 8 pages.
Lit. 2	VPN Multicast Technologies LLC v. Dimension Data North America, Inc., Dimension Data Holdings PLC, and Dimension Data, LLC; Complaint; Case No. 2:14-cv-1014; October 31, 2014; 8 pages.
Lit. 1; Lit. 2	VPN Multicast Technologies LLC v. AT&T Inc. and AT&T Corporation; VPN Multicast Technologies LLC v. Dimension Data North America, Inc., Dimension Data Holdings PLC, and Dimension Data, LLC; Dimension Data North America, Inc.'s Answer and Affirmative Defenses to Plaintiff's First Amended Complaint; Case Nos. 2:14-cv-1013 and 2:14-cv-1014; January 29, 2015; 15 pages.
	International Telecommunications Union Recommendation H.323, Titled "Packet Based Multimedia Communication System," November 2000, 258 pages.
	International Telecommunications Union Recommendation H.261, Titled "Video Codec for Audio Visual Services at Px64 kbps," March 1993, 29 pages.
	International Telecommunications Untion Recommendation H.263, Titled "Video Coding for Low Bit-Rate Communications," February 1998, 167 pages.

EXAMINER	/Suhan Ni/	DATE CONSIDERED	02/21/2015

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

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /SN/

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	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
13/674,233	11/12/2012	2656	722	207.0002-03000	24	3

CONFIRMATION NO. 5197

CORRECTED FILING RECEIPT

22882
MARTIN & FERRARO, LLP
1557 LAKE O'PINES STREET, NE
HARTVILLE, OH 44632

OC000000078036481

Date Mailed: 07/01/2015

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)

Thomas Dye, Austin, TX;
Thomas Dundon, San Marcos, TX;

Applicant(s)

VPN Multicast Technologies LLC, Plano, TX

Assignment For Published Patent Application

VPN Multicast Technologies LLC, Plano, TX

Power of Attorney: The patent practitioners associated with Customer Number 22882

Domestic Priority data as claimed by applicant

This application is a CON of 12/646,892 12/23/2009 PAT 8339997
which is a CON of 10/796,560 03/09/2004 PAT 7664056
which claims benefit of 60/453,307 03/10/2003

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: 12/03/2012
The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 13/674,233**
Projected Publication Date: Not Applicable
Non-Publication Request: No
Early Publication Request: No

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Exhibit 1005 – 018

**** SMALL ENTITY ****

Title

AUDIO-VIDEO MULTI-PARTICIPANT CONFERENCE SYSTEMS USING PSTN AND INTERNET NETWORKS

Preliminary Class

370

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.

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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.

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/674,233	11/12/2012	Thomas Dye	207.0002-03000	5197

22882 7590 06/26/2015

MARTIN & FERRARO, LLP
1557 LAKE O'PINES STREET, NE
HARTVILLE, OH 44632

EXAMINER
NI, SUHAN

ART UNIT	PAPER NUMBER
2656	

NOTIFICATION DATE	DELIVERY MODE
06/26/2015	ELECTRONIC

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Response to Rule 312 Communication	Application No.	Applicant(s)
	13/674,233	DYE ET AL.
	Examiner	Art Unit
	SUHAN NI	2656

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

1. ☒ The amendment filed on *02 June 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.

Attachments:IDS

/CURTIS KUNTZ/ Supervisory Patent Examiner, Art Unit 2656	/SUHAN NI/ Primary Examiner, Art Unit 2656

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Exhibit 1005 – 022

Amendments to the Claims:

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

Listing of Claims:

Claims 1-19. (Cancelled)

20. (Previously Presented) A system for supporting a multi-participant conference call comprising:

a first mixer that mixes a Public Switched Telephone Network (PSTN) client audio data stream with a moderator audio-video data stream into a first mixed data stream;

a first transport output that transmits the first mixed data stream to at least one remote client that receives the first mixed data stream, the at least one remote client communicatively coupled to the Internet, which generates a remote client audio-video data stream;

a second mixer that mixes the moderator audio-video data stream with the remote client audio-video data stream into a second mixed data stream; and

a second transport output that transmits a mixed audio data stream, corresponding to the second mixed data stream, to the PSTN client.

21. (Previously Presented) The system of claim 20 further comprising a third mixer that mixes the audio data from the PSTN client with the audio-video data stream from the remote client into a third mixed data stream and communicates the third mixed data stream to the moderator.

22. (Presently Amended) The system of claim 20 further comprising a VoIP decoder that receives IP packets including the audio data stream generated by the PSTN client, the VoIP ~~decodes~~ decoder decodes the IP packets including the audio

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Exhibit 1005 – 023

data from the PSTN client.

23. (Previously Presented) The system of claim 20 further comprising at least one audio decompressor that decodes IP packets including the audio-video data stream generated by the remote client.

24. (Previously Presented) The system of claim 20 wherein the PSTN client audio data stream and the moderator audio-video data stream are transported across a virtual private network tunnel.

25. (Previously Presented) The system of claim 20 wherein the moderator audio-video data stream and the remote client audio-video data stream are transported across a virtual private network tunnel.

26. (Previously Presented) The system of claim 25 further comprising an encoder that receives the first mixed data stream and encodes the first mixed voice data before transmitting the first mixed data stream to the remote client.

27. (Presently Amended) The system of claim 24 further comprising a VoIP encoder that encodes the second mixed data stream and ~~encode~~ encodes the second mixed voice data before transmitting the second mixed data stream to the PSTN client.

Claims 28-35 (Cancelled).

36. (Previously Presented) A non-transitory computer-readable medium including instructions for a multi-participant conference process to be executed by a local moderator computer, the process comprising:

receiving audio data from a telephone through a public switched telephone network (PTSN);

receiving audio data and video data from a first remote computer through an Internet;

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receiving audio data and video data from a second remote computer through the Internet;

receiving audio data from a local audio input device communicatively connected to the local moderator computer;

receiving video data from a local video input device communicatively connected to the local moderator computer;

mixing the audio data received from the telephone with the audio data received from the local audio input device and the video data received from the local video input device into mixed audio-video data;

transmitting the mixed audio-video data to the first remote computer and the second remote computer;

mixing the audio data received from the first remote computer and the audio data received from the second remote computer with the audio data received from the local audio input device into mixed audio data;

compressing the mixed audio data;

transmitting the compressed mixed audio data to the telephone; and

transmitting collaboration data to the first remote computer and the second remote computer.

37. (Previously Presented) The process of claim 36, further comprising mixing the audio data received from the telephone with the audio data received from the first and second remote computers into a second mixed audio data.

38. (Previously Presented) The process of claim 36, wherein the receiving audio data from the telephone includes receiving internet protocol (IP) packets, the process further comprising decoding the IP packets.

39. (Previously Presented) The process of claim 36, wherein the receiving audio data and video data from the first remote computer includes receiving internet protocol (IP) packets, the process further including decoding the IP packets.

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40. (Previously Presented) The process of claim 36, wherein the transmitting the mixed audio-video data includes transmitting the mixed audio-video data through a Virtual Private Network (VPN).

41. (Previously Presented) The process of claim 36, wherein the transmitting the mixed audio data includes transmitting the mixed audio data through a Virtual Private Network (VPN).

42. (Previously Presented) The process of claim 36, further comprising encoding the mixed audio-video data before the transmitting of the mixed audio-video data to the first and second remote computers.

43. (Previously Presented) The process of claim 36, further comprising encoding the compressed mixed audio data before the transmitting of the mixed audio data to the telephone.

44. (Presently Amended) A computer-implemented multi-participant conference system utilizing a local moderator computer, the system comprising:

a voice over IP decoder configured to decode audio data received by the local moderator computer from a telephone through a public switched telephone network (PSTN);

a voice over IP encoder configured to compress audio data transported from the local moderator computer to the telephone through the ~~PTSN~~PSTN;

a first mixer configured to mix decoded audio data received by the local moderator computer from the telephone through the ~~PTSN~~ PSTN with audio data received by the local moderator computer from a local audio input device and video data received by the local moderator computer from a local video input device into an audio-video stream for transmission through an Internet to a first remote computer and a second remote computer;

a second mixer configured to mix audio data received by the local moderator computer from the first remote computer and the second remote

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computer through the Internet with audio data received by the local moderator computer from the local audio input device into an audio stream for transmission to the telephone through the PSTN; and

a data collaboration unit configured to transmit collaboration data from the local moderator through the internet to the first remote computer and the second remote computer.

45. (Previously Presented) The system of claim 44, further comprising a third mixer configured to mix the decoded audio data received from the telephone with the audio data received from the first and second remote computers.

46. (Presently Amended) The system of claim 44, wherein the audio data received by the local moderator computer from the telephone through the ~~PTSN~~ PSTN is transported through a virtual private network (VPN) tunnel.

47. (Previously Presented) The system of claim 44, wherein audio data transported from the local moderator computer to the telephone is transported through a virtual private network (VPN) tunnel.

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/674,233	11/12/2012	Thomas Dye	207.0002-03000	5197

22882 7590 06/19/2015

MARTIN & FERRARO, LLP
1557 LAKE O'PINES STREET, NE
HARTVILLE, OH 44632

EXAMINER
NI, SUHAN

ART UNIT	PAPER NUMBER
2656	

NOTIFICATION DATE	DELIVERY MODE
06/19/2015	ELECTRONIC

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

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APPLICATION NO./ CONTROL NO.	FILING DATE	FIRST NAMED INVENTOR / PATENT IN REEXAMINATION	ATTORNEY DOCKET NO.
13/674,233	12 November, 2012	DYE ET AL.	207.0002-03000

MARTIN & FERRARO, LLP
1557 LAKE O'PINES STREET, NE
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EXAMINER	
SUHAN NI	
ART UNIT	PAPER
2656	20150604

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Commissioner for Patents

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

/SUHAN NI/
Primary Examiner, Art Unit 2656

PTO-90C (Rev.04-03)

OMB 0651-0031

Substitute for FORM PTO-1449	Attorney Docket Number 207.0002-03000	Customer No. 22882	
INFORMATION DISCLOSURE STATEMENT IN AN APPLICATION	Applicant Thomas Dye et al.	Application Number 13/674,233	
(Use several sheets if necessary) **Sheet 1 of 2**	Filing Date November 12, 2012	Group Art Unit 2656	Examiner Suhan Ni

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
Lit. 1; Lit. 2	6,526,056	2/2003	Rekhter et al.			
Lit. 1; Lit. 2	6,778,531	8/2004	Kodialam et al.			
Lit. 1; Lit. 2	7,203,957	4/2007	Balissat et al.			
Lit. 1; Lit. 2	7,281,058	10/2007	Shepherd et al.			
Lit. 1; Lit. 2	7,330,468	2/2008	Tse-Au			
Lit. 1; Lit. 2	7,366,894	4/2008	Kalimuthu et al.			
Lit. 1; Lit. 2	7,447,203	11/2008	Chen et al.			
Lit. 1; Lit. 2	7,447,901	11/2008	Sullenberger et al.			
Lit. 1; Lit. 2	7,562,386	7/2009	Balissat et al.			
Lit. 1; Lit. 2	7,570,648	8/2009	Hu et al.			
Lit. 1; Lit. 2	7,830,787	11/2010	Wijnands et al.			

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION (YES/NO)
Lit. 1; Lit. 2	WO 01/91397 A2	11/2001	WIPO			N/A
Lit. 1; Lit. 2	WO 02/098063 A1	12/2002	WIPO			N/A

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

Lit. 1; Lit. 2	VPN Multicast Technologies LLC v. AT&T Corp.; VPN Multicast Technologies LLC v. Dimension Data North America, Inc., et al., Plaintiff's Responses to Defendants' First Set of Common Interrogatories to VPN Multicast Technologies LLC, Case Nos. 2:14-cv-1013 and 2:14-cv-1014, April 14, 2015, 28 pgs.
Lit. 1; Lit. 2	VPN Multicast Technologies LLC v. AT&T Corp.; VPN Multicast Technologies LLC v. Dimension Data North America, Inc., et al.; Defendants' Invalidity Contentions including Appendix A and Claim Charts; Case Nos. 2:14-cv-1013 and 2:14-cv-1014; April 16, 2015; 2,274 pages.
Lit. 1; Lit. 2	VPN Multicast Technologies LLC v. AT&T Corp.; VPN Multicast Technologies LLC v. Dimension Data North America, Inc., et al.; AT&T's Objections and Responses to VPN's First Set of Common Interrogatories; Case Nos. 2:14-cv-1013 and 2:14-cv-1014; April 23, 2015; 20 pages.
Lit. 1; Lit. 2	Alchaal et al., "Offering a Multicast Delivery Service in a Programmable Secure IP VPN Environment," Fourth International Workshop on Networked Group Communication (NGC '02), 2002, 6 pgs.
Lit. 1; Lit. 2	Bokun et al., "The MECCANO Internet Multimedia Conferencing Architecture," Multimedia Education and Conferencing Collaboration over ATM Networks and Others (MECCANO), Ver. 3.1.2, December 1999, 67 pgs.
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Lit. 1; Lit. 2	Costa et al., "An Introduction to Virtual Private Networks: Towards D-VPNs," Network and Information Systems Journal, Vol. 2, June 2000, 20 pgs.
Lit. 1; Lit. 2	Eriksson, "MBONE: The Multicast Backbone," ACM Communications of the ACM 37, 8, August 1994, Pages 54-60, 11 pgs.
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Lit. 1; Lit. 2	Kent et al., "Security Architecture for the Internet Protocol," Network Working Group, Request for Comments: 2401, Obsoletes: 1825, Category: Standards Track, November 1998, 61 pgs.
Lit. 1; Lit. 2	Kirstein et al., "The RadioActive Networking Architecture," IEEE, DARPA Active Networks Conference and Exposition, 2002. Proceedings, May 2002, 16 pgs.
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Lit. 1; Lit. 2	Labonte et al., "Group Management Strategies for Secure Multicasting on Active Virtual Private Networks," IEEE, 25th annual IEEE Conference on Local Computer Networks, Pages 213-222, November 2000, 10 pgs.
Lit. 1; Lit. 2	Lamaster et al., "Internet technologies and requirements for telemedicine," Minimally Invasive Therapy and Allied Technologies 1997, Vol. 6, No. 5-6, Pages 436-443, 1997, 8 pgs.
Lit. 1; Lit. 2	Macedonia et al., "MBone Provides Audio and Video Across the Internet," U.S. Naval Post Graduate School Website, available at http://www.nps.edu/library, April 1994, 8 pgs.
Lit. 1; Lit. 2	Rosen et al., "Multicast in MPLS/BGP VPNs," Network Working Group, Internet Draft, November 2000, 17 pgs.
Lit. 1; Lit. 2	Savetz et al., "MBONE: Multicasting Tomorrow's Internet," IDG Books Worldwide, Inc., 1996, 259 pgs.
Lit. 1; Lit. 2	Waitzman et al., "Distance Vector Multicast Routing Protocol," Networks Working Group, Request For Comments: 1075, November 1988, 24 pgs.
Lit. 1; Lit. 2	Wittmann et al., "Multicast Communication: Protocols and Applications," Morgan Kaufmann Publishers, 1999, 362 pgs.

EXAMINER	/Suhan Ni/	**DATE CONSIDERED**	06/04/2015

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

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /SN/

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Exhibit 1005 – 031

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	)	Confirmation No.: 5197
Thomas Dye et al.	)	
Serial No.: 13/674,233	)	Group Art Unit: 2656
Filed: February 12, 2012	)	Examiner: Suhan Ni
For: AUDIO-VIDEO MULTI-PARTICIPANT CONFERENCE SYSTEMS USING PSTN AND INTERNET NETWORKS	)	

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

Sir:

AMENDMENT AFTER ALLOWANCE

Pursuant to 37 C.F.R. § 1.312 and subject to the recommendation of the Examiner and the approval of the Commissioner, and without withdrawing the case from issue, kindly amend the subject application as follows:

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

Remarks begin on page 7 of this paper.

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Exhibit 1005 – 032

Amendments to the Claims:

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

Listing of Claims:

Claims 1-19. (Cancelled)

20. (Previously Presented) A system for supporting a multi-participant conference call comprising:

a first mixer that mixes a Public Switched Telephone Network (PSTN) client audio data stream with a moderator audio-video data stream into a first mixed data stream;

a first transport output that transmits the first mixed data stream to at least one remote client that receives the first mixed data stream, the at least one remote client communicatively coupled to the Internet, which generates a remote client audio-video data stream;

a second mixer that mixes the moderator audio-video data stream with the remote client audio-video data stream into a second mixed data stream; and

a second transport output that transmits a mixed audio data stream, corresponding to the second mixed data stream, to the PSTN client.

21. (Previously Presented) The system of claim 20 further comprising a third mixer that mixes the audio data from the PSTN client with the audio-video data stream from the remote client into a third mixed data stream and communicates the third mixed data stream to the moderator.

22. (Presently Amended) The system of claim 20 further comprising a VoIP decoder that receives IP packets including the audio data stream generated by the PSTN client, the VoIP ~~decodes~~ decoder decodes the IP packets including the audio

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Exhibit 1005 – 033

data from the PSTN client.

23. (Previously Presented) The system of claim 20 further comprising at least one audio decompressor that decodes IP packets including the audio-video data stream generated by the remote client.

24. (Previously Presented) The system of claim 20 wherein the PSTN client audio data stream and the moderator audio-video data stream are transported across a virtual private network tunnel.

25. (Previously Presented) The system of claim 20 wherein the moderator audio-video data stream and the remote client audio-video data stream are transported across a virtual private network tunnel.

26. (Previously Presented) The system of claim 25 further comprising an encoder that receives the first mixed data stream and encodes the first mixed voice data before transmitting the first mixed data stream to the remote client.

27. (Presently Amended) The system of claim 24 further comprising a VoIP encoder that encodes the second mixed data stream and ~~encode~~ encodes the second mixed voice data before transmitting the second mixed data stream to the PSTN client.

Claims 28-35 (Cancelled).

36. (Previously Presented) A non-transitory computer-readable medium including instructions for a multi-participant conference process to be executed by a local moderator computer, the process comprising:

receiving audio data from a telephone through a public switched telephone network (PTSN);

receiving audio data and video data from a first remote computer through an Internet;

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receiving audio data and video data from a second remote computer through the Internet;

receiving audio data from a local audio input device communicatively connected to the local moderator computer;

receiving video data from a local video input device communicatively connected to the local moderator computer;

mixing the audio data received from the telephone with the audio data received from the local audio input device and the video data received from the local video input device into mixed audio-video data;

transmitting the mixed audio-video data to the first remote computer and the second remote computer;

mixing the audio data received from the first remote computer and the audio data received from the second remote computer with the audio data received from the local audio input device into mixed audio data;

compressing the mixed audio data;

transmitting the compressed mixed audio data to the telephone; and

transmitting collaboration data to the first remote computer and the second remote computer.

37. (Previously Presented) The process of claim 36, further comprising mixing the audio data received from the telephone with the audio data received from the first and second remote computers into a second mixed audio data.

38. (Previously Presented) The process of claim 36, wherein the receiving audio data from the telephone includes receiving internet protocol (IP) packets, the process further comprising decoding the IP packets.

39. (Previously Presented) The process of claim 36, wherein the receiving audio data and video data from the first remote computer includes receiving internet protocol (IP) packets, the process further including decoding the IP packets.

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Exhibit 1005 – 035

40. (Previously Presented) The process of claim 36, wherein the transmitting the mixed audio-video data includes transmitting the mixed audio-video data through a Virtual Private Network (VPN).

41. (Previously Presented) The process of claim 36, wherein the transmitting the mixed audio data includes transmitting the mixed audio data through a Virtual Private Network (VPN).

42. (Previously Presented) The process of claim 36, further comprising encoding the mixed audio-video data before the transmitting of the mixed audio-video data to the first and second remote computers.

43. (Previously Presented) The process of claim 36, further comprising encoding the compressed mixed audio data before the transmitting of the mixed audio data to the telephone.

44. (Presently Amended) A computer-implemented multi-participant conference system utilizing a local moderator computer, the system comprising:

a voice over IP decoder configured to decode audio data received by the local moderator computer from a telephone through a public switched telephone network (PSTN);

a voice over IP encoder configured to compress audio data transported from the local moderator computer to the telephone through the ~~PTSN~~PSTN;

a first mixer configured to mix decoded audio data received by the local moderator computer from the telephone through the ~~PTSN~~ PSTN with audio data received by the local moderator computer from a local audio input device and video data received by the local moderator computer from a local video input device into an audio-video stream for transmission through an Internet to a first remote computer and a second remote computer;

a second mixer configured to mix audio data received by the local moderator computer from the first remote computer and the second remote

computer through the Internet with audio data received by the local moderator computer from the local audio input device into an audio stream for transmission to the telephone through the PSTN; and

a data collaboration unit configured to transmit collaboration data from the local moderator through the internet to the first remote computer and the second remote computer.

45. (Previously Presented) The system of claim 44, further comprising a third mixer configured to mix the decoded audio data received from the telephone with the audio data received from the first and second remote computers.

46. (Presently Amended) The system of claim 44, wherein the audio data received by the local moderator computer from the telephone through the ~~PTSN~~ PSTN is transported through a virtual private network (VPN) tunnel.

47. (Previously Presented) The system of claim 44, wherein audio data transported from the local moderator computer to the telephone is transported through a virtual private network (VPN) tunnel.

REMARKS

The above-identified application was allowed in the Notice of Allowance mailed March 2, 2015. The issue fee has not been paid.

Subsequent to the receipt of the Notice of Allowance, applicant noted five unintentional typographical errors in the claims. The requested amendment is submitted to correct the noted typographical errors.

Each of the requested amendments is fully supported by the specification and drawings, will not require an additional search, and does not raise new issues. Therefore, applicant respectfully requests that this Amendment be entered and the requested changes made.

To the extent any extension of time under 37 C.F.R. § 1.136 is required to obtain entry of this reply, such extension is hereby respectfully requested. If there are any fees due under 37 C.F.R. §§ 1.16 or 1.17 which are not enclosed herewith, including any fees required for an extension of time under 37 C.F.R. § 1.136, please charge such fees to our Deposit Account No. 50-1068.

Respectfully submitted,

MARTIN & FERRARO, LLP

Dated: June 2, 2015

By: /Brent D. Martin/
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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	)	Confirmation No.: 5197
Thomas Dye et al.	)	
Serial No.: 13/674,233	)	Group Art Unit: 2656
Filed: November 12, 2012	)	Examiner: Suhan Ni
For: AUDIO-VIDEO MULTI-PARTICIPANT CONFERENCE SYSTEMS USING PSTN AND INTERNET NETWORKS	)	

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

Sir:

INFORMATION DISCLOSURE STATEMENT UNDER 37 C.F.R. § 1.97(d)

Pursuant to 37 C.F.R. §§ 1.56 and 1.97(d), Applicant brings to the attention of the Examiner the documents listed on the attached Form PTO/SB/08. This Information Disclosure Statement is being filed after a Notice of Allowance but before payment of the issue fee and is accompanied by the required fee of $90.00 (to be charged to Deposit Account No. 50-1068 and a certification as specified under 37 C.F.R. § 1.97(e).

The present Application is a continuation of Application No. 12/646,892, filed December 23, 2009, now U.S. Patent No. 8,339,997; which is a continuation of Application No. 10/796,560, filed March 9, 2004, now U.S. Patent No. 7,664,056.

Applicant brings to the Examiner's attention Application Nos. 10/772,012, filed February 4, 2004, now U.S. Patent No. 7,444,425; 12/237,286, filed September 24, 2008, now U.S. Patent No. 8,477,778 ("'778 patent"); 13/674,227, filed November 12, 2012 (Publication No. 2013/0163480), which is pending; and 14/590,791, filed January 6, 2015, which is pending.

Applicant also brings to the attention of the Examiner the file history (the Office Actions and responses) of each of the above-referenced patents and applications. While the individual Office Actions and responses are not attached hereto, they are

available in each of the file wrappers in the Patent Office, through PAIR, or will be provided by the Applicant at the Examiner's request.

No item of information contained in this Information Disclosure Statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the undersigned after making reasonable inquiry, no item of information contained in this Information Disclosure Statement was known to any individual designated in 37 C.F.R. § 1.56(c) more than three months prior to the filing date of this Information Disclosure Statement.

Copies of the listed non-U.S. patent documents are attached. Applicant respectfully requests that the Examiner consider the listed documents and indicate that they were considered by making appropriate notations on the attached form.

Applicant brings to the Examiner's attention that the '778 patent is the subject of litigation in the United States District Court for the Eastern District of Texas, Marshall Division, Civil Action No. 2:14-cv-1013 hereinafter referred to as Litigation 1. The documents associated with Litigation 1 are identified by the designation "Lit. 1" in the Examiner Initial column of the attached Form PTO/SB/08.

The '778 patent is also the subject of litigation in the United States District Court for the Eastern District of Texas, Marshall Division, Civil Action No. 2:14-cv-1014 hereinafter referred to as Litigation 2. The documents associated with Litigation 2 are identified by the designation "Lit. 2" in the Examiner Initial column of the attached Form PTO/SB/08.

Applicant hereby respectfully requests the Examiner to advise Applicant of any additional types of litigation documents beyond those already provided that the Examiner may desire in association with the present application.

This submission does not represent that a search has been made or that no better art exists and does not constitute an admission that each or all of the listed documents are material or constitute "prior art." If the Examiner applies any of the documents as prior art against any claims in the application and Applicant determines that the cited documents do not constitute "prior art" under United States law, Applicant reserves the right to present to the office the relevant facts and law regarding the appropriate status of such documents.

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Applicant further reserves the right to take appropriate action to establish the patentability of the disclosed invention over the listed documents, should one or more of the documents be applied against the claims of the present application.

If there is any fee due in connection with the filing of this Statement, please charge the fee to our Deposit Account No. 50-1068.

Respectfully submitted,

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OMB 0651-0031

Substitute for FORM PTO-1449	Attorney Docket Number 207.0002-03000	Customer No. 22882	
INFORMATION DISCLOSURE STATEMENT IN AN APPLICATION	Applicant Thomas Dye et al.	Application Number 13/674,233	
(Use several sheets if necessary) Sheet 1 of 2	Filing Date November 12, 2012	Group Art Unit 2656	Examiner Suhan Ni

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
Lit. 1; Lit. 2	6,526,056	2/2003	Rekhter et al.			
Lit. 1; Lit. 2	6,778,531	8/2004	Kodialam et al.			
Lit. 1; Lit. 2	7,203,957	4/2007	Balissat et al.			
Lit. 1; Lit. 2	7,281,058	10/2007	Shepherd et al.			
Lit. 1; Lit. 2	7,330,468	2/2008	Tse-Au			
Lit. 1; Lit. 2	7,366,894	4/2008	Kalimuthu et al.			
Lit. 1; Lit. 2	7,447,203	11/2008	Chen et al.			
Lit. 1; Lit. 2	7,447,901	11/2008	Sullenberger et al.			
Lit. 1; Lit. 2	7,562,386	7/2009	Balissat et al.			
Lit. 1; Lit. 2	7,570,648	8/2009	Hu et al.			
Lit. 1; Lit. 2	7,830,787	11/2010	Wijnands et al.			

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION (YES/NO)
Lit. 1; Lit. 2	WO 01/91397 A2	11/2001	WIPO			N/A
Lit. 1; Lit. 2	WO 02/098063 A1	12/2002	WIPO			N/A

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

Lit. 1; Lit. 2	VPN Multicast Technologies LLC v. AT&T Corp.; VPN Multicast Technologies LLC v. Dimension Data North America, Inc., et al., Plaintiff's Responses to Defendants' First Set of Common Interrogatories to VPN Multicast Technologies LLC, Case Nos. 2:14-cv-1013 and 2:14-cv-1014, April 14, 2015, 28 pgs.
Lit. 1; Lit. 2	VPN Multicast Technologies LLC v. AT&T Corp.; VPN Multicast Technologies LLC v. Dimension Data North America, Inc., et al.; Defendants' Invalidity Contentions including Appendix A and Claim Charts; Case Nos. 2:14-cv-1013 and 2:14-cv-1014; April 16, 2015; 2,274 pages.
Lit. 1; Lit. 2	VPN Multicast Technologies LLC v. AT&T Corp.; VPN Multicast Technologies LLC v. Dimension Data North America, Inc., et al.; AT&T's Objections and Responses to VPN's First Set of Common Interrogatories; Case Nos. 2:14-cv-1013 and 2:14-cv-1014; April 23, 2015; 20 pages.
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Lit. 1; Lit. 2	Labonte et al., "Group Management Strategies for Secure Multicasting on Active Virtual Private Networks," IEEE, 25th annual IEEE Conference on Local Computer Networks, Pages 213-222, November 2000, 10 pgs.
Lit. 1; Lit. 2	Lamaster et al., "Internet technologies and requirements for telemedicine," Minimally Invasive Therapy and Allied Technologies 1997, Vol. 6, No. 5-6, Pages 436-443, 1997, 8 pgs.
Lit. 1; Lit. 2	Macedonia et al., "MBone Provides Audio and Video Across the Internet," U.S. Naval Post Graduate School Website, available at http://www.nps.edu/library, April 1994, 8 pgs.
Lit. 1; Lit. 2	Rosen et al., "Multicast in MPLS/BGP VPNs," Network Working Group, Internet Draft, November 2000, 17 pgs.
Lit. 1; Lit. 2	Savetz et al., "MBONE: Multicasting Tomorrow's Internet," IDG Books Worldwide, Inc., 1996, 259 pgs.
Lit. 1; Lit. 2	Waitzman et al., "Distance Vector Multicast Routing Protocol," Networks Working Group, Request For Comments: 1075, November 1988, 24 pgs.
Lit. 1; Lit. 2	Wittmann et al., "Multicast Communication: Protocols and Applications," Morgan Kaufmann Publishers, 1999, 362 pgs.

EXAMINER	**DATE CONSIDERED**

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

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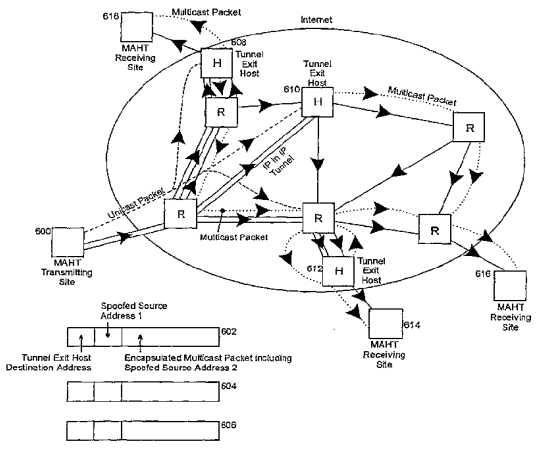
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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: METHOD AND SYSTEM FOR ANTI DENIAL OF SERVICE AND ANTI TRAFFIC ANALYSIS CAPABILITIES FOR IP BASED VIRTUAL PRIVATE NETWORKS AND DATA DISTRIBUTION THROUGH USE OF AN IP MULTICAST ADDRESS HOPPING TECHNIQUE



(57) Abstract: A method and system for Internet Protocol network communications and uses thereof for protecting Internet sites against denial of service and traffic analysis attacks on insecure public networks such as the Internet are provided. The method provides for communicating multicast packets between end stations, in a multicast IP network, on a chosen multicast IP address from a plurality of multicast IP addresses for multicast communication using a multicast address hopping technique. The technique selectively varies the chosen multicast IP address from the plurality of multicast IP addresses according to a predetermined scheme known to the end stations but not to unauthorized endstations. The packets are then communicated on the chosen multicast IP address. Indicia normally capable of identifying the source of the packets may be selectively varied to conceal the source of the packets. Further, the packets may be communicated to an end station having subscribed to a set of multicast IP addresses comprising at least one multicast IP address from the plurality of multicast IP addresses for multicast communication and including the chosen multicast IP address for transmitting the packets. The set of multicast IP addresses may also be selectively varied according to a secret predetermined scheme known to the end stations, particularly by randomly adding to and dropping from the set of multicast IP addresses. Multiple sets of communicating groups all utilizing the same address space can coexist such that their respective traffic is intermingled on the various addresses, making traffic analysis very difficult. In another embodiment, a data coding scheme such as code division multiplexing may be employed on the individual multicast packets data fields to allow data for individual destinations to be mixed together in one packet that is multicast to a plurality of receivers. Each receiver then decodes its applicable data by passing the received multicast data field through the appropriate decoding scheme such as a code division de-multiplexing process. In further aspects of the invention, various uses of the invention for Virtual Private Networks and other secure communication systems are also provided.

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TITLE OF THE INVENTION

METHOD AND SYSTEM FOR ANTI DENIAL OF SERVICE AND ANTI TRAFFIC ANALYSIS CAPABILITIES FOR IP BASED VIRTUAL PRIVATE NETWORKS AND DATA DISTRIBUTION THROUGH USE OF AN IP MULTICAST ADDRESS HOPPING TECHNIQUE

FIELD OF THE INVENTION

The present invention generally relates to a method and system for Internet Protocol network communications and uses thereof for providing enhanced virtual private network capabilities on insecure public networks such as the Internet.

BACKGROUND OF THE INVENTION

An ever-increasing trend is the use of the Internet Protocol (IP) based Internet as a communications network for business to consumer (B2C), business to business (B2B), and consumer to consumer (C2C) interaction and transactions. There is a constantly evolving gamut of threats encountered with respect to IP networks, particularly the Internet. Although a network is just the communication channel through which information is accessed or flows, the interconnection of systems worldwide through networks, especially the Internet, has become so widespread that it has become a key component of modern military, industrial, government, and private systems. The growing dependence of the various systems on a properly functioning network increases their operational vulnerability through disruption of the network. The gamut of threats to IP network based systems includes techniques to steal information, corrupt or alter information, destroy information, deny use of services or information, gather indicators of future action, and affect the public's view of various issues, including social, political, and even confidence in a country's government. The Internet, in particular, is an insecure public network and presents various weaknesses that can

be exploited by criminals or other elements to disrupt or monitor the normal communications between parties on the Internet. Some of these weaknesses include vulnerabilities to various types of Denial of Service (DoS) attacks. Recently, such attacks have successfully disrupted commercial services offered by prominent vendors.

Other vulnerabilities in using a public network for private communications include traffic analysis. Traffic analysis can be defined as the analysis of messages, typically encrypted messages, to determine: where they come from, where they go to, how long they are, when they are sent, how frequent or infrequent they are, whether they coincide with outside events like meetings, and more. There is increasing pressure for industries to gain competitive intelligence (CI) about competitors. This could involve traffic analysis of communications between their competitor various sites or to suppliers or customers. As well, national, military, or criminal entities may use traffic analysis to gain insight into intentions or actual operations of potential or real opponents. Encryption technology is well known and available to provide confidentiality, authentication, and integrity of data transmitted over the Internet. Confidentiality is defined as ensuring only the authorized parties can read the communications. Authentication is defined as ensuring that the communication was actually originated by the party it was purportedly sent by. Integrity is defined as ensuring that the data has not been changed by anyone during the communication process.

Encryption technology forms the basis for Virtual Private Technology (VPN) currently in use on the Internet. A Virtual Private Network is defined as a secure, private network running over a public network such as the Internet. It is created by using software, hardware, or a combination of the two to create a secure link between computers over a public insecure network. This is done through encryption, packet tunneling, and firewalls. Since users can eliminate leased line costs by using the Internet as a Wide Area Network (WAN), a VPN is a cost-effective solution to secure wide area network connectivity. A major disadvantage of such a system under Internet Protocol (IP) is that the packets travel between the two or more sites with identifiable source and destination

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addresses. Knowledge of the source and destination addresses allows an attacker to perform certain types of Denial of Service attacks against these sites. Note also that an eavesdropper can observe the volume and timing of the packets. This allows an attacker to perform traffic analysis on this information flow. Thus users of VPN technology are desirous of having a method to prevent traffic analysis against their communications and also to prevent or alleviate the effects of a denial of service attack against their communications.

Denial of Service (DoS) can be defined as action(s) which prevent any part of an automated information system (AIS) from functioning in accordance with its intended purpose or intentional degradation or blocking of computer or network resources. The Computer Emergency Response Team (CERT) at Carnegie Mellon University divides Denial of Service into three modes of attack with sub categories. CERT notes that a Denial of Service may only be a component of a larger attack. The three modes are classified under consumption of scarce resources, destruction or alteration of configuration information, and consumption of other resources. This invention particularly relates to the category of Consumption of Scarce Resources, specifically the sub categories of Bandwidth Consumption, Network Connectivity, and Consumption of Other Resources.

Denial of Service (DoS) attacks are often done through the use of scripts also called tools. A few examples of such tools are Capi, Back Orifice 2000 (BO2K), Domain Name System Attack, and Internet Control Message Protocol (ICMP) ECHO which is based on the ping-flooding concept. These tools are freely available for download from the Internet.

Distributed Denial of Service (DDoS) is an enhanced version of a Denial of Service attack where the DoS tools are distributed to multiple hosts, which can then be coordinated to anonymously perform an attack on the target host simultaneously, typically after some time delay. Some of the currently known Distributed Denial of Service Tools are: Trinoo, Tribe Flood Network (TFN) and Tribe Flood Net 2K, and Stacheldraht (meaning "barbed wire" in German).

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Users of the Internet as a communications medium wish to have immunity from Denial of Service attacks that prevent them from using the Internet as they desire. Disruption of this service can be very costly as certain attacks in early February 2000 against major commercial Internet sites demonstrated. Some estimates range as high as $1.2 Billion loss for the several days of attacks.

Users of VPN technology on the Internet still must have identifiable IP addresses used to route the VPN encrypted packets through the network between the VPN nodes. However attackers can use these addresses to direct Denial of Service or traffic analysis attacks against these nodes.

UNICAST IP PACKET ROUTING AND DELIVERY

Traditional Internet protocol (IP) networks rely mostly on the use of unicast protocol (also known as point to point) packet routing and delivery for communications between end stations (for example, a user and a host site). For unicast, a packet is generated and passed into the network by a first end station having the destination address of the second end station as a parameter. This packet is then routed through the network until it is delivered to the end station computer (or is discarded within the network if it times out or a route to the specified address is not found). The destination end station may or may not have been expecting this packet. For example, a ping packet or connection request packet is typically not expected by its recipient. On the other hand, once a connection-oriented communication like TCP/IP (Transmission Control Protocol) has been initiated between the two stations, then each station is in effect expecting packets from the other station and actively accounts for and sends acknowledgements for these packets.

Unicast Packet Routing and Denial of Service Attacks

The important thing to note is that the unicast delivery of packets is based on a "push" system. Packets can be generated and inserted into the

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network for delivery to an end station. The end station has little or no control to stop or regulate the flow of certain types of these packets, even if they are causing problems i.e. during an active Denial of Service attack. This "push" protocol forms the weakness that is exploited in many Denial of Service and Distributed Denial of Service attacks occurring on the Internet.

A Denial of Service attack can take the form of a storm of packets addressed to the victim host. This storm of packets can completely clog the communications links into the victim system thus effectively denying service to any legitimate users. The attack can also take the form of using up resources on the target computer such as maximum number of TCP connections. Such an attack can consist of creating multiple TCP connections and then leaving them hanging until they time out. This can use up all the available connection slots thereby denying legitimate users any connections.

Multicast Technology

In contrast to unicast protocol, multicast protocol within an IP network uses a "pull" type system. The destination end station must actively request the reception of these multicast packets by "subscribing" to the router network with special subscription request packets (Internet Group Management Protocol or IGMP) for each multicast address of interest. Once a subscription message is received by a given router from an attached end station the router will autonomously communicate within the network of routing devices to receive the multicast packets with the applicable address. There can be multiple recipients of this traffic flow. If a subscription for a particular address is not renewed periodically by the attached host (typically, in the order of 10's of seconds) then the subscription for that particular address will time out and the router network will no longer route packets for delivery to that particular host. Alternately a host can "de-subscribe" from a given multicast address with a special de-subscribe message to the router which has an immediate impact on the delivery of multicast packets. The important difference between multicast and unicast packet delivery is that

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under multicast, the end computer station has control over the addresses from which it will accept data.

Under the current version of the Internet Protocol (IP Version 4 or IPv4), the addresses assigned for multicast are known as Class D addresses and range from the 224.0.0.0 to 239.255.255.255. The Internet Assigned Numbers Authority (IANA) maintains a list of registered users and assigns new numbers for new uses. The range from 224.0.0.0 to 224.0.0.25 is reserved for permanent assignment for various applications, including use by routing protocols. The set from 239.0.0.0 to 239.255.255.255 is reserved for various administratively scoped applications; much the same way as the 192.168.0.0 address range is assigned for administratively scoped unicast purposes. Under IPv6, the emerging new IP version, it is anticipated that there will be 112 bits of information to designate a multicast group. This is a much expanded address space over the current IPv4 allocation that only has 28 bits for address space.

MULTICAST ROUTING PROTOCOLS

Routers in a network or internetwork use multicast routing protocols to efficiently route multicast packets through the network or internetwork much the same as they use unicast (point-to-point) routing protocols to efficiently route unicast packets through the network. The multicast protocols are used to deliver multicast packets from the multicast source to multiple destinations that consist of the members of the multicast group.

Unicast routing protocols use one of two basic techniques, either distance vector (e.g. Routing Information Protocol - RIP), or link state (e.g. Open Shortest Path First - OSPF). Multicast routing protocols can be divided into three categories, distance vector (derived from unicast protocols like RIP), link state (derived from protocols like OSPF), and the newer shared-tree protocols. The multicast protocols in use include: the Distance Vector Multicast Routing Protocol (DVMRP) and Protocol Independent –Dense Mode (PIM-DM) based on distance vector, Multicast Open Shortest Path First (MOSPF) based on link state, and

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Protocol Independent – Sparse Mode (PIM-SM) and Core-Base Tree (CBT) based on shared trees. Each of these protocols has their strengths and weaknesses and is employed on various parts of the Internet.

Normally, in any Autonomous System (or domain) within the Internet, there is only one multicast protocol used. An Autonomous System is defined as a network administered by one entity and operating under one unicast routing protocol. A protocol used only within an Autonomous System is referred to as an interior gateway protocol (IGP). The administrative authority for a given Autonomous System specifies which unicast and multicast protocol is to be used within the Autonomous System. The decision is based on a number of factors including the type of routing equipment used in the Autonomous System, personnel experience with the various protocols, expected number of users and groups, and dispersion of users. There are protocols in place for routing unicast between autonomous systems, known as exterior gateway protocols (EGP). Autonomous Systems within the Internet are linked together by routers that use these unicast EGP that enforce routing policies. One weakness of multicast is the lack of an EGP for routing multicast between Autonomous Systems. There is work underway to define interdomain routing protocols, notably the Border Gateway Multicast Protocol (BGMP).

TUNNELING

An IP packet tunneling technique can be used to, among other things, tunnel multicast packets from one area of the Internet to another area of the Internet through an area that does not support multicast. In this technique, the multicast packets are received by a router or host on one end of a tunnel, encapsulated in a unicast IP packet and sent by normal IP unicast to the router or host at the other end of the tunnel where the packets are de-encapsulated and sent back out into the network as multicast packets. This technique is effective but requires a significant amount of administrative overhead. There are various

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existing and implemented protocols for IP tunneling in use on the Internet including "IP in IP".

SCOPING

Scoping of multicast packets refers to methods of limiting the range to which a multicast packet can travel in a network. There are presently two main methods used for scoping multicast packets, administrative and Time To Live (TTL) scoping. Administrative scoping involves using the multicast addresses on packets in the address space from 239.0.0.0 to 239.255.255.255. Multicast packets in this range do not cross administrative boundaries. Since multicast addresses are assigned locally within the Autonomous System they need not be unique between areas thus allowing for reuse of address space. TTL scoping refers to placing a low value in the TTL field of a packet when it is initially created. Every IP packet has a data field of one byte that defines a time to live for the packet. Every time the packet crosses a router or similar device or is held in a queue for 30 seconds, the TTL field is decremented. If the TTL reaches zero before the packet reaches its ultimate destination the packet is discarded wherever it is when the TTL reaches zero. Placing a low initial value within the TTL of the packet limits the range to which it can travel.

MULTICAST ADDRESS ALLOCATION

Currently there are very few permanently allocated multicast addresses. Multicast applications are quite free to choose nearly any multicast address for their use. There is a danger of address collision with other applications, so applications must be designed to detect and handle erroneous packets from other applications using the same multicast address. There are methods currently being researched to prevent this problem by providing dynamic multicast address allocation. The current research has defined a three level allocation hierarchy. Within an Allocation Domain, the lower level multicast

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applications running on hosts use a Multicast Dynamic Host Control Protocol (MDHCP) (based on the Dynamic Host Control Protocol) to request multicast addresses from the next level Multicast Address Allocation Servers (MAAS). An Allocation Domain normally coincides with the boundaries of the Autonomous System in which it is located. The MAAS's claim multicast addresses allocated through the use of the multicast Address Allocation Protocol (AAP). Certain nodes within the Autonomous System, usually routers, use the Multicast Address Set Claim (MASC) protocol to claim multicast address sets which they allocate to the MAAS's through the AAP. This architecture is experimental and no devices are known that currently support this architecture.

ROUTER INTERFACES

Routers are complex devices designed to efficiently receive and transmit data packets across multiple physical communication channels. These channels can include Ethernet, token ring, serial lines, ATM links, or Frame relay, all with varying characteristics and set up requirements. These channels are normally physically connected to the routers on what are called interfaces. The routers run various protocols that determine how they will receive, process, and transmit packets. These protocols can include the unicast routing protocols such as RIP or OSPF, and the multicast protocols such as DVMRP or MOSPF. Normally routers communicate between each other to exchange status and routing information in order to optimize delivery of packets. This data exchange can include advertising routes the router is aware of to reach an end destination.

ROUTER LIMITATIONS

There are some physical implementation limitations in routers depending on the manufacturer and the model. For example in the Cisco 3600 series of routers, there is a maximum of 7000 entries allowed by default in the multicast routing table. Configuring the router can change this parameter.

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Thus, in the Internet Protocol network, having a publicly available communications address is problematic as undesirable third parties may launch an attack, overwhelming the particular address or monitor the address for information not intended for the third party.

Transmitting IP packets to an IP address is somewhat akin to transmitting a radio signal at a particular frequency. A third party to the communication can monitor the frequency to eavesdrop on the communication or attempt to overwhelm or jam the frequency with a jamming signal. In the radio communications field, a technique known as spread spectrum communications employs a frequency hopping system where a transmitting station transmits bursts of data sequentially on a prearranged set of channels in a predetermined random pattern at specific times. The receiving station listens to the appropriate channels at the appropriate time in order to receive the communications. Frequencies can be shared among many users, as there can be many groups all hopping around in the frequency channels in a coordinated fashion. Spread spectrum techniques permit secure communications, reducing information gathering and denial of communications abilities. However such techniques require coordinated efforts between transmitting and receiving parties.

Thus, it is desirable for end stations to be able to communicate in an IP network having the limitations described herein, particularly where the address for communication is publicly known, having a method or system to alleviate most or all of the effects of certain types of Denial of Service attacks or information gathering.

SUMMARY OF THE INVENTION

The present invention provides a method and system for Internet Protocol network communications and a use thereof for protecting Internet sites

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against denial of service and traffic analysis attacks on insecure public networks such as the Internet.

In an embodiment, the present invention provides a method for transmitting multicast packets between a transmitting end station and one or more receiving end stations, in a multicast IP network, on a chosen multicast IP address from a plurality of multicast IP addresses for multicast communication using a multicast address hopping technique. The technique selectively varies the chosen multicast IP address from the plurality of multicast IP addresses according to a predetermined scheme known to the end stations but not to unauthorized end stations. The packets are then communicated on the chosen multicast IP address. In an aspect of the invention, indicia normally capable of identifying the source of the packets may be selectively varied to conceal the source of the packets.

In another embodiment, there is provided a method for receiving multicast packets from a transmitting end station on a chosen multicast address from a plurality of multicast IP addresses for multicast communication using a multicast addressing hopping technique and where indicia normally capable of identifying the source of the packets may be selectively varied to conceal the source of the packets. The packets may be communicated to an end station having subscribed to a set of multicast IP addresses comprising at least one multicast IP address from the plurality of multicast IP addresses for multicast communication and including the chosen multicast IP address for transmitting the packets. The set of multicast IP addresses may also be selectively varied according to a secret predetermined scheme known to the end stations, particularly by randomly adding to and dropping from the set of multicast IP addresses.

The invention provides protection from unauthorized personnel who may determine which address to disrupt or monitor for traffic between the end stations. Even if the unauthorized personnel can discover a particular multicast address chosen, addresses are dropped and new ones generated in a random fashion thus limiting the time in which the attacker can monitor packets or direct packets against an end station. Multiple sets of communicating groups all utilizing

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the same address space can coexist such that their respective traffic is intermingled on the various addresses, making traffic analysis very difficult.

In an aspect of the invention, the indicia may be chosen from the Time To Live (TTL) field and the IP Source address of individual IP multicast packets. The TTL field may be randomly set (jittered) to prevent eavesdroppers from deducing the separate sources of a packet stream through correlation of the TTL fields.

The IP Source Address of multicast IP packets may be "spoofed", that is filled in with a false source address, which can be changed in a random appearing method. Random appearing spoofed IP addresses prevent eavesdroppers from determining the real source of the packets.

In another embodiment, a data coding scheme such as code division multiplexing may be employed on the individual multicast packets data fields to allow data for individual destinations to be mixed together in one packet that is multicast to a plurality of receivers. Each receiver then decodes its applicable data by passing the received multicast data field through the appropriate decoding scheme such as a code division de-multiplexing process.

In further aspects of the invention, various uses of the invention for Virtual Private Networks and other secure communication systems are also provided.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing and other features and advantages will be better understood from the following detailed description of the MAHT technique and of certain preferred embodiments of the invention with reference to the drawings, in which:

FIG. 1 is a schematic diagram showing the general architecture of a system using the multicast address hopping technique;

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FIG. 2 is a schematic diagram showing the general conceptual architecture of an MAHT receiving device implementing a multicast address hopping technique;

FIG. 3 is a schematic diagram showing the general conceptual architecture of an MAHT transmitting device implementing a multicast address hopping technique;

FIG. 4 is a schematic diagram showing the general architecture of an enhanced VPN system using MAHT to provide protection against a traffic analysis attack;

FIG. 5 is a schematic diagram showing the configuration of an enhanced VPN using MAHT with spoofed IP address and IP in IP tunnels to provide protection against traffic analysis;

FIG. 6 is a schematic diagram showing the configuration of an enhanced VPN using MAHT with spoofed IP addresses and multiple IP in IP tunnels to provide protection against traffic analysis;

FIG. 7 is a schematic diagram showing an MAHT system transmitting multiple data streams to a plurality of MAHT receivers such that only authorized subscribers correctly receive a given data stream;

FIG. 8 is a schematic diagram showing an MAHT system using code division multiplexing to transmit data to a plurality of MAHT receivers; and

Fig. 9 is a schematic diagram showing an overview of the existing prototype test bed.

DETAILED TECHNICAL DESCRIPTION

The following are features of the MAHT technology to aid in anti DoS attacks and anti traffic analysis for communications between end stations on a public network:

data is communicated between the stations by multicast protocol having multicast addressing which hides a receiving station's actual IP address;

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multicast address hopping prevents others from discovering and monitoring or attacking a particular multicast address;

indicia within the packets normally capable of indicating the source of the packets may be selectively varied to conceal the source of the packets. For example, TTL fields may be jittered to prevent traffic analysis by correlation of TTLs, and IP Source Addresses may be spoofed (with or without the use of IP Tunneling) to conceal the IP Source Address of the transmitting station;

unicast routes to the stations forming a VPN may be suppressed to avoid a unicast based attack on the stations;

data coding of packet data, such as by CDMA techniques, may be employed to make analysis difficult.

The MAHT can be implemented in various configurations to give protection against different types of threats. Configuration possibilities depend on the type of in place network infrastructure particularly the multicast routing protocol and IP packet filtering definitions.

Referring now to the drawings and more particularly to FIG 1., there is shown, in a schematic diagram form, the general architecture of a system that uses the MAHT to communicate within an Autonomous System of the Internet. The MAHT Receiver, Block 100, is connected to an Autonomous System, Block 104, of the Internet through Router 1, Block 106. The MAHT Transmitter, Block 102 is connected to the same Autonomous System through Router 4, Block 108. There is a plurality of routers interconnected together that form the Autonomous System router network, Block 104.

The MAHT Receiver, Block 100, subscribes to a set of multicast addresses, from the plurality of available multicast addresses in the Autonomous System, by sending the appropriate IGMP subscribe messages to Router 1, Block 106. The MAHT Transmitter, Block 102, encapsulates data in a multicast packet with an address known to be in the current set of multicast addresses to which the MAHT Receiver, Block 100, has subscribed. The data may comprise unicast IP packets destined for the MAHT Receiver, Block 100, or another site with which the

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Receiver is familiar (e.g. a site to be protected from a Denial of Service attack) or other data.

Router 1, Block 106 communicates with the other routers within the Autonomous System, Block 104, to request delivery of any multicast packets in the set of addresses in current use by the MAHT Receiver, Block 100. The Routers use the standard multicast routing protocol in use within the Autonomous System, Block 104, to communicate, e.g. PIM-DM, DVMRP, MOSPF, etc. In the example illustrated in Fig. 1, the MAHT Receiver, Block 100, has subscribed to a set of addresses starting with 224.1.6.4 and including 229.5.34.21. The MAHT Transmitter, Block 102, transmits the encapsulated data in multicast packets having an address selected from the same set of multicast addresses. After a time, a further address is selected for communicating with the Receiver. These multicast packets are then routed through the Autonomous System, Block 104, by the plurality of routers to be ultimately delivered to the MAHT Receiver, Block 100. If the encapsulated data comprised unicast data, the original unicast packets may then be recovered and passed on as may be necessary.

The set of addresses used by the MAHT Receiver, Block 100, and the MAHT Transmitter, Block 102, includes at least one address and preferably a larger number of addresses. The size of the set may vary depending on the capacity of the Receiver to maintain the set and the expected ability of third parties who may be monitoring the Receiver's communications. By choosing a sufficiently large number of addresses, the Receiver cloaks the particular addresses actually used for communication among those addresses to which it subscribes while lessening the chances that a person monitoring the communications can determine meaningful information about the communications.

In a preferred embodiment, addresses may be dropped from the set of addresses and new ones added to the set from the plurality of available multicast addresses in an agreed upon synchronized change scheme between the MAHT Receiver and Transmitter. Addresses for the set of addresses and particular address selected for a period of time for actual communication are selected in a fashion that is not known to parties not intended to be capable of

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receiving the data, such as by random selection according to a prescribed scheme known to the MAHT Receiver and Transmitter.

The duration of the subscription by the MAHT Receiver to any address or addresses from the set of addresses and the length of time that a particular address is selected for actual communication is preferably of random length. This random addressing scheme makes it difficult, if not impossible, for a remote attacker to determine which multicast address to attack to carry out a denial of service attack on the MAHT Receiver or which address to monitor for information gathering purposes as data may be spread over multiple addresses. While in the preferred example, the Receiver subscribes to multiple addresses at any one time, it is understood that the receiver may subscribe to the selected address for communication in sufficient time prior to its use, dropping the address upon termination of its use. However, such a method does not hide the selected address among a set of potential addresses, should a third party be monitoring the subscription traffic from the Receiver.

Preferably, when the MAHT is used for anti Denial of Service of a unicast-based service supplied from an end station (as described more fully below), Router 1, Block 106, (and any router adjacent to a MAHT receiver, Block 100, or transmitter Block 102) is configurable such that it does not advertise an IP route to itself nor to any downstream connected devices. This means that even though there is a physical communication link between itself and a neighboring upstream router, Router 2, Block 110, or Router 5, Block 112, the upstream router is not aware of the address of the downstream router. However, the downstream router can still pass IP packets addressed to remote network hosts through the physical communication link to the upstream router that forwards them on to the remote hosts. This in effect leaves a one-way unicast route from the downstream router, e.g. Router 1, Block 106, and any connected downstream hosts, e.g. the MAHT Receiver, Block 100, into the Internet. No unicast packets can be delivered to the downstream router, e.g. Router 1, Block 106, or connected hosts, e.g. the MAHT Receiver, Block 100, since there are no unicast routes available to route them from the upstream router e.g. Router 2 or Router 5. This means that no

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attack packets can be directed against the router or protected host since no route exists to them. The ability to configure a router in this mode is a built in capability to most commercial routing equipment.

It is understood that for multicast protocol within the IP network, routers, e.g. Router 1, Block 106, permit multicast subscribe or de-subscribe (IGMP) packets to be passed from the downstream router, Router 1 to the upstream router through the physical communication link connected to the applicable interface. The upstream router e.g. Router 2 or Router 5, receives these IGMP subscribe or de-subscribe messages on the interface corresponding to the physical communication link to the downstream router, e.g. Router 1. This upstream router will then become aware that there is a multicast subscriber for that particular multicast address somewhere through that interface even though the router is not aware of the addresses of any hosts or subnets reachable through that interface. The upstream router, e.g. Router 2 or Router 5, then processes a request through to the other routers within the Autonomous System to receive any packets destined for that multicast address. When the router receives these multicast packets from senders elsewhere within the Autonomous System, Block 104, e.g. the MAHT Transmitter, Block 102, it will forward these multicast packets through the interface to the downstream router, e.g. Router 1, Block 106. In this example, Router 1, Block 106, will then pass these multicast packets on to the MAHT Receiver, Block 100. The ability to configure a router in this mode is a built-in capability to most commercial routing equipment.

Referring now to FIG. 2, there is shown a representative schematic diagram of a general conceptual architecture for a MAHT Receiver implementing the multi address hopping technique for receiving data from a MAHT Transmitter. The MAHT Receiver, Block 200, could be built as a specialized device or run as a software program on a general- purpose computer.

The MAHT Receiver, Block 200, includes a multicast address generating function comprising means to selectively vary the choice of multicast addresses on which to receive multicast data from the plurality of available multicast addresses for communicating with another end station. The Receiver

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further comprises means to synchronize with the Transmitter for coordinated communication on the selected multicast addresses. In the preferred embodiment, the means to selectively vary the choice of addresses comprises means to generate addresses according to a secret predetermined scheme known to the Receiver and a Transmitter, which means may be initiated by a cryptographic key. The predetermined scheme is secret in that it may be known by the Receiver, Transmitter and other selected end stations but not by another who may wish to monitor or disrupt the traffic of the selected end stations.

The MAHT Receiver, Block 200, may be connected into the IP based public network (e.g. Internet) through one or more interfaces such as an Ethernet port shown at Block 202. Configuration File, Block 204, and a current Cryptographic Key, Block 206, contain the necessary information to initialize and start the MAHT. The Configuration File may include such things as number of active Wide Area Network, (WAN), multicast ports to open, cryptographic algorithms to use, and logging settings. The System Initializer process, Block 208, reads in the Configuration File, Block 204, and the current Cryptographic Key, Block 206, and then creates the other processes with the appropriate parameters. Listen Address Generator, Block 210, generates the appropriate multicast addresses to listen to in accordance with the predetermined scheme and any configuration parameters. These parameters include the current time, number of addresses to open, and current cryptographic key. The Time Synchronization process, Block 212 provides the current time to the Listen Address Generator, Block 210, so that the addresses are subscribed to and dropped in synchronization with the remote MAHT Transmitter. The time synchronization could be based on the system clock, an externally supplied more accurate time standard, e.g. from a Global Positioning Satellite receiver, a network time standard such as the Network Time Protocol (NTP), or a time synchronization method with the MAHT process potentially based on the NTP technique for synchronizing time across an IP network.

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The WAN Listener processes, (Block 214 through 218), are created by the Listener Address Generator, Block 210. The number of WAN Listener processes created is determined by the configuration file parameters, Block 204. Each of these WAN Listener processes will listen to a different multicast address by subscribing to the upstream router using an IGMP subscribe packet sent through the Ethernet port, Block 202. Each WAN Listener process will drop their current address and subscribe to a new one in accordance with the control signals from the Listen Address Generator, Block 210. Each WAN Listener, Block 214 through 218 passes any received multicast packets to the Packet De-encapsulator, Block 220.

The Packet De-encapsulator takes the data, for example a unicast packet, from the multicast packet and performs any checks or processing on the packet including decryption and authentication if so configured. Packets are checked to ensure that they actually originated with the appropriate MAHT Transmitter. If they are actually from another multicast transmitter using the same address, these packets are discarded. If the multicast packet is from the appropriate MAHT Transmitter and the data is a unicast packet intended for a host site familiar to the MAHT Receiver, Block 200, the Packet De-encapsulator, Block 220, may pass the de-encapsulated unicast packet on to the LAN Transmitter, Block 224, to send the packet out through the Ethernet Port, Block 202, in its original unicast format, to be delivered to the unicast destination host.

Optionally, in the preferred embodiment, the processing of packets in the Packet De-encapsulator is monitored by the Collision Detection process, Block 222. This process determines if there are too many packets arriving on a multicast address that are actually from another multicast transmitter using the same address, in effect an address collision. If there is too much traffic on this address then the Collision Detection process, Block 222, can instruct the Listen Address Generator, Block 210, to drop this particular address and add a new one before the normal scheduled address drop time. The remote MAHT Transmitter can be notified that this particular address has been dropped via a control packet sent from the MATH Receiver, Block 200, to the MAHT Transmitter.

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Referring now to FIG. 3, there is shown a representative schematic diagram of a preferred architecture for a MAHT Transmitter, Block 300, implementing the multicast address hopping technique for transmitting data to a MAHT Receiver. The MAHT Transmitter, Block 300, could be built as a specialized device or run as a software program on a general purpose computer.

The MAHT Transmitter, Block 300, includes a multicast address generating function comprising means to selectively vary the choice of multicast addresses on which to transmit multicast data from the plurality of available multicast addresses for communicating with another end station. The MAHT Transmitter, Block 300, further comprises means to synchronize with the MAHT Receiver for coordinated communication on the selected multicast addresses. In the preferred embodiment, the means to selectively vary the choice of addresses comprises means to generate addresses according to the secret predetermined criteria known to the MAHT Receiver and the MAHT Transmitter, which means may be initiated by a cryptographic key as described herein above. The MAHT Transmitter may be connected into the Internet through one or more interfaces such as an Ethernet port shown at Block 302.

Configuration File, Block 304, and a current Cryptographic Key, Block 306, contain the necessary information to initialize and start the MAHT Transmitter, Block 300. The Configuration File may include such things as number of WAN multicast addresses to use, information for cryptographic steps, TTL jitter settings, IP spoofing settings, Retransmit Servers to use, and logging settings. The System Initializer process, Block 308, reads in the Configuration File and the current Cryptographic Key and then creates the other processes with the appropriate parameters.

For the case where the MAHT Transmitter, Block 300, is used to forward unicast data received from another host to the MAHT Receiver or a host with which the MAHT Transmitter and Receiver are familiar, LAN Listener process, Block 318, listens for appropriate unicast packets received on the Ethernet port,

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Block 302. The LAN Listener process, Block 318, then passes these packets on to the Packet Encapsulator, Block 316.

The Packet Encapsulator, Block 316, takes the original unicast packet from the LAN Listener process, Block 318, and performs processing on the packet including encryption and authentication, if so configured, to build a multicast packet. In other cases, the Packet Encapsulator may encapsulate and process other data it receives from other processes (not shown). The Transmit Address Generator, Block 310, generates the appropriate multicast addresses to transmit to in accordance with the configuration parameters. These parameters include the current time, number of addresses to use, hopping order, and current cryptographic key. The Time Synchronization process, Block 312 provides the current time to the Transmit Address Generator, Block 310 in accordance with a method discussed in relation to the Receiver, so that the addresses for transmission are selected and dropped in synchronization with the MAHT Receiver.

The TTL field is a mechanism used in IP packets to ensure packets do not loop endlessly around a network without ever reaching their destination. The TTL data field in an individual IP packet is decremented every time it passes through a router or spends a predetermined time (e.g. 30 seconds) waiting in a queue. Once the TTL field in a packet reaches 0 the router that is handling it automatically discards the packet. The maximum value of TTL is 255 but can be set lower to limit the hops a packet can travel. Setting the TTL to a low value to prevent distant travel is known as administrative scoping and is often used to limit how far multicast packets can travel. The Packet Encapsulator may set the Time To Live (TTL) field in individual IP multicast packets randomly (i.e. in a jittered manner) to prevent eavesdroppers from deducing the separate sources of a packet stream through correlation of the TTL fields. Of course, the value chosen should not be so low as to prevent reception of the packet by the intended receiving station. In a preferred embodiment, the TTL value is jittered around a nominal average value that is chosen such that the maximum range of jitter to be added and subtracted from the nominal average value will not be so low as to

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prevent reception of the packet by the intended receiving station nor so high as to be beyond the maximum value of 255. The average TTL value could be chosen depending on network topology and any administrative scoping requirements. The generated jitter values would preferably be in a uniform distribution for values to produce the maximum and minimum acceptable values of TTL. For example, the nominal TTL could be set to 128 with a uniform distribution for the generated TTLs from a minimum of 64 to a maximum of 192. The system could be further enhanced by including an adaptive process such that the individual nominal average TTL values are adaptively set so that the average TTL values arriving at a receiving site are adaptively adjusted to be the same for different transmitting sites. This adaptive process requires feedback from the MAHT receiving sites to the MATH transmitting sites. This adaptive process would further complicate any traffic analysis attempts by hiding any differential trends in average TTL for packets originating from different transmitting sites.

WAN Transmitter process, Block 314, is created by the Transmit Address Generator, Block 310. The WAN Transmitter receives encapsulated packets from the Packet Encapsulator, Block 316, and transmits them to the Internet through the Ethernet port, Block 302. Optionally, The MAHT Transmitter, Block 300, can be notified that a particular multicast address has been dropped, due to address collision, via a control packet sent from the MAHT Receiver to the MAHT Transmitter.

The MAHT may work with any of the IGP multicast routing protocols within an Autonomous System. Once an EGP, such as BGMP, has been defined and implemented the present invention can operate across Autonomous Systems. It is also currently possible to use well-known IP tunneling techniques to communicate multicast packets between two autonomous systems although this is an administration intensive process.

The MAHT does not necessarily require scoping but can use either TTL, administrative, or both types of scoping methods to increase the effectiveness of the system or to meet administrative requirements.

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The MAHT can work within the developmental Multicast Address Allocation architecture provided that the total number of multicast addresses available is sufficient and the allocation order can be randomized in some fashion. Until the dynamic address allocation problem is resolved and standardized the present invention can operate within an Autonomous System by defining it's own multicast addresses and ensuring detection and handling of packets from other applications using the same multicast address. If there is an address collision such that there are too many erroneous packets being delivered then that particular address can be dropped.

Physical router limitations, especially the simultaneous number of open multicast route entries, must be taken into account when planning and implementing this invention in a particular Autonomous System of the Internet. These limitations can impact the implementation configuration of the present invention. However routers typically have a default limit of several thousands of routes and can be configured for more if required. For example, the Cisco 3600 series of routers have a default limit of 7000 multicast route entries that is expected to be more than adequate for practical implementation of this invention.

The MAHT may be used in a system and method for protection against certain types of Denial of Service attacks for Internet sites using IP networks, especially the Internet, as a communications media.

In one embodiment, the system can provide anti-traffic analysis capabilities for communications between a site and a number of other sites. Referring now to Figure 4, there is shown a system that has a transmitting site and a number of receiving sites. The transmitting site, Block 400, uses the MAHT technique to transmit traffic to the plurality of receiving sites, Blocks 402, 404, and 406. Any attacker, Block 408, who monitors the transmitted packets, does not know to whom the packets are really destined thus denying him destination information to analyze. Notethat under normal multicast transmission schemes, the attacker does know from where the packets originated by observing the source address in the multicast packet.

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Depending on which multicast routing protocol is in effect in the Autonomous System, it may be possible to spoof the IP Source address for the multicast packets. Spoofing in this case means randomly putting in a false address for the IP Source address in the IP Source address field of the packet. This would deny the attacker knowledge of the source of the packets. Implementation of the IP Address Spoofing technique is straightforward for use with the Core Based Tree (CBT) multicast routing. The Packet Encapsulator, Block 316, of a transmitting end station may insert a spoofed IP Source Address, unconnected to the transmitting end station, in the multicast packet.

Spoofing the source address may have practical implementation aspects involving filtering at routers in the Internet and in the multicast routing protocol in use in the Autonomous System. Certain multicast routing algorithms, notably the Distance Vector Multicast Routing Protocol (DVMRP), cannot easily be used with IP spoofing techniques. This is due to the fact that they use a reverse path forwarding technique for multicast packets whereby a multicast packet is only forwarded on to other subscribing routers only if the packet is received on the physical interface through which a unicast packet destined for the source address in the multicast packet would be sent. The implementation configuration of the MAHT with spoofed IP addresses depends on which multicast routing protocol is in effect in the implementation area. For example, use of MAHT including IP spoofing in a DVMRP area will require use of additional infrastructure or techniques such as IP tunneling.

Referring now to Figure 5, there is shown a MAHT system that uses tunnels to allow IP spoofing to protect the IP Source address of the transmitting site. The Transmitting site, Block 500, takes the multicast packet and encapsulates it in a tunneling protocol such as IP in IP. The multicast packet has a spoofed IP Source address inserted in place of the normal IP Source address. The multicast packet is encapsulated in a unicast tunnel packet, Block 502. This unicast tunnel packet also has a spoofed IP Source address. This unicast packet is then delivered into the Internet to be delivered to the receiving tunnel exit host or router system, Block 504, at the other end of the tunnel. Once this unicast

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packet arrives at the other end of the tunnel the multicast packet is de-encapsulated and processed as a normal packet. By appropriate selection for the spoofed IP Source address in the multicast packet, the underlying multicast routing protocol will correctly process this de-encapsulated packet at the tunnel exit host and deliver it to the receiving site, Block 506. In this way the transmitting source address can be hidden from attackers. Preferably there is a plurality of tunnels implemented leading to a plurality of tunnel exit hosts thereby greatly increasing the complexity of any attacker traffic analysis and also providing greater reliability and anti denial of service capability. This plurality of exit hosts could be scattered throughout an Autonomous region or across several Autonomous Systems, thus ensuring multiple widely separated paths for the data packet flow.

Referring to Figure 6, there is shown a system incorporating multiple tunnels scattered across an Autonomous Region. There is an MAHT transmitting site, Block 600, that encapsulates the original multicast MAHT packets with a spoofed IP Source address, Block 602, 604, and 606 in unicast tunnel packets addressed to the range of tunnel exit hosts, Blocks 608, 610, and 612. Any encapsulated multicast packet arriving at a tunnel host will be de-encapsulated and delivered using the standard underlying multicast routing algorithm to the MAHT receiving sites, Blocks 614, 616, and 618. Note that the multicast packets exiting from the IP in IP tunnel can be destined to a plurality of MAHT receivers. The capability of the tunneling technique could be further enhanced over the standard IP tunneling techniques such as IP in IP by adding custom software to the tunnel exit hosts and the MAHT transmitter such that the packets are encrypted thus providing even greater resistance to traffic analysis.

In another embodiment, the MAHT can provide anti denial of service capabilities to a VPN system. In this embodiment, the VPN sites across the public network are all configured to use the MAHT technique to communicate on a full time basis. The VPN is set up such that there is no return unicast route from the public network back into the MAHT configured VPN sites. Such a requirement may be met by the non-advertisement of a unicast route to the VPN sites, by filtering unicast packets destined for the sites or decoying unicast traffic to another

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device. The MAHT technique allows the data traffic to flow between the various communicating sites but denies an attacker an effective unicast IP address against which to direct a denial of service attack. Preferably this embodiment would also include varying the indicia of packet source, such as the use of the IP spoofing techniques previously described, in order to provide anti traffic analysis capabilities as well.

In another embodiment, the MAHT system could be set up to provide an emergency backup mode for individual VPN sites that come under active denial of service attacks. In this embodiment, the individual VPN sites would normally communicate with default unicast point to point protocols. However if one site came under active denial of service attack then it could switch either manually or, preferably, automatically, to MAHT back up mode. In this mode the router connecting the VPN into the public network would be instructed, preferably by the VPN device using an automatic control channel, to cease advertising a unicast route into the site, thus shutting down the denial of service attack. The VPN site would then commence using the MAHT technique to communicate to the other VPN sites. The site under attack instructs the other VPN sites to transmit to it using MAHT. As the site under attack is still capable of unicast transmission even though unicast reception is suppressed, the site could still use normal unicast to send packets to the other VPN sites. Otherwise, the site under attack may indicate to the other VPN sites a desire to transmit to them using MAHT. Once the attack has ceased or been isolated then the VPN site under attack could revert back to normal operation.

In another embodiment, the MAHT system could be used to deliver data streams to multiple authorized receivers while providing an efficient method to prevent unauthorized users from viewing the data. It is computationally costly to perform real time high bandwidth decryption and administratively difficult to distribute decryption keys to multiple subscribers. Rather than encrypting the data stream it would be more efficient to use the MAHT technique to transmit the data stream on different and changing multicast ports. The receiving subscribers would have to know the correct hopping sequence and timing but would not be required

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to run any real time decryption software or hardware. It is computationally trivial to subscribe and de-subscribe to multicast addresses. The receiving subscribers could receive the hopping sequence through various means. For example, a subscriber could establish a secure connection to a web site using a standard protocol like Secure Sockets Level, (SSL). This web site would provide a pay for use service by passing through this connection the hopping sequence and timing to the end user on a continuing basis and the user could be charged on the basis of the time connected to the hopping and timing server and which data stream was used. Alternately, a user could receive the appropriate sequence and timing information for a fixed period for a periodic fee. This service would preferably offer multiple different data streams, for example, video (movies), audio (radio broadcasts), or real time data (stock quote feeds). This would increase the difficulty for an unauthorized user to effectively intercept the correct data stream.

Referring now to Figure 7, there is shown a MAHT system transmitting multiple data streams to a plurality of MAHT receivers such that only authorized subscribers correctly receive a given data stream. The MAHT transmitter, Block 700, receives a plurality of data streams, for example video streams, Blocks 702, 704, and 706, from connected sources, 708, 710, and 712. The MAHT transmitter, Block 700, uses the MAHT technique to transmit these data streams in MAHT multicast packets to multiple and changing multicast addresses in the Internet, Block 714. Authorized users, Blocks 716, 718, and 720, who have the correct addressing hopping and timing sequence for a given data stream can subscribe to the appropriate address at the appropriate times and receive the data stream. In this case Authorized Subscriber 1, Block 716, has subscribed to Data Stream 2, Block 704, and similarly Authorized Subscriber 2, Block 718, to Data Stream N, Block 706, and Authorized Subscriber N, Block 720, to Data Stream 1, Block 702. If a subscriber does not have the correct information they will not receive the packets correctly and may even receive a mixed up conglomeration of packets originating from different data streams.

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In another embodiment, the system may be further enhanced by formatting a data portion of the multicast packet with data intended for different end stations according to a data coding scheme for combining and separating the data. The scheme may use a code division multiplexing technique. In a preferred embodiment of this system, a MAHT Transmitting site communicates with a plurality of MAHT Receiving sites using the MAHT technique. However each Receiving site subscribes to the same full set of multicast addresses and therefore receives all packets communicated. However, the MAHT transmitting software uses a code division multiplexing algorithm to embed data for every site on every packet, including null data if there were no data for a particular receiving site. An IP packet typically consists of an IP packet header, header options (if needed) and a data or payload portion. The data portion itself can be divided into a header and data depending on what protocol is being used for that packet. It is intended that the code division multiplexing process be used on the portions of the IP packet not including the actual IP packet header.

Code division multiplexing or direct sequence spreading is a well-understood and implemented technology. In this embodiment, a different orthogonal code sequence having a fixed length is generated for each receiving end station. After a given number of bits the orthogonal code repeats itself exactly. In classic direct spreading the speed of the code sequence is called the chipping rate, measured in chips per second (cps). In this invention, it is called a chip ratio, since the underlying physical network, that may change during transit, determines the speed at which the bits or chips are transmitted on each segment of the physical communications link. For direct sequence, the amount of spreading is dependent upon the ratio of chips per bit of information. Each bit of the original message is multiplied by the code sequence thus the original message is spread by the factor of the orthogonal code length. For example a 50 bit message that is spread with a 5 bit code will result in a 250 bit coded sequence. At the receiver, the information is recovered by binary multiplying the signal with a locally generated replica of the code sequence for each sequence of bits corresponding to the code length and counting the number of "one" bits in the result. The

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resultant count is put through a threshold device to decide whether the original bit was a binary "one" or "zero". This process is sequentially used on each set of bits corresponding to the code length to recover the original sequence of bits in the message.

Referring now to Figure 8, there is shown a system using both MAHT and code division multiplexing. The MAHT transmitter, Block 800, sends different data to a plurality of MAHT receivers, Blocks 802, 804, and 806. A pseudorandom sequence generator, Block 808, generates a different orthogonal code sequence for each MAHT receiver, e.g. Block 810. The MAHT transmitter then takes the data destined for each receiving site, e.g. Block 812 destined for Receiver 1, and multiplies each bit in the message destined for that receiver by its corresponding code sequence, e.g. Block 810, to result in a combination data and code sequence for each receiver, e.g. Block 814 for Receiver 1, which is the length of the data length times the code sequence length. These individual data and code sequences are then arithmetically added together to result in a combined result, Block 816, containing data destined for all the receivers. Note that any carry over bits from this binary addition process are discarded. This data is then packaged in a data portion of an MAHT multicast packet and transmitted to all the MAHT receivers, Blocks 802, 804, and 806, that have all subscribed to the applicable multicast address to receive this packet.

Once the multicast packet is received at a given MAHT receiver the data destined for that particular receiver is recovered by passing the received combined result from the data portion of the packet, Block 818, through a code division de-multiplexer that uses the identical pseudorandom sequence, Block 822, that the MAHT transmitter used to encode the data for that receiver. The received combined data, Block 818, is identical to the Combined data at Block 816. The code division de-multiplexer consists of a pseudorandom sequence generator, Block 820, which generates the same sequence, Block 822, as the code sequence, Block 810, generated by the MAHT Transmitter pseudorandom generator, Block 808, for traffic destined for Receiver 1. The output of the de-multiplexer is the original data destined for Receiver 1. Such a system may be

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further extended by having the spreading sequence be much longer than a physical packet length thus enabling more reliable delivery of data when packets are lost in transit since information could be recovered even if some packets are lost. It is also possible to implement this system in a full duplex arrangement between a plurality of participating sites by having each site run both the MAHT transmitting and receiving systems with the appropriate parameters. A Transmitting site may incorporate null data in the coding scheme for sites for which there is no current data to be sent.

As may be understood, a data coding scheme such as code division multiple access may be used in a multicasting network protocol that does not incorporate MAHT or that does incorporate MAHT with schemes to hide the source of the multicast packets, such as TTL jittering or IP Source Address.

The MAHT of the subject invention has been partially prototyped and tested using a three router laboratory test bed. Referring now to Figure 9, there is shown the set up for the existing prototype test bed. The test bed comprised two Cisco™ 3620 model routers, Router 1, Block 908, and Router 2, Block 910, directly connected together using DCE and DTE V.35 cables. These directly connected cables simulated a long distance high- speed serial communications link. Each of these Cisco Routers was connected in turn through one of their Ethernet ports to a Local Area Network (LAN), LAN 1, Block 906, for Router 1, and LAN 2, Block 912, for Router 2. There was an Intel™ based Linux ™ computer, Block 904, running custom software developed for the MRS functionality located on LAN 1. This MRS computer had a second Ethernet card that connected to LAN 3, Block 902, and was configured to route IP packets between the LAN 1, and LAN 3. There was a Linux computer used as a Protected Server Site Host, Block 900, which was also connected into LAN 3, Block 902. This PSSH Linux workstation was configured to run an ftp server, an http server, a telnet server, and an email server. On LAN 2, Block 912, there were two computers connected, a Linux based workstation, Block 914, and a Windows™ 95 based workstation, Block 916. The Linux based workstation, Block 914, was running custom software to provide DFS functionality. The Windows computer, Block 916, was running a Netscape™ and

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Microsoft Internet Explorer™ web browser software as well as standard Windows ftp, ping, and telnet client software.

Router 1, Block 908 was configured to block all packets destined for the PSSH, Block 900, that arrived on the serial interface from Router 2, Block 910. However, the Routers were configured using the Protocol Independent Multicast – Dense Mode (PIM-DM) routing protocol to allow multicast packets to travel from the rest of the network to LAN 1, block 906 and LAN2, Block 912. Thus there was a multicast route available between LAN 1 and LAN 2 but no unicast traffic was allowed to flow from the Client Host, block 916 to the PSSH, Block 900.

The system was tested using ftp, ping, web browsing, and ping between the PSSH and Client Host. When the DFS software, Block 914, and MRS software, Block 904 were turned off there was no connectivity between the Client Host and the MRS. When the DFS and MRS were turned on thereby initiating the MAHT protocol, then normal communications occurred between the Client Host and the PSSH using ftp, telnet, ping, and web browsing. The DFS, Block 914, picked up packets destined for the PSSH, Block 900, using packet sniffing software, encapsulated them in multicast packets, and sent them back to Router 2, block 910. This router forwarded the packets out its serial interface 0/1 to Router 1, Block 908, since Router 1 had been receiving IGMP subscribe messages for each of the 20 multicast addresses. These packets were delivered to the MRS, Block 904, where the original unicast packets were de-encapsulated and passed to the PSSH, Block 900, through the second Ethernet interface onto LAN 3, Block 902. Normal unicast packets from the PSSH, Block 900, destined for the Client Host, Block 916, could still pass normally from the PSSH through the network to the Client Host. This allowed a full bi-directional flow of data between the PSSH, Block 900 running various services and the Client Host, Block 916, in a completely transparent manner. The system achieved a rate of over 80 kilo bits per second even while using 446 bit encryption on each packet.

The multicast address hopping software was implemented primarily in the Java™ programming language with several low level Ethernet packet interface routines implemented in the C language. The software was configured

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to hop within a set of 20 multicast addresses in a fixed pattern and did not drop or add new addresses.

Although the present invention has been described with respect to certain preferred embodiments thereof, various changes and modifications may be suggested to one skilled in the art and it is intended that the present invention encompass such changes and modifications as fall within the scope of the appended claims

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WHAT IS CLAIMED IS:

1. In a multicast capable Internet Protocol (IP) network, a method for transmitting multicast packets between a transmitting end station and one or more receiving end stations on a chosen multicast (IP) address from a plurality of multicast IP addresses for multicast communication, the packets comprising one or more indicia normally capable of identifying an end station as the source of the packets, the method comprising the steps of:

selectively varying the chosen multicast IP address from the plurality of multicast IP addresses according to a predetermined scheme known to the transmitting and receiving end stations;

selectively varying one or more of the indicia within the packets so as to conceal the source of the packets; and

transmitting the packets on the chosen multicast IP address.

2. The method of claim 1 wherein the step of selectively varying the chosen multicast IP address comprises:
randomly hopping from one multicast IP address to another.

3. The method of claim 1 wherein the indicia are chosen from the group comprising a Time To Life (TTL) field and a IP Source Address field of the multicast packets.

4. The method of claim 1 further including the step of tunneling the multicast packets according to a network protocol to one or more tunnel exit hosts each capable of receiving and re-transmitting the multicast packets.

5. The method of claim 1 further comprising the steps of:
combining according to a data coding scheme data intended for each receiving end station, at least some of the data being different for different receiving end stations, to make combined data capable of separation by each receiving end

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stations to obtain the data intended for the receiving end station; and coding a portion of said packets for transmission to all receiving stations with said combined data.

6. The method of claim 5 wherein said data coding scheme is a code division multiple access (CDMA) scheme.

7. The method of claim 1 wherein the multicast packets comprise at least one stream of data and wherein the step or transmitting comprises, for each stream, transmitting the multicast packets comprising the stream to one or more receiving end stations.

8. In a multicast capable Internet Protocol (IP) network, a method for receiving multicast packets at one or more receiving end stations from a transmitting end station on a chosen multicast (IP) address from a plurality of multicast IP addresses for multicast communication, the packets comprising one or more indicia normally capable of identifying an end station as the source of the packets, the method comprising the step of:

selectively varying the chosen multicast IP address from the plurality of multicast IP addresses according to a predetermined scheme known to the transmitting and receiving end stations;

subscribing to the chosen multicast IP address; and

receiving the packets on the chosen multicast IP address;

wherein the one or more of the indicia within the packets are selectively varied so as to conceal the source of the packets.

9. The method of claim 8 further including the step of subscribing to a set of multicast IP addresses comprising at least one multicast IP address from the plurality of multicast IP addresses for multicast communication and including the chosen multicast IP address for transmitting the packets.

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10. The method of claim 9 further comprising the steps of selectively varying the set of multicast IP addresses to which at least one of the receiving end stations is subscribed according to a predetermined scheme known to the at least one receiving end station and transmitting end station and subscribing to the varied set.

11. The method of claim 10 wherein the predetermined scheme for selectively varying the set of multicast IP addresses comprises randomly adding to and dropping from the set of multicast IP addresses.

12. The method of claim 8 wherein the step of selectively varying the chosen multicast IP address comprises:
randomly hopping from one multicast IP address to another chosen from the set of multicast IP addresses.

13. The method of claim 8 wherein at least one of the receiving end stations is isolated from the network so as to prevent the reception of unicast packets.

14. The method of claim 8 further comprising the step of:
separating according to a data coding scheme combined data from data intended for each receiving end station, at least some of the data being different for different receiving end stations and coded in a portion of said packets for transmission to all receiving stations to obtain the data intended for the receiving end station.

15. The method of claim 14 wherein said data coding scheme is code division multiple access (CDMA) scheme.

16. In a multicast capable Internet Protocol (IP) network, a system for transmitting multicast packets between a transmitting end station and one or more receiving end stations on a chosen multicast (IP) address from a plurality of

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multicast IP addresses for multicast communication, the packets comprising one or more indicia normally capable of identifying an end station as the source of the packets, the system comprising;

means for selectively varying the chosen multicast IP address from the plurality of multicast IP addresses according to a predetermined scheme known to the transmitting and receiving end stations;

means for selectively varying one or more of the indicia within the packets so as to conceal the source of the packets; and

means for transmitting the packets on the chosen multicast IP address.

17. The system of claim 16 wherein the means for selectively varying the chosen multicast IP address comprises:

means for randomly hopping from one multicast IP address to another.

18. The system of claim 16 wherein the indicia are chosen from the group comprising a Time To Life (TTL) field and a IP Source Address field of the multicast packets.

19. The system of claim 16 further including means for tunneling the multicast packets according to a network protocol to one or more tunnel exit hosts each capable of receiving and re-transmitting the multicast packets.

20. The system of claim 16 further comprising:

means for combining, according to a data coding scheme data intended for each receiving end station, at least some of the data being different for different receiving end stations, to make combined data capable of separation by each receiving end stations to obtain the data intended for the receiving end station; and coding a portion of said packets for transmission to all receiving stations with said combined data.

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21. The system of claim 16 wherein the multicast packets comprise at least one stream of data and wherein the step or transmitting comprises, for each stream, transmitting the multicast packets comprising each stream to one or more receiving end stations.

22. In a multicast capable Internet Protocol (IP) network, a system for receiving multicast packets at one or more receiving end stations from a transmitting end station on a chosen multicast (IP) address from a plurality of multicast IP addresses for multicast communication, the packets comprising one or more indicia normally capable of identifying an end station as the source of the packets, the system comprising:

means for selectively varying the chosen multicast IP address from the plurality of multicast IP addresses according to a predetermined scheme known to the transmitting and receiving end stations;

means for subscribing to the chosen multicast IP address; and

means for receiving the packets on the chosen multicast IP address;

wherein the one or more of the indicia within the packets are selectively varied so as to conceal the source of the packets.

23. The system of claim 22 further comprising means for subscribing to a set of multicast IP addresses comprising at least one multicast IP address from the plurality of multicast IP addresses for multicast communication and including the chosen multicast IP address for transmitting the packets.

24. The system of claim 23 further comprising means for selectively varying the set of multicast IP addresses to which at least one of the receiving end stations is subscribed according to a predetermined scheme known to the at least one receiving end station and transmitting end station and means for subscribing to the varied set.

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25. The system of claim 24 wherein means for selectively varying the set of multicast IP addresses comprises means for randomly adding to and dropping from the set of multicast IP addresses.

26. The system of claim 22 wherein the means for selectively varying the chosen multicast IP address comprises:
means for randomly hopping from one multicast IP address to another chosen from the set of multicast IP addresses.

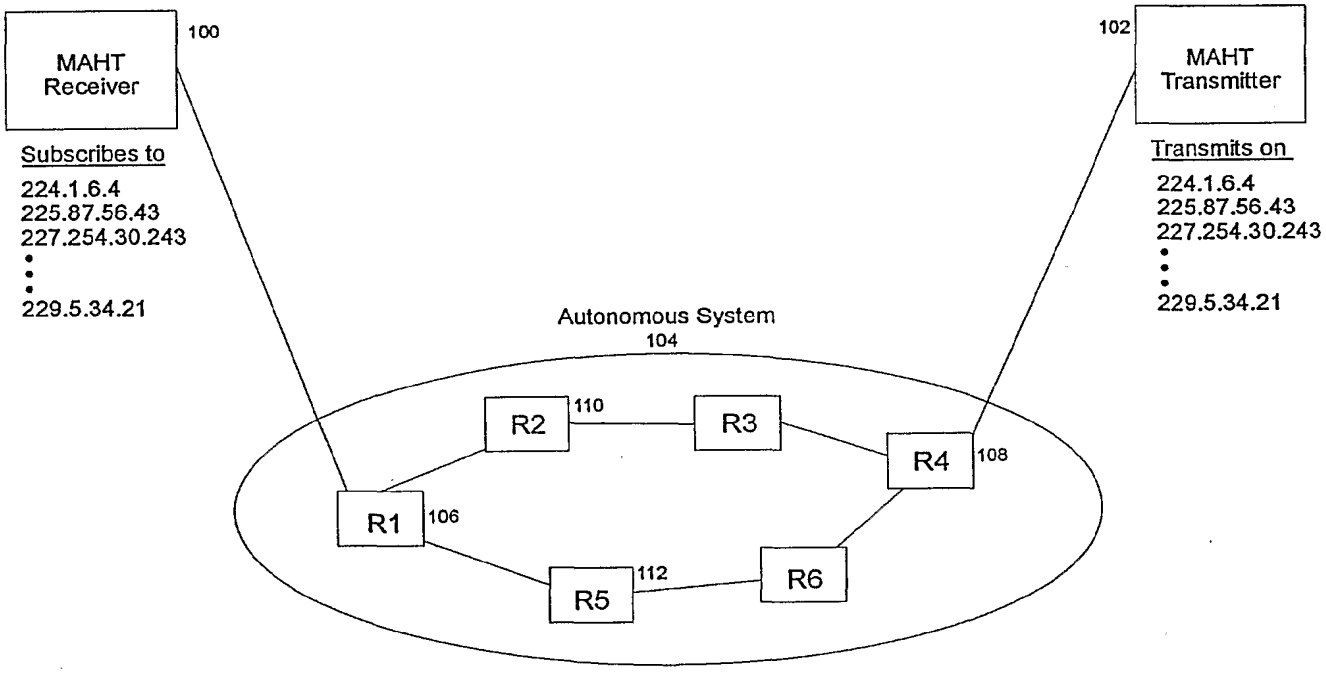
27. The system of claim 22 wherein at least one of the receiving end stations comprises means for isolating the receiving end station from the network for preventing the reception of unicast packets.

28. The system of claim 22 further comprising the step of:
separating according to a data coding scheme combined data from data intended for each receiving end station, at least some of the data being different for different receiving end stations and coded in a portion of said packets for transmission to all receiving stations to obtain the data intended for the receiving end station.

29. The system of claim 28 wherein said data coding scheme is code division multiple access (CDMA) scheme.

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Figure 1



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Figure 2

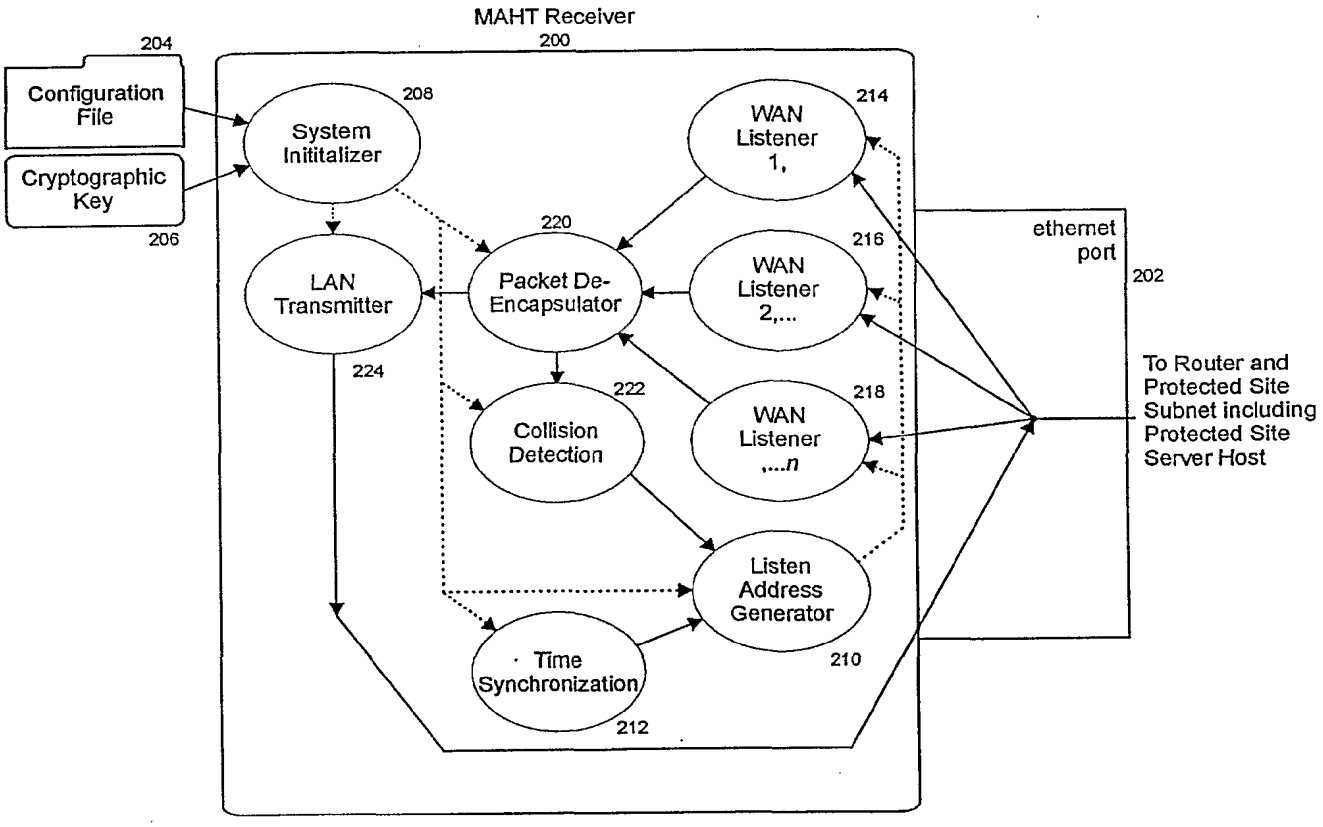

MAHT Receiver
200
204
Configuration File
Cryptographic Key
206
System Inititalizer
208
WAN Listener 1,
214
ethernet port
202
LAN Transmitter
224
Packet De-Encapsulator
220
WAN Listener 2,...
216
To Router and Protected Site Subnet including Protected Site Server Host
Collision Detection
222
WAN Listener ,...n
218
Listen Address Generator
210
Time Synchronization
212

Figure 3

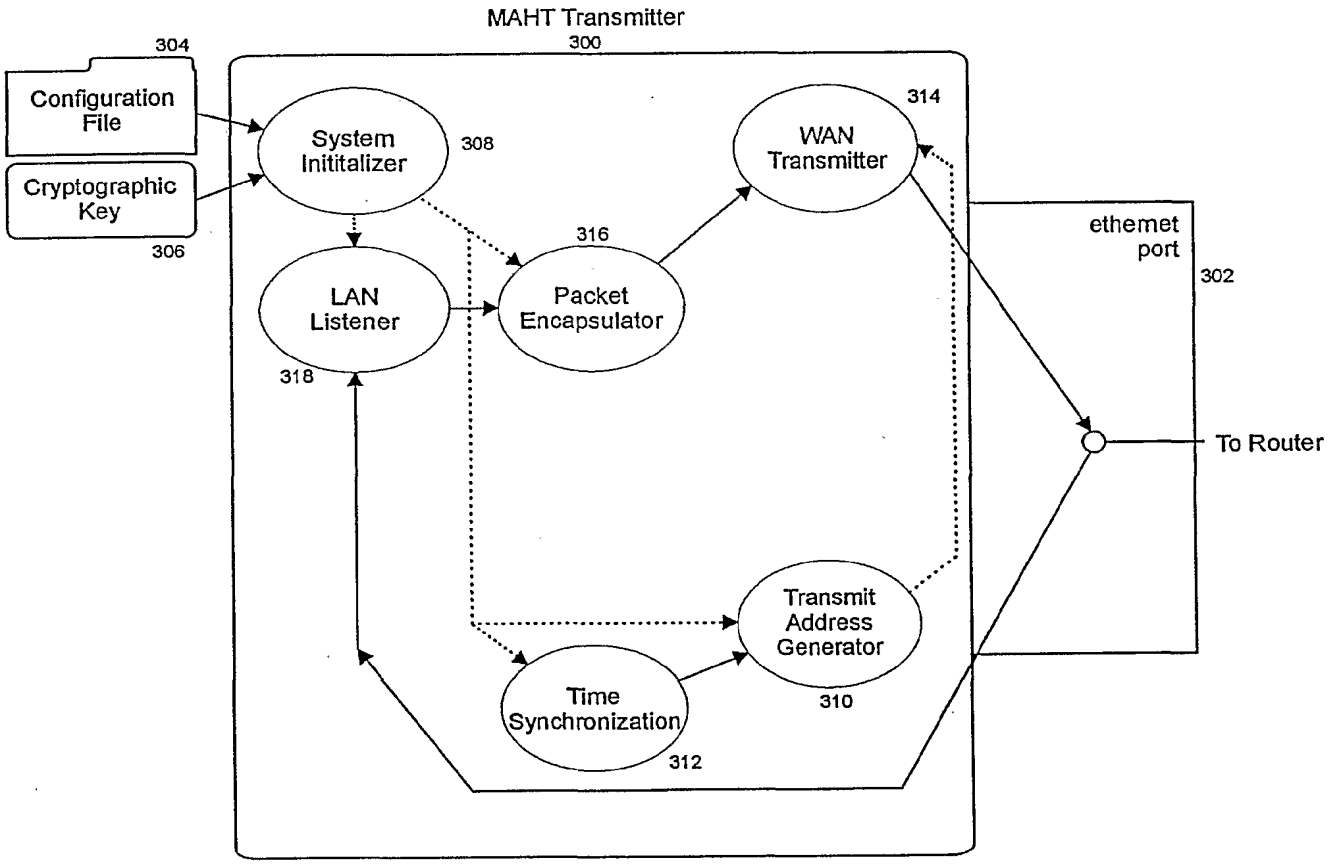
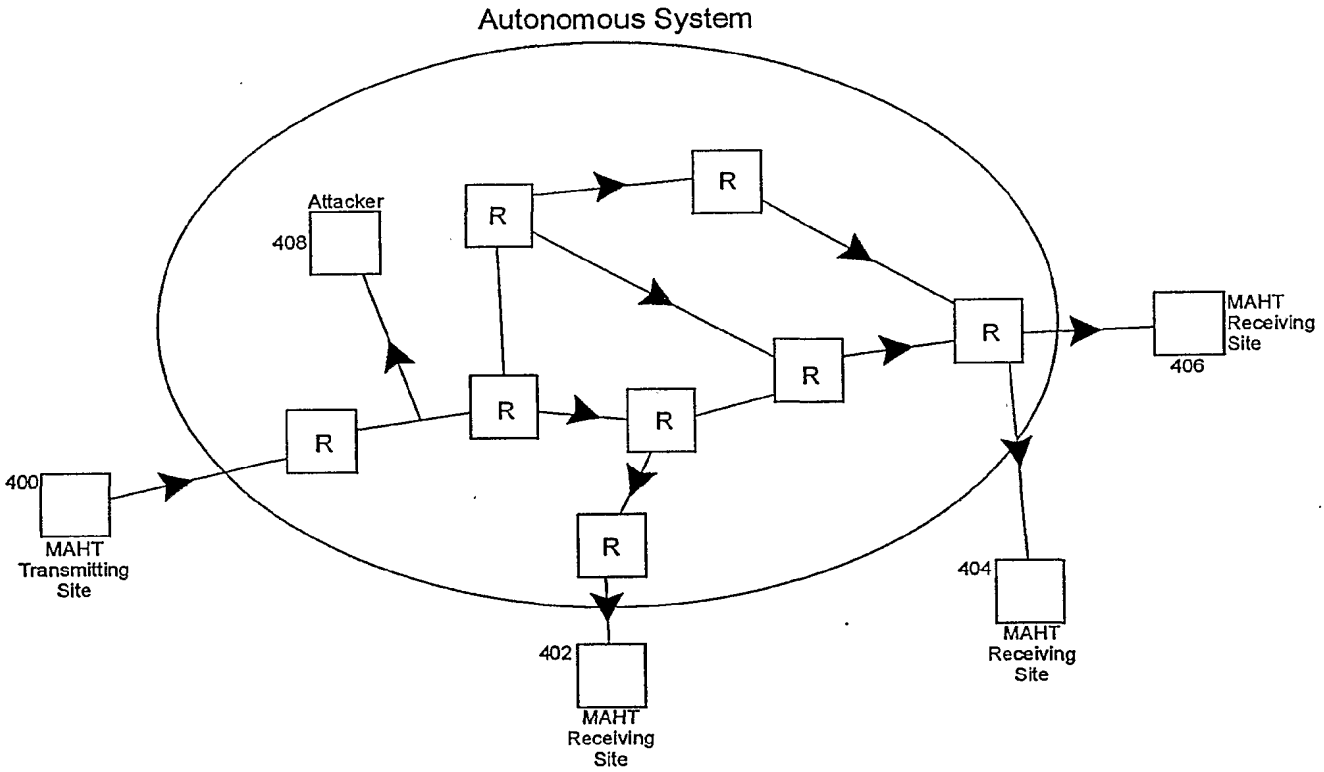
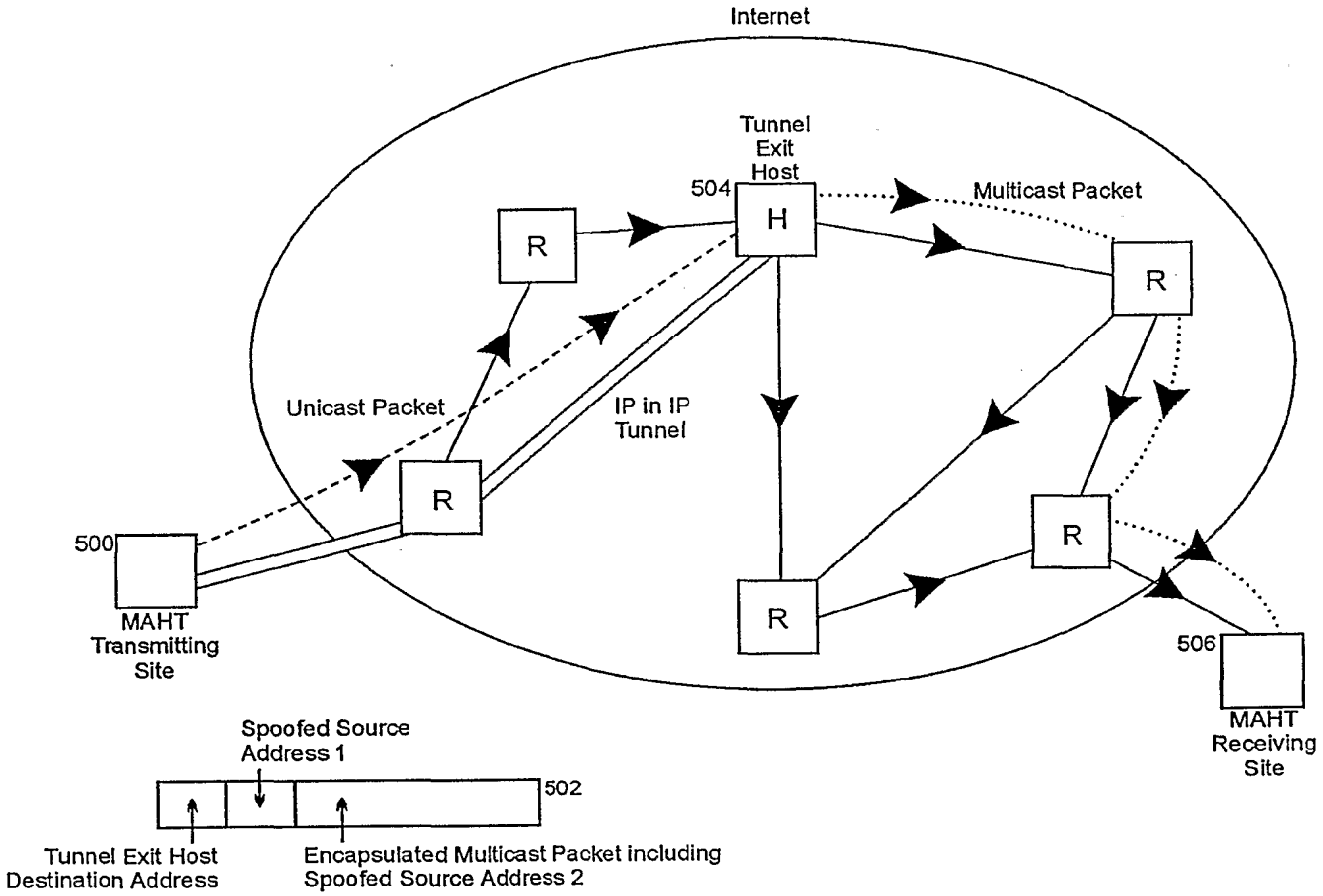

MAHT Transmitter
300
304
Configuration File
Cryptographic Key
306
System Inititalizer
308
WAN Transmitter
314
ethernet port
302
316
LAN Listener
318
Packet Encapsulator
To Router
Transmit Address Generator
310
Time Synchronization
312

Figure 4



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Figure 5



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Figure 6

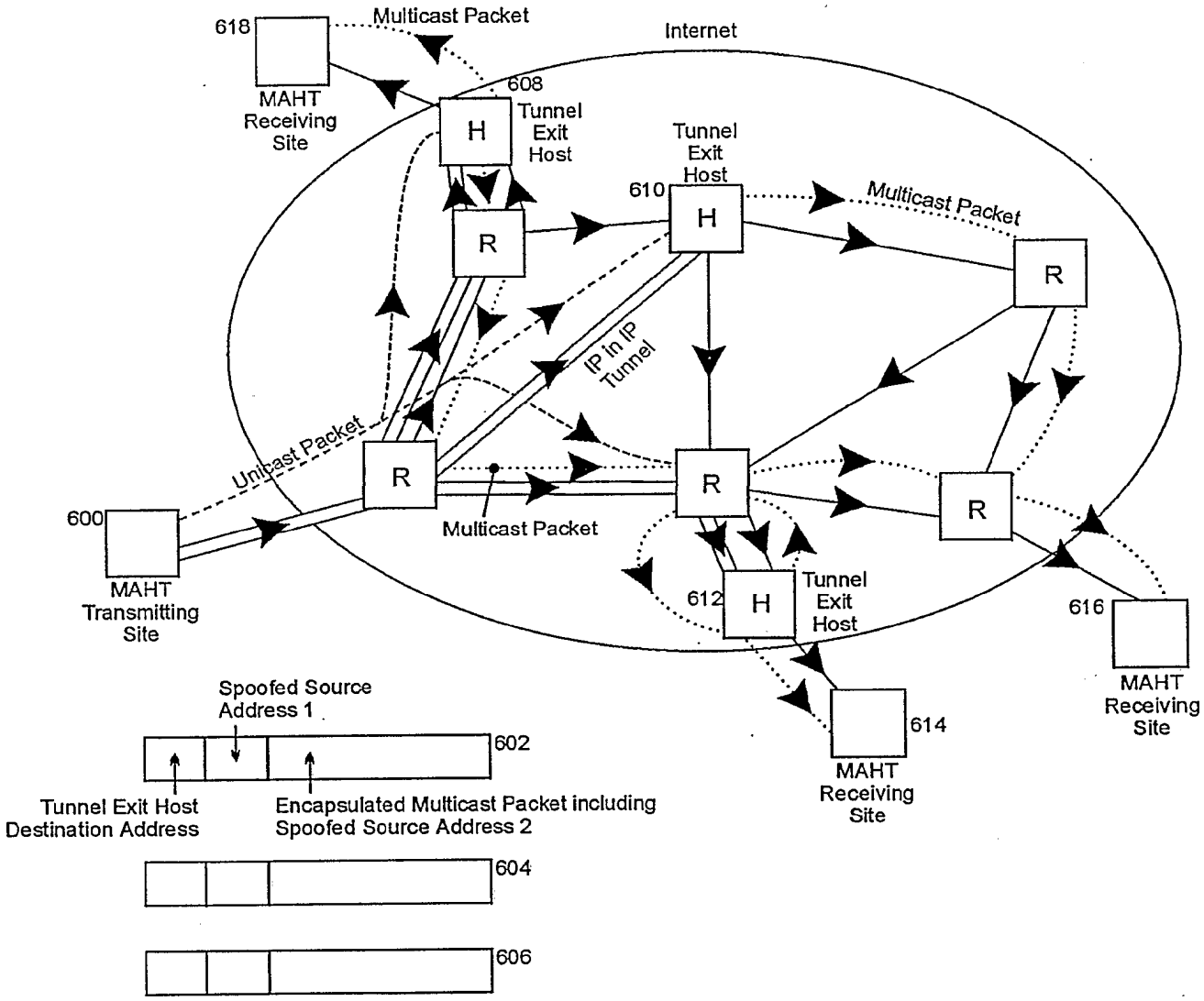

618
Multicast Packet
Internet
MAHT Receiving Site
608
H
Tunnel Exit Host
Tunnel Exit Host
610
H
Multicast Packet
R
R
IP in IP Tunnel
Unicast Packet
R
R
R
600
MAHT Transmitting Site
Multicast Packet
612
H
Tunnel Exit Host
616
MAHT Receiving Site
614
MAHT Receiving Site
Spoofed Source Address 1
602
Tunnel Exit Host Destination Address
Encapsulated Multicast Packet including Spoofed Source Address 2
604
606

Figure 7

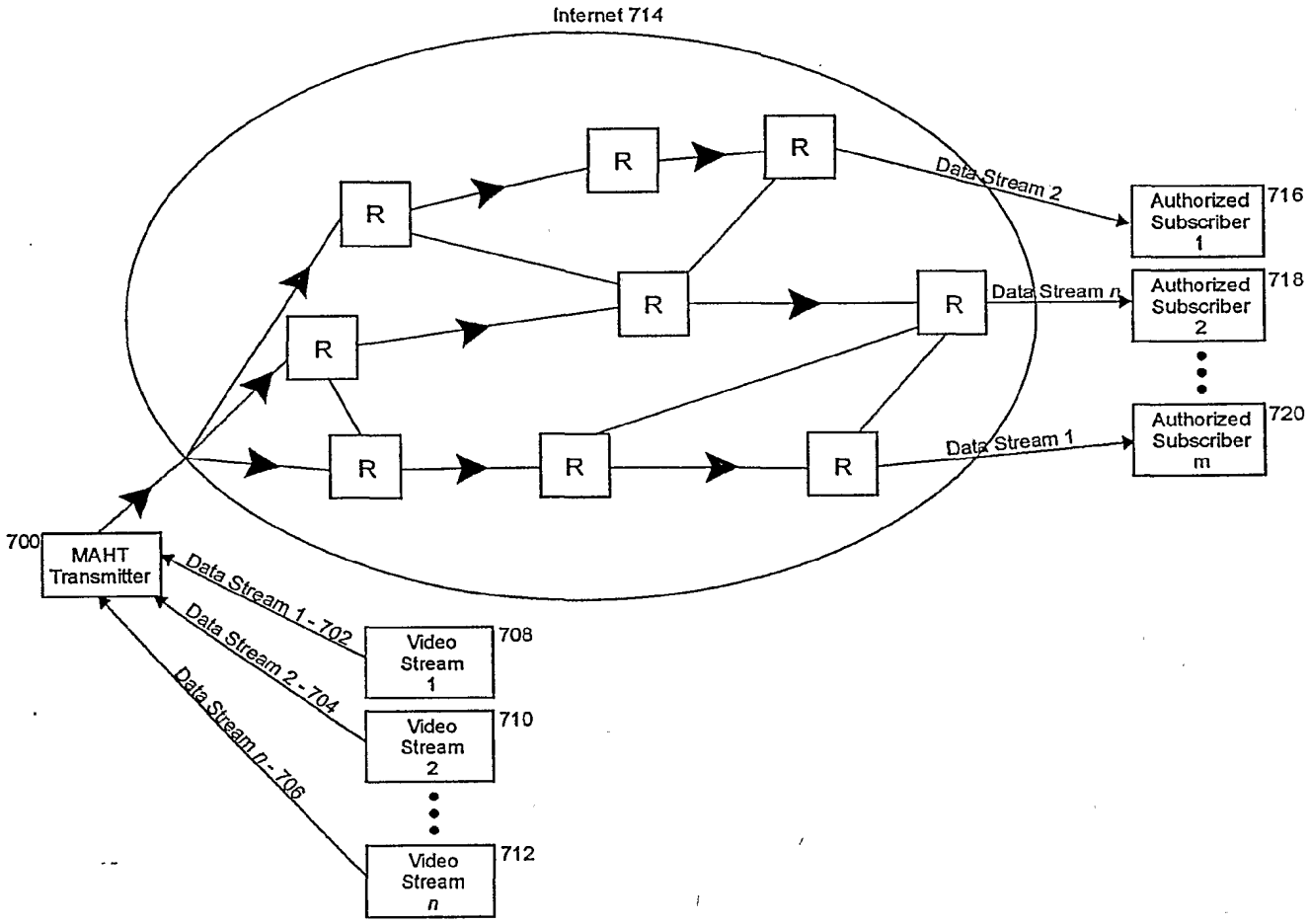

Internet 714
R
Data Stream 2
Authorized Subscriber 1
716
Data Stream n
Authorized Subscriber 2
718
Authorized Subscriber m
720
Data Stream 1
700
MAHT Transmitter
Data Stream 1 - 702
Data Stream 2 - 704
Data Stream n - 706
Video Stream 1
708
Video Stream 2
710
Video Stream n
712

Figure 8

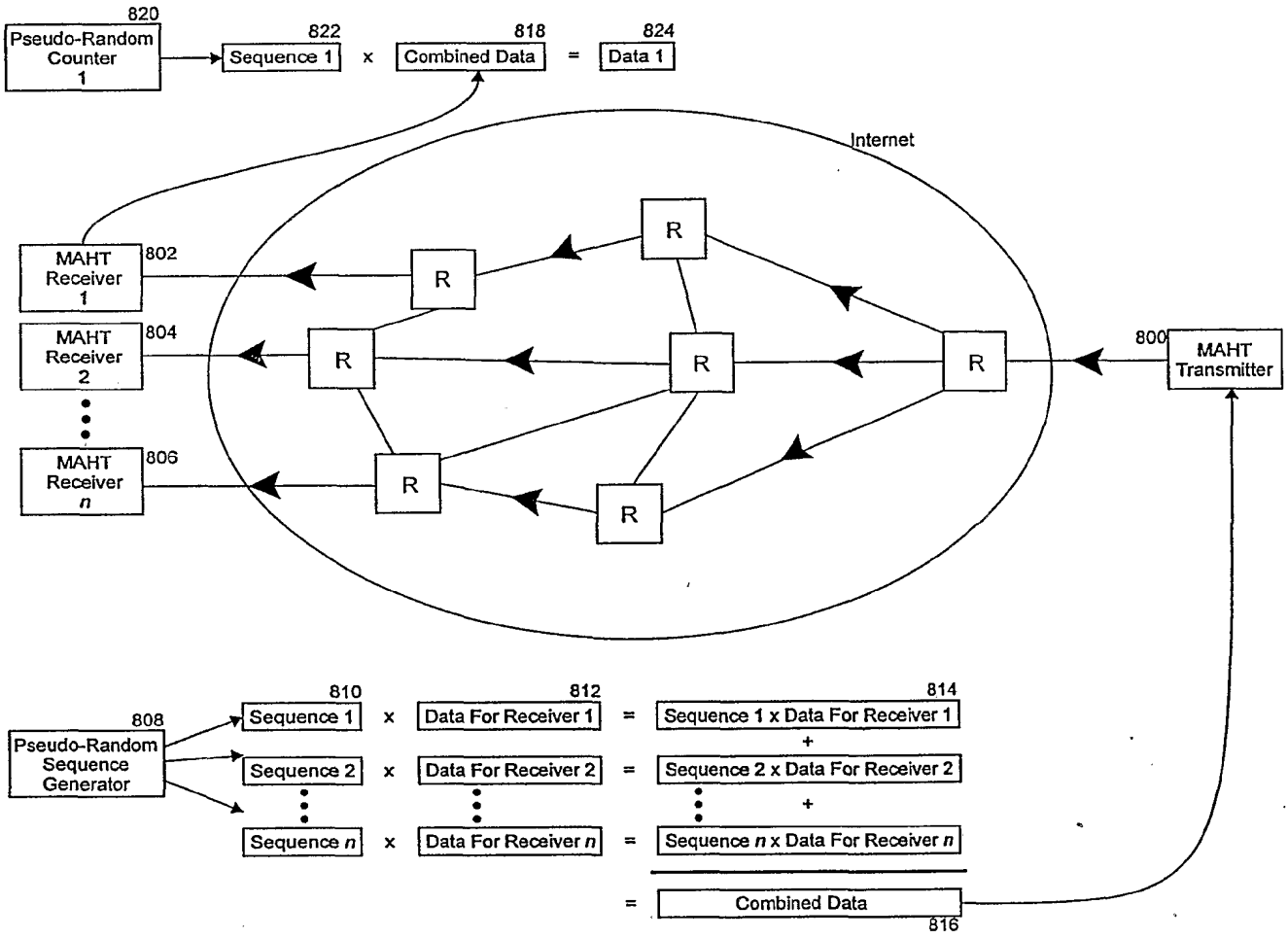
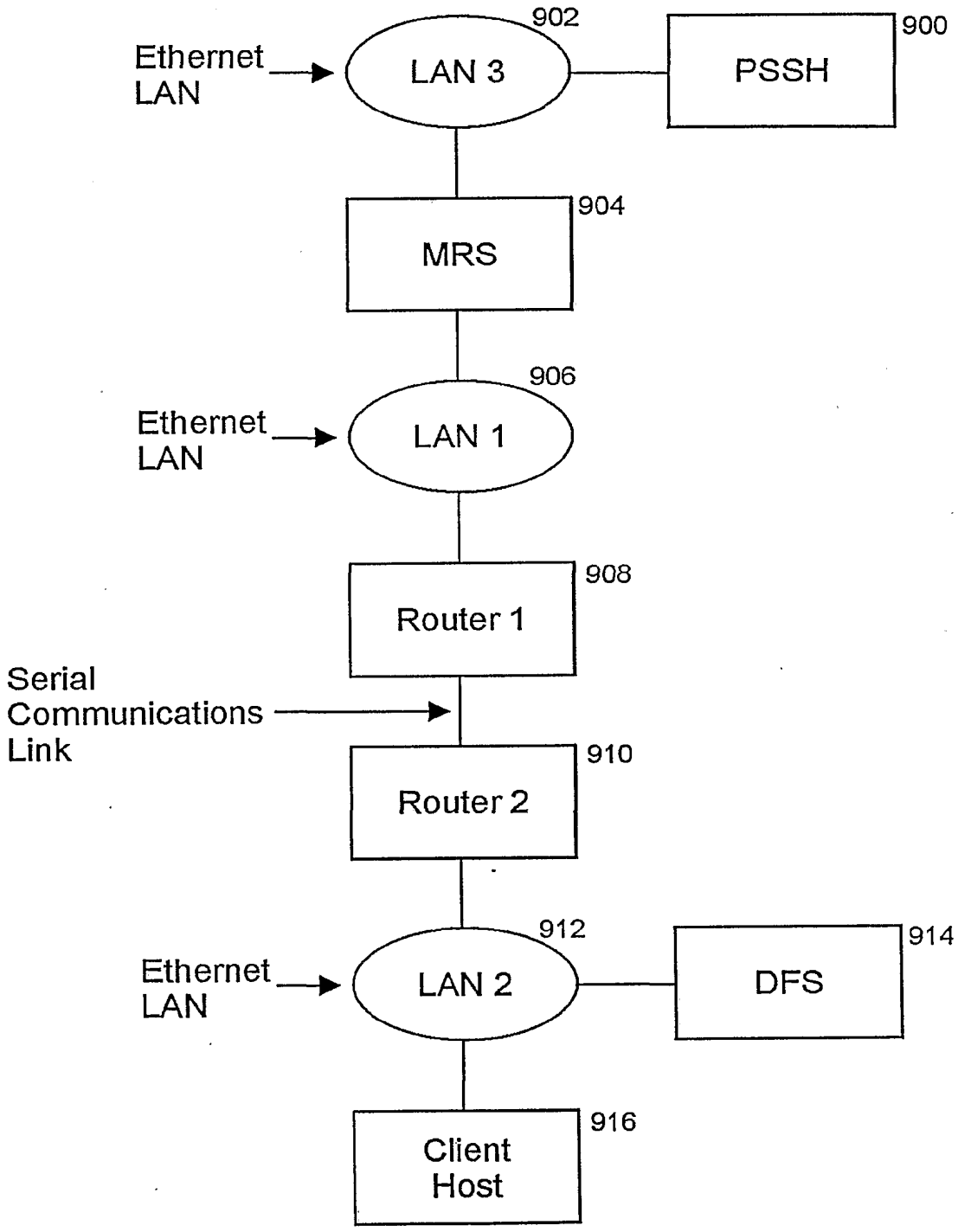

820
Pseudo-Random Counter 1
822
Sequence 1
x
818
Combined Data
=
824
Data 1
Internet
MAHT Receiver 1
802
MAHT Receiver 2
804
MAHT Receiver n
806
R
800
MAHT Transmitter
808
Pseudo-Random Sequence Generator
810
Sequence 1
Sequence 2
Sequence n
812
Data For Receiver 1
Data For Receiver 2
Data For Receiver n
814
Sequence 1 x Data For Receiver 1
Sequence 2 x Data For Receiver 2
Sequence n x Data For Receiver n
+
Combined Data
816

Figure 9


902
900
Ethernet LAN
LAN 3
PSSH
904
MRS
906
Ethernet LAN
LAN 1
908
Router 1
Serial Communications Link
910
Router 2
912
914
Ethernet LAN
LAN 2
DFS
916
Client Host

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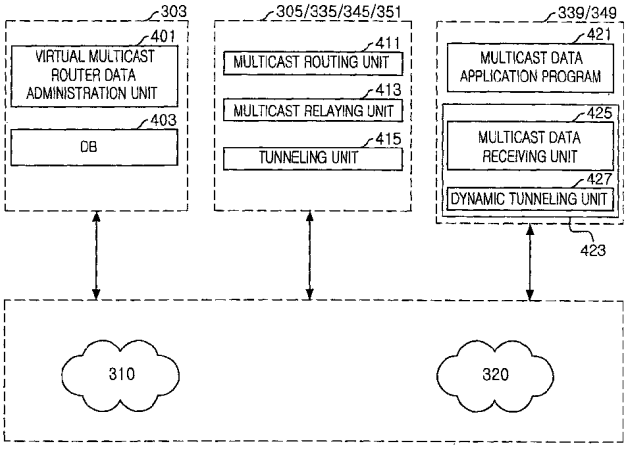
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(54) Title: METHOD AND SYSTEM FOR VIRTUAL MULTICAST NETWORKING



(57) Abstract: Method and system for virtual multicast networking, which can provide multicasting application service on non-multicast network that does not support multicast, are provided. A virtual multicast networking system for providing virtual multicast network on network environment where a multicast data source network to which multicast data source server is connected is linked through backbone network to non-multicast network that does not support multicast and to which a client is connected, the virtual multicast networking system includes: virtual multicast router system, included in the non-multicast network, for routing or relaying multicast data through tunnelling to multicast router or the nearest virtual multicast router system; multicast agent system, mounted on the client, for receiving the multicast data through tunnelling to the nearest virtual multicast router system, and transmitting the received multicast data to application program mounted on the client; and multicast management system, included in the multicast data source network, for managing the IP address of the virtual multicast router system and transmitting the IP address information of the virtual multicast router system to the virtual multicast router system or the multicast agent system.

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METHOD AND SYSTEM FOR VIRTUAL MULTICAST NETWORKING

Technical Field

The present invention relates to a multicasting technology in an Internet broadcasting system; and, more particularly, to a virtual multicast networking method for establishing a multicast network without changing existing routers or switches on the Internet, and a system thereof.

Background Art

Conventional data transmission method on the Internet is peer-to-peer transmission or unicast transmission, in which data are transmitted from one sending end to one receiving end. However, in case where multicast data transmission is performed in the unicasting method to transmit the same data to many receiving ends, there are problems that the server of the sending has a great deal of load, and the bandwidth of the network is occupied inefficiently.

Furthermore, the problems with performing multicast transmission in the unicasting method become more serious, because the next-generation Internet is based on multimedia data transmission, and the volume of multimedia data is very big.

If the problem with the unicasting method is solved, it is possible to broadcast multimedia data stream, such as video and audio data. In short, although a stream of multimedia data is outputted from a sending end, i.e., media server, once through the Internet, the data stream can be transmitted to all the clients (of a multicast group), which are final receiving ends that desire to receive the data stream, selectively, which is multicast technology. When data is transmitted from the sending end,

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each client of the multicast group that desires to receive the data can receive the same duplication of the data.

Multicast technology is a mixture of the advantages of unicasting and broadcasting technologies. It enhances the network efficiency and reduces the confusion of a network. Since it duplicates data and transmits the duplicated data to the receiving ends that desire to receive the data, i.e., ones that belong to the multicast group, it prevents unnecessary data reception. Accordingly, an Internet service provider can convert its network into a multicast network using multicast equipment adopting the multicasting technology.

On a multicast network, broadcast data can be transmitted as many as the bandwidth allows on the network, no matter how many clients are connected thereto. For instance, if the allowed bandwidth of a cable TV network is 30Mbps, 30 one-Mbps broadcast data or 60 500-Kbps broadcast data can be transmitted.

Despite the advantages of multicasting technology, there are many restrictions in converting the existing Internet into a multicast network. For instance, networking equipment that constitutes the Internet does not support the multicasting function, and it costs a lot of money to substitute the equipment with multicast-supporting equipment.

Fig. 1 is a diagram showing a conventional multicast network using a static tunneling technique. So far, to support the multicasting function, all the routers between the media server 101, i.e., sending end, and the clients 103, i.e., the final receiving ends should support the multicasting technology. So, if there are networks 105 and 107 that do not support the multicasting function in between, tunneling method should be used.

According to the conventional tunneling method, when a router 105 between the sending end and the receiving end

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does not support the multicast function, a virtual path is formed between multicast-supporting routers 109 to exchange multicast data, and the router 105 that does not support the multicasting function simply relay the multicast data. Between the multicast-supporting routers 109 connected through the tunneling method, the multicast data is encapsulated in the form of a unicast IP packet and transmitted to the encapsulated multicast data by adding a header containing a tunnel source address and a tunnel destination address. So, it has no problem to pass the router 105 that does not support the multicasting function.

The conventional tunneling method is a static technique, so the multicasting function should be set up in the router 109 manually. Accordingly, the router 109 on the part of the media server 101, the sending end, and the router 109 on the part of the client 103 that requires multicasting should be set up with the multicasting function, which acts as a big burden for the Internet service provider, because it should respond to every request for multicast setup from a plurality of clients 103 that desire to receive multicast data.

Furthermore, recent increasing demand for establishing a home network leads to increasing request for multicast service. However, since most clients 103 use flexible IP addresses, it is impossible to establish a multicast network using a static tunneling method. In short, a fixed IP address is needed in order to set up the multicasting function in a router and perform static tunneling, but if a client has a flexible IP address, the multicasting function cannot be set up in the router.

Fig. 2 is a diagram illustrating a conventional multicast network using a peer-to peer (P2P) transmission technique. Since it becomes hard to modify the scheme of a router, a multicast method is developed recently that makes other clients receive data by making a client, which has

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received the data from the sending end in the unicasting method, upload the received data on the Internet and relay the data to other clients.

According to the multicasting method, a client 213 receives data from the data transmission server 207 of a network 201 having a data source 205 in the unicasting method, and the client 213 uploads the received data on the network 203, to which it belongs, and then other clients 215 and 217 on the network receive the data from the client 213.

In short, when a client of a network receives data, the client performs as a repeater and thereby other client on the same network can receive the data.

As networks are mainly formed of routers and many routers and switches support the multicasting function recently, using the routers to the maximum extent makes it easy to administrate the network and reduces errors. However, this multicasting method also have a problem that the performance is deteriorated due to the limit in the upload speed on an asymmetric network, such as xDSL or cable network.

Disclosure of Invention

It is, therefore, an object of the present invention to provide a method and system for virtual multicast networking that can make clients receive multicast data even on a network that does not support multicasting function, without substituting or modifying networking equipment.

Those skilled in the art of this invention may understand the other objects and advantages of the present invention easily from the drawings, detailed description, and claims of this specification.

In accordance with one aspect of the present invention,

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there is provided a virtual multicast networking system including a client and a multicast source network having a multicast source server, for providing a virtual multicast network in a network environment wherein a non-multicast network that does not support a multicast function is connected through a backbone network, the virtual multicast networking system comprising: a virtual multicast router system included in the non-multicast network, for transmitting or relaying encapsulated multicast data through tunneling with a multicast router or the nearest virtual multicast router system; a multicast agent system loaded on the client, for receiving the encapsulated multicast data through dynamic tunneling with the nearest virtual multicast router system, extracting the multicast data transmitted by the multicast source server from the encapsulated multicast data, and transmitting the extracted multicast data to an application program loaded on the client; and a multicast administration system included in the multicast source network, for managing the IP addresses of the virtual multicast router system, and transmitting the address information of the virtual multicast router system to the virtual multicast router system or the multicast agent system.

In accordance with another aspect of the present invention, there is provided a method for performing virtual multicast networking in a virtual multicast networking system, the method comprising the steps of: a) at a virtual multicast router system included in the non-multicast network, transmitting or relaying encapsulated multicast data through tunneling with a multicast router or the nearest virtual multicast router system; b) at a multicast agent system loaded on the client, receiving the encapsulated multicast data through dynamic tunneling with the nearest virtual multicast router system, extracting the multicast data transmitted from the multicast source server

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from the received encapsulated multicast data, and transmitting the extracted multicast data to an application program loaded on the client; and c) at a multicast administration system included in the multicast source network, managing the IP addresses of the virtual multicast router system, and transmitting the address information of the virtual multicast router system to the virtual multicast router system or the multicast agent system.

In accordance with further anther aspect of the present invention, there is provided a virtual multicast networking system including a client and a multicast source network having a multicast source server, for providing a virtual multicast network in a network environment wherein a non-multicast network that does not support a multicast function is connected through a backbone network, the virtual multicast networking system comprising: a virtual multicast router system included in the non-multicast network, for transmitting or relaying encapsulated multicast data through tunneling with a multicast router or the nearest virtual multicast router system; and a multicast agent system loaded on the client, for receiving the encapsulated multicast data through dynamic tunneling with the nearest virtual multicast router system, extracting the multicast data transmitted from the multicast source server from the encapsulated multicast data, and transmitting the extracted multicast data to an application program loaded on the client.

According to this invention, it is possible to provide multicast service on a network that does not support multicasting function. A networking system in accordance with the embodiment of the present invention includes a multicast administration server, a virtual multicast router and a multicast agent.

The multicast administration server administrates IP addresses of the respective multicast routers, and the

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addresses are used for the multicast administration server to search for an arbitrary virtual multicast router or a virtual multicast router closest to the multicast agent. The IP address of a virtual multicast router searched out later is cached in the multicast administration server for quick search.

The virtual multicast router performs multicast routing, and transmits multicast data to users on a network that does not support multicasting.

The virtual multicast router can be connected to another virtual multicast router through dynamic tunneling. Accordingly, a virtual multicast network can be established on a network that does not support multicasting, without any separate setup in the network scheme.

According to the embodiment of the present invention, a multicast agent is set up in the client to transmit and receive multicast data through the virtual multicast router.

Brief Description of Drawings

The above and other objects and features of the present invention will become apparent from the following description of the preferred embodiments given in conjunction with the accompanying drawings, in which:

Fig. 1 is a diagram illustrating a multicast network to which a conventional static tunneling is applied;

Fig. 2 is a diagram showing a multicast network to which a conventional peer-to-peer transmission technique is applied;

Fig. 3 is a diagram describing a virtual multicast network in accordance with a first embodiment of the present invention;

Fig. 4 is a block diagram showing the system of the virtual multicast network of Fig. 3 in accordance with the first embodiment of the present invention;

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Fig. 5 is a transaction flow chart describing the dynamic tunneling between the multicast routers in accordance with the first embodiment of the present invention;

Fig. 6 is a transaction flow chart describing a multicast agent receiving the multicast data in accordance with the first embodiment of the present invention; and

Fig. 7 is a diagram showing the process of a multicast agent or a virtual multicast router searching for the nearest virtual multicast router in accordance with a second embodiment of the present invention.

Best Mode for Carrying Out the Invention

Other objects and aspects of the invention will become apparent from the following description of the embodiments with reference to the accompanying drawings, which is set forth hereinafter. The same reference numerals in different drawings represent the same elements, and thus their descriptions will be omitted. While describing this invention, if more concrete description of the related arts is considered to blur the point of this invention, the description will be omitted.

An asymmetric digital subscriber line (ADSL) network illustrated in the drawings to describe an embodiment of the present invention is a network that does not support multicasting. It is obvious to those skilled in the art of this invention that the ADSL network as shown in the drawings can be variously changed into another form of a network that does not support multicasting, either, such as integrated services digital network (ISDN), cable network, and radio network. Therefore, this invention should be construed not limited to the ADSL network illustrated in the drawings.

Fig. 3 is a diagram describing a virtual multicast

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network in accordance with a first embodiment of the present invention. As illustrated in the drawing, the application environment of the virtual multicast networking method and system of the present invention includes a multicast source network 300 connected to a backbone network 310 in support of the multicasting function or a backbone network 320 that does not support the multicasting function.

The multicast source network 300 includes a multicast source, which is a media server 301, a multicast administration server 303, a virtual multicast router 305, and a multicast router 307. In case where a backbone network supports the multicasting function, the multicast router 307 operates to connect the multicast source network 300 to the backbone network 310 in support of the multicasting function. On the other hand, the virtual multicast router 305 operates to connect the multicast source network 300 to the backbone network 320 that does not support the multicasting function, in case where a backbone network supports the multicasting function. Accordingly, it is obvious to those skilled in the art that the virtual multicast router 305 and/or the multicast router 307 may be set up together or separately, according to the environment of a backbone network connected with the multicast source network 300.

The multicast administration server 303 administrates the IP addresses of virtual multicast routers. Later, the multicast administration server 303 searches the IP addresses of all virtual multicast routers to find out the nearest virtual multicast router.

In case of the backbone network 310 supporting the multicast function, the virtual multicast router can be set up on an xDSL network, or in a home gateway of a home network.

In case of the backbone network 320 not supporting the

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multicast function, the virtual multicast router can be set up on the multicast source network 300 and the xDSL network to form a multicast network through dynamic tunneling.

In short, the virtual multicast networking in accordance with the present invention can be formed in two different environments, and in an environment combining the two environments.

First, there is a case where the multicast-supporting backbone network 310 is connected to a non-multicast network—for example, an ADSL network 330—through a non-multicast router 331. Most ADSL networks do not support the multicasting function.

The ADSL network 330 includes a virtual multicast router 335 of the present invention, and a plurality of clients 339 are connected to an ADSL network 330 through an ADSL server (b-RAS) 333 and ADSL service device (DSLAM) 337. That is, in accordance with the embodiment of the present invention, the virtual multicast router 335 is set up on a sub network, such as b-RAS 333 that forms the ADSL network 330, to support multicasting.

The multicast router included in the multicast source network 300 and the virtual multicast router in the ADSL network 330 transmits and receives multicast data through static tunneling. For static tunneling, an IP tunneling technique may be used, and as multicast routing protocol, protocol independent multicast-sparse mode (PIM-SM), distance vector multicast routing protocol (DVMRP), or source specific multicast (SSM) can be used. To perform the static tunneling, tunneling setup data is set up in advance in the configuration file of the routers 307 and 335.

To receive multicast data transmitted from the multicast source network 300, the clients 339 searches for the nearest virtual multicast router 335 from the multicast administration server 303, and then registers the address

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of the nearest virtual multicast router 335 in the multicast group (Dynamic tunneling).

When the virtual multicast router 335 receives data heading for the addresses of the multicast group, it encapsulates the data and transmits the encapsulated data to the multicast agent of the registered clients 339 through the path set up by the tunneling method. The multicast agent removes the header containing the tunnel source address and the tunnel destination address from the encapsulated multicast data, and then transmits the multicast data to an application program set up in the clients 339.

The tunneling between the virtual multicast router 335 and the multicast agents of the clients registered in the multicast group, and the method of data transmission through a path set up by the tunneling are various based on the environment of networks, to which the virtual multicast router receiving the multicast data or the multicast agent belongs to. For example, a tunneling set up from the virtual multicast router 335 to a virtual multicast router of a non-multicast network or a multicast agent may be IP tunneling, UDP tunneling, or TCP tunneling. The method of data transmission through a path set up by this tunneling method may be IP multicast transmission or UDP/TCP unicast transmission. In case where the virtual multicast router or multicast agent is in a network address translator (NAT) or firewall environment, multicast data are transmitted by the TCP tunneling, and in other cases, they are transmitted by the UDP tunneling.

Second, there is a case where the non-multicast backbone network 320 is connected to a non-multicast network—for example, an ADSL network 340—through a non-multicast router 341. The ADSL network 340 includes a virtual multicast router 34 of the present invention, and a plurality of clients 349 are connected to the ADSL network

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340 through the ADSL server (b-RAS) 343 and ADSL service device (DSLAM) 347. That is, in accordance with the first embodiment of the present invention, the virtual multicast router 345 is set up on a sub network, such as b-RAS 343 that forms the ADSL network 340, to support the multicast.

A home network 350 includes a home network gateway 351 connected to the non-multicast router 341, a TV set 353, which is a home network client, a desktop computer 355, a video camera 357, and a laptop computer 359.

The virtual multicast router of the present invention can be used as an exclusive hardware system that performs the role of a multicast router in a non-multicast network, such as xDSL, or a server software in the home network gateway 351 needed to establish a home network.

The virtual multicast router 345 or 351 sets up a data path with the virtual multicast router 305 included in the multicast source network 300 by performing dynamic tunneling to form a virtual multicast network. Also, the dynamic tunneling is carried out between the virtual multicast routers 345 and 351, too, to provide multicast service to the home network environment 350.

When the virtual multicast router 345 or 351 receives multicast data from the multicast source network 300, it transmits the multicast data to the clients 349, 355, and 359 registered in the multicast group.

Third, there is a case where the non-multicast backbone network 320 is connected to a multicast-supporting network through the virtual multicast router of the present invention (not shown). In this case, the virtual multicast router sets up a data path with the virtual multicast router 305 in the multicast source network 300 by performing dynamic tunneling. The router and clients on a multicast-supporting network can receive data transmitted in a multicast method from the virtual multicast router that are connected with a backbone network and has a path

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that leads to the virtual multicast router 305, the path being set up in the dynamic tunneling method. For instance, the router and clients of a multicast-supporting network receives data transmitted in the IP multicasting method from the virtual multicast router that are connected with a backbone network and has a path that leads to the virtual multicast router 305, the path being set up in the dynamic tunneling method.

In short, the virtual multicast router of the present invention can set up a data transmission path by performing tunneling in various methods according to the environment of its sub-network, and on the other hand, it can also transmit encapsulated data to the virtual multicast router or multicast agent in various data transmission methods.

Fig. 4 is a block diagram showing the system of the virtual multicast network of Fig. 3. In accordance with the first embodiment of the present invention, the multicast networking system includes the multicast administration server 303, virtual multicast router 305, 335, 345, and 351, and multicast agent 423.

The multicast administration server 303 includes a virtual multicast router data administration unit 401 and a database 403. The virtual multicast router data administration unit 401 administrates the IP address of the virtual multicast router, and upon receipt of a request for searching IP addresses of the virtual multicast routers 305, 335, 345, and 351 transmitted from a multicast agent 423 or the virtual multicast routers 305, 335, 345, and 351, it refers to the IP addresses of the virtual multicast routers stored in the database 403, and searches for the nearest virtual multicast router 305, 335, 345, or 351 from the virtual multicast routers 305, 335, 345, and 351. The search result is transmitted to a corresponding multicast agent 423 or the virtual multicast routers 305, 335, 345, and 351.

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In general, since the multicast agent 423 of the clients and the virtual multicast routers 305, 335, 345, and 351 search for the nearest virtual multicast router 305, 335, 345, or 351 by calculating hop counters, the nearest virtual multicast router 305, 335, 345, or 351 is always the same. In this case, it takes very long time to set up a path and, the bandwidth of the network is wasted due to unnecessary data transmission, because IP addresses of all the virtual multicast routers should be transmitted from the multicast administration server 303 and then the nearest virtual multicast router should be searched for to set up a path every time.

To perform searching and set up a path quickly, the multicast administration server 303 forms a caching table of the IP addresses and network addresses of the multicast agent 423 which has requested searching or virtual multicast routers 305, 335, 345, and 351, and the IP address of a virtual multicast router that is searched out to be the nearest one from the multicast agent 423 or virtual multicast routers 305, 335, 345, and 351, and store the caching table in the database 403. The caching table reduces time for setting up a path of the multicast agent 423 or virtual multicast routers 305, 335, 345, and 351 through dynamic tunneling by performing quick searching, and prevents unnecessary data transmission.

The virtual multicast routers 305, 335, 345, and 351 includes a tunneling unit 415 for performing static and/or dynamic tunneling between general multicast routers or virtual multicast routers, a multicast routing unit 411, and a multicast relaying unit 413.

The virtual multicast routers 305, 335, 345 can be formed as an exclusive hardware virtual multicast router that can embody multicast networking with respect to a non-multicast network 330, 340, or 350, or in the home networking environment, it can be embodied as a software

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that enables multicast networking and installed in a home network gateway and a router of a non-multicast network.

The virtual multicast router of the present invention sets up a data transmission path by performing tunneling in various methods, such as IP tunneling, UDP tunneling, and TCP tunneling according to the environment of its sub-network, and it also transmits encapsulated data to the virtual multicast router of the sub-network or multicast agent in diverse data transmission methods, such as IP multicast transmission, and UDP/TCP unicast transmission.

For example, tunneling from the virtual multicast router 335 to the virtual multicast router of a non-multicast network or the multicast agent can be IP tunneling, UDP tunneling, or TCP tunneling, and the data transmission method through a path set up by this tunneling can be the IP multicast transmission, or UDP/TCP unicast transmission.

Meanwhile, in case where a multicast-supporting network is connected to the non-multicast backbone network 320 through the virtual multicast router of the present invention, the virtual multicast router sets up a data path with the virtual multicast router 305 on the multicast source network 300 by performing the dynamic tunneling to form a virtual multicast network, and the router and clients on the multicast-supporting network can receive data in the IP multicast data transmission method from the virtual multicast router, which is connected with the backbone network, and has a path set up with the virtual multicast router 305 by performing dynamic tunneling.

Static tunneling performed by the tunneling unit 415 is a method used between the multicast router 307 and the virtual multicast routers 305, 335, 345, or 351. As described above, the multicast router 307 on the multicast source network 300 and the virtual multicast router 335 on the ADSL network 330 transmits and receives multicast data

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through the static tunneling. As a static tunneling, the IP tunneling method can be used. For performing the static tunneling, tunneling setup data are stored in the configuration file of the routers 307 and 335 in advance.

Also, dynamic tunneling performed by the tunneling unit 415 is a method used between a virtual multicast router and a virtual multicast router—for example, between the virtual multicast routers 305 and 345, or between the virtual multicast routers 345 and 351. In the dynamic tunneling, the IP tunneling method can be used, too, just as the static tunneling, and UDP tunneling and TCP tunneling methods can be used as well. Different from static tunneling, the dynamic tunneling is performed dynamically on the request of the virtual multicast router, and the removal of the tunneling is carried out dynamically, too.

Meanwhile, the virtual multicast routers 305, 335, 345, or 351 perform different functions depending on the presence of a multicast router on the sub-network it belongs to. That is, the virtual multicast routers 305, 335, 345, and 351 examine if there is a multicast router on the sub-network it belongs to, and if there is a multicast router, it does not perform the role of a multicast router, but simply performs the role of a multicast repeater. If there is no multicast router after searching, it performs the roles of a multicast router and multicast repeater simultaneously. Therefore, in accordance with the first embodiment of the present embodiment, the virtual multicast routers 305, 335, 345, and 351 are activated to operate as the multicast routing unit 411 and/or multicast repeater 413, which will be described later, selectively depending on the environment of the sub-network it belongs to.

The multicast routing unit 411 that performs as a multicast router routes multicast data, using standard multicast routing protocol, which is Protocol Independent

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Multicast-Sparse Mode (PIM-SM), Distance Vector Multicast Routing Protocol (DVMRP), or Source Specific Multicast (SSM).

The multicast repeater 413 receives multicast data and transmits them to the clients 339, 349, 353, and 359 with a network in the non-multicast network environments 330, 340, and 350. The multicast repeater 413 administrates the joining and secession to and from a particular multicast group.

Membership information is registered, when the clients 339, 349, 353 and 359 transmit the multicast address and port number of a multicast group they want to join, after the virtual multicast router or multicast agent sets up a path with another virtual multicast router through dynamic tunneling. The membership information includes the addresses of the clients in the multicast group, port number of the multicast group, and address of a multicast agent or virtual multicast router registered in the multicast group.

When the clients 339, 349, 353, and 359 are registered in a particular multicast group, and then the virtual multicast routers 305, 335, 345, and 351 receive multicast data to be transmitted to the clients 339, 349, 353, and 359 of the multicast group, the received data are encapsulated and transmitted to the multicast agent mounted on the clients 339, 349, 353, and 359 of the multicast group, or another virtual multicast router.

In case where the network including the virtual multicast routers 305, 335, 345, and 351 supports broadcasting or unicasting only, the Internet group management protocol (IGMP) snooping of the L2 switch can be emulated.

IGMP Snooping is a well-known technology that makes a switch transmit multicast traffics intelligently. Based on the IGMP query and report message, a switch transmits

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traffics only to the ports that have requested multicast. This method prevents the switch from broadcast traffics and affecting the performance of the network. IGMP needs a router that can figure out if a multicast group exists on the sub-network, and administrates the membership of the group.

The multicast agent 423 is a system mounted on the client to receive multicast data. It includes a dynamic tunneling unit 427 for performing dynamic tunneling to set up a path with the multicast data receiving unit 425 and thus receive multicast data on a non-multicast network 330, 340, or 350.

The dynamic tunneling unit 427 requires the IP address of a virtual multicast router nearest to the multicast administration server 303. If the IP address of the nearest virtual multicast router is informed by the multicast administration server 303, the dynamic tunneling unit 427 sets up a path by performing dynamic tunneling. Otherwise, it brings the IP addresses of all virtual multicast routers, and then searches for the nearest virtual multicast router based on the IP addresses. The dynamic tunneling unit 427 calculates the hop counters of the IP addresses, and searches for the nearest virtual multicast router. That is, a virtual multicast router with an IP address having the smallest hop counter is considered to be in the nearest location.

After finding the nearest virtual multicast router, the multicast agent 423 requests it to join the multicast group. If the request is accepted, the multicast agent 423 can receive multicast data from the moment. When the multicast agent 423 receives multicast data through the multicast data receiving unit 425, it resets Time to Live (TTL) at 0, using the IP multicast inside the client, and performs multicast again, and then the multicast application program receives multicast data.

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Fig. 5 is a transaction flow chart describing the dynamic tunneling between the multicast routers in accordance with the first embodiment of the present invention. The process of dynamic tunneling of each virtual multicast router 305, 335, 345, or 351 is as follows.

At step S501, a first virtual multicast router 501 requests data of the nearest virtual multicast router, i.e., its IP address, to the multicast administration server 303, the IP address of the first virtual multicast router 501 already registered in the multicast administration server 303. At step S503, the multicast administration server 303 searches the virtual multicast router caching data stored in the database 403, and then at step S505, if there are data on the nearest multicast router, it transmits the data, otherwise, transmits data on all virtual multicast routers.

At step S507, the first virtual multicast router 501 that has received the router data from the multicast administration server 303 determines whether the received data is on the nearest virtual multicast router, that is, whether the data is about one single virtual multicast router, and at step S515, if the router data proves to be the nearest virtual multicast router, it requests dynamic tunneling to the nearest virtual multicast router, i.e., a second virtual multicast router 503. In case where the received data at the step S507 are not data on one virtual multicast router, but on all virtual multicast routers, at step S509, it acquires data on the nearest virtual multicast router from the received data on all virtual multicast routers by calculating hop counter, as described above.

The data on the nearest virtual multicast router is obtained from the above received data on all virtual multicast routers by calculating hop counter, because the first virtual multicast router 501 has never transmitted

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the data on the nearest virtual multicast router to the multicast administration server 303 before. Therefore, once the first multicast router 501 calculates hop counters and obtains data on the nearest virtual multicast router 503, at step S511, it transmits the data on the nearest virtual multicast router to the multicast administration server 303, and at step S513, the multicast administration server 303 updates the caching table of virtual multicast router IP addresses stored in the database 403. Later on, if the data on the nearest virtual multicast router is requested again from the first virtual multicast router 501, the multicast administration server 303 transmits the data on the nearest virtual multicast router based on the updated caching table.

Meanwhile, at step S515, the first virtual multicast router 501 that has obtained data on the nearest virtual multicast router 503 at the step S509 requests dynamic tunneling to the second virtual multicast router 503. The request for dynamic tunneling includes the IP address of the first virtual multicast router 501 as a destination address of the multicast data, which is used to encapsulate the multicast data.

At step S517, the second virtual multicast router 503 performs setting for dynamic tunneling, taking its IP address as a transmission source (tunnel source) address of encapsulated multicast data, and the IP address of the first virtual multicast router 501 as the destination (tunnel destination) address of the encapsulated multicast data. Then, at step S519, if the acknowledgement for the dynamic tunneling request is transmitted to the first virtual multicast router 501, at step S521, a path is set up between the first virtual multicast router 501 and the second virtual multicast router 503 by performing dynamic tunneling. That is, going through the flow illustrated in Fig. 5, the virtual multicast router performs dynamic

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tunneling with the nearest virtual multicast router among other virtual multicast routers, and a multicast tree is formed by the multicast tree forming algorithm of the PIM-SM, DVMRP, or SSM.

Fig. 6 is a transaction flow chart describing the multicast data reception of a multicast agent in accordance with the first embodiment of the present invention. It is assumed that a path is already set up between the virtual multicast router 501 of the network 330, 340, or 350, to which the multicast agent 423 belongs and the multicast source server 301, and this assumption can be expected from the logic flow illustrated in Fig. 5 sufficiently.

At step S601, when the IP address of the multicast agent 423 is registered in the multicast administration server 303, the multicast agent 423 requests the multicast administration server 303 for data on the nearest virtual multicast router, that is, IP address. At step S603, the multicast administration server 303 searches virtual multicast router caching data stored in the database 403, and if there is registered data on the nearest multicast router, transmits the data, and otherwise, if there is no registered data on it, at step S605, the multicast administration server 303 transmits data on all virtual multicast routers.

At step S607, the multicast agent 423 which has received data on a router from the multicast administration server 303 determines whether the received data are data on the nearest virtual multicast router, that is, the data is about one virtual multicast router, if the data is about the nearest virtual multicast router, at step S615, it requests the nearest virtual multicast router, for example a virtual multicast router 501, to join the multicast group.

Otherwise, if the data received at the step S607 are about all virtual multicast routers, at step S609, it obtains data on the nearest virtual multicast router from

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the received data on all virtual multicast router addresses. By calculating hop counters of all the virtual multicast routers, the data on the nearest virtual multicast router can be obtained.

Since the multicast agent 423 has not transmitted any data on the nearest virtual multicast router to the multicast administration server 303 before, it is possible for the multicast agent 423 to obtain data on the nearest virtual multicast router by calculating the hop counters. Accordingly, at step S611, once the multicast agent obtains the data on the nearest virtual multicast router 501, it transmits the data to the multicast administration server 303. Then, at step S613, the multicast administration server 303 updates the virtual multicast router IP address caching table, which is stored in the database 403. Later on, when the IP address of the nearest virtual multicast router is requested again by the multicast agent 423, the multicast administration server 303 transmits the data on the nearest virtual multicast router 501 based on the updated caching table.

Meanwhile, at step S615, the multicast agent 423 that obtained the data on the nearest virtual multicast router 501 requests the multicast agent 423 to join the multicast group through the nearest virtual multicast router 501. The request for joining a multicast group is a request asking for dynamic tunneling, and it includes the IP address of the multicast agent 423 as the address of the destination of multicast data, which is used to encapsulate the multicast data.

At step S617, in response to the request for joining the multicast group, the virtual multicast router 501 updates the group data with its IP address as a transmission source (dynamic tunnel source) address of the encapsulated multicast data and the IP address of the multicast agent 423 as the destination address of the

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encapsulated multicast data, and, at step S619, it transmits acknowledgement of the multicast group request. Then, at step S621, a path between the multicast agent 423 and the multicast router is set up.

In short, when the multicast agent is registered in the multicast group, and when data are transmitted from the multicast source server 301, the virtual multicast router 501 checks out the address of the multicast data and transmits the multicast data to the multicast agent 423 registered on the multicast group. The multicast agent 423 that has received the multicast data from the virtual multicast router 501 removes the header, which contains the tunnel source address and the tunnel destination address, from the IP encapsulated multicast data, and perform re-multicasting to a multicast data application program loaded on a client.

Fig. 7 is a diagram showing the process of a multicast agent or a virtual multicast router searching for the nearest virtual multicast router in accordance with a second embodiment of the present invention.

In Figs. 5 and 6, the multicast agent 423 or the first virtual multicast router 501 determines if the router data transmitted from the multicast administration server 303 is on the nearest virtual multicast router at step S507 or S607. If the received data prove to be data on all virtual multicast routers, at step S509 or S609, their hop counters are calculated from the received data on all virtual multicast router addresses and the data on the nearest virtual multicast router are obtained.

Fig. 7 shows another embodiment for obtaining data on the nearest virtual multicast router data not by calculating hop counters as described in Figs. 5 and 6, but by calculating round trip time (RTT).

First, the multicast source server 301 calculates the RTT values between the multicast source server 301 and the

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virtual multicast routers 501 and 701a to 701n by transmitting a message to each of the virtual multicast routers 501 and 701a to 701n periodically, and then it transmits the maximum RTT value and the average RTT value of the calculated RTT values to the virtual multicast routers 501 and 701a to 701n. Accordingly, the multicast source server 301 and the respective virtual multicast routers 501 and 701a to 701n are always aware of the maximum RTT value and the average RTT value of the virtual multicast routers.

In this circumstance, at step S701, if the multicast agent 423 or the first virtual multicast router 501 requests the multicast source server 301 for the data on the nearest high-ranked virtual multicast router, at step S703, the multicast source server 301 transmits to the other virtual multicast routers 701a to 701n a command to send the data to the multicast agent 423 or the first virtual multicast router 501 in a particular time period.

At step S705, each of the virtual multicast routers 701a to 701n, which has received the data transmission command, waits for a time subtracting the average RTT value from the maximum RTT value based on the time point when the data transmission command is received, and transmits the data to the multicast agent 423 or the first multicast router 501.

At step S707, the multicast agent 423 or the first multicast router 501 recognizes the virtual multicast router that has sent the data arriving first among the data transmitted from each of the virtual multicast routers 701a to 701n as the nearest virtual multicast router and thus obtains the data on the nearest virtual multicast router.

At step S709, the subsequent process is the same as the steps S513 through S521 or the steps S613 through S621 of Fig. 5 or 6.

The method of the present invention described can be

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embodied as a program and recorded in a computer-readable recording medium, such as CD-ROMs, RAMs, ROMs, floppy disks, hard disks, and optical magnetic disks.

This invention, which is a method and system for virtual multicast networking, can provide multicast application service such as Internet broadcasting effectively even in a network environment that does not support the multicasting function. The dynamic tunneling technology between the virtual multicast routers solves the problem of a conventional static tunneling that a user should set up the tunneling by himself and the problem in multicast networking when a user uses a dynamic IP.

The application of multicast service will be enhanced due to this dynamic tunneling technology, because a multicast network can be established without performing any set up process to the existing network environment.

Later on, when home networking is generalized, it is also possible to use the multicast technology at an end terminal, too, and provide various services by applying the multicast technology to the home gateway.

While the present invention has been described with respect to certain preferred embodiments, it will be apparent to those skilled in the art that various changes and modifications may be made without departing from the scope of the invention as defined in the following claims.

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CLAIMS

1. A virtual multicast networking system including a client and a multicast source network having a multicast source server, for providing a virtual multicast network in a network environment wherein a non-multicast network that does not support a multicast function is connected through a backbone network, the virtual multicast networking system comprising:

a virtual multicast router system included in the non-multicast network, for transmitting or relaying encapsulated multicast data through tunneling with a multicast router or the nearest virtual multicast router system;

a multicast agent system loaded on the client, for receiving the encapsulated multicast data through dynamic tunneling with the nearest virtual multicast router system, extracting the multicast data transmitted by the multicast source server from the encapsulated multicast data, and transmitting the extracted multicast data to an application program loaded on the client; and

a multicast administration system included in the multicast source network, for managing the IP addresses of the virtual multicast router system, and transmitting the address information of the virtual multicast router system to the virtual multicast router system or the multicast agent system.

2. The system as recited in claim 1, wherein the virtual multicast router system includes:

a tunneling unit for transmitting a dynamic tunneling request including its IP address to the nearest virtual multicast router system, and setting up a tunnel source address and a tunnel destination address for dynamic tunneling based on the dynamic tunneling request from the

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nearest virtual multicast router system or the multicast agent system; and

a multicast relaying unit for managing the membership information of the multicast group, and transmitting the encapsulated multicast data, which are transmitted from the nearest virtual multicast router system through dynamic tunneling, to the client or virtual multicast router system included in the membership information of the multicast group through a multicast router included in a sub-network of the non-multicast network, to which the virtual multicast router system belongs.

3. The system as recited in claim 2, wherein the virtual multicast router system further includes a multicast routing unit for routing the encapsulated multicast data, if there is no multicast router or virtual multicast router system on the non-multicast network.

4. The system as recited in claim 3, wherein the multicast agent system includes:

a dynamic tunneling unit for transmitting a multicast group joining request including the IP address of the multicast agent system to the virtual multicast router system; and

a multicast data receiving unit for receiving encapsulated multicast data from the virtual multicast router system, removing the header that includes the tunnel source address and the tunnel destination address from the received data, and transmitting the multicast data, which is transmitted from the multicast source server, to an application program of the client.

5. The system as recited in claim 4, wherein the multicast data receiving unit transmits the multicast data transmitted from the multicast source server to the

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application program of the client by setting time to live (TTL) at zero using IP multicast.

6. The system as recited in claim 5, wherein the multicast administration system includes:

a database for caching and storing in a table the IP address information of all virtual multicast router systems in the network environment; and

a virtual multicast router data administration unit for searching the database and transmitting the data on the nearest virtual multicast router to the tunneling unit or the dynamic tunneling unit, upon a request for the address information of the nearest virtual multicast router system from the tunneling unit or the dynamic tunneling unit.

7. The system as recited in claim 6, wherein the virtual multicast router data administration unit searches the database, upon the request for the nearest virtual multicast router system data, and if there is no data on the nearest virtual multicast router, transmitting the address information of all virtual multicast router systems stored in the table to the tunneling unit or the dynamic tunneling unit.

8. The system as recited in claim 7, wherein the tunneling unit or the dynamic tunneling unit obtains the address information of the nearest virtual multicast router system by calculating hop counters based on the address information of all virtual multicast router systems transmitted from the virtual multicast router data administration unit, and transmits the obtained address information of the nearest virtual multicast router system to the virtual multicast router data administration unit.

9. The system as recited in claim 6, wherein the

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virtual multicast router data administration unit searches the database upon the request for data on the nearest virtual multicast router system, and if there is no information on the nearest virtual multicast router, transmits to all the virtual multicast router systems in the network environment a command to send data for checking out distance to the tunneling unit or the dynamic tunneling unit at a predetermined time point.

10. The system as recited in claim 9, wherein the virtual multicast router data administration unit periodically obtains each average round trip time (RTT) and the maximum RTT of all the virtual multicast router systems in the network environment, and transmits the average RTT and the maximum RTT to all the virtual multicast router systems in the network environment; and

wherein the predetermined time point is a time subtracting the average RTT value from the maximum RTT value based on the time point when the command is received is passed.

11. The system as recited in claim 10, wherein the tunneling unit or the dynamic tunneling unit obtains the address information of the nearest virtual multicast router system based on the data that has arrived first among other data sent from all the virtual multicast router systems in the network environment to check out the distance, and transmits the obtained address information of the nearest virtual multicast router system to the virtual multicast router data administration unit.

12. The system as recited in claim 8 or 10, wherein the virtual multicast router data administration unit further performs the function of updating the IP address information of the virtual multicast router systems, which

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are stored in the database in the form of a table, based on the address information of the nearest virtual multicast router system transmitted from the tunneling unit or the dynamic tunneling unit.

13. The system as recited in claim 12, wherein the virtual multicast router system performs tunneling and transmits the encapsulated multicast data based on the network environment, to which the multicast agent system or the nearest virtual multicast router system that receives the encapsulated multicast data transmitted from the virtual multicast router system belongs.

14. The system as recited in claim 13, wherein the virtual multicast router system emulates the Internet group management protocol (IGMP) snooping function of L2 switch, in case where the non-multicast network supports a broadcast or unicast function only.

15. The system as recited in claim 2, wherein the backbone network does not support the multicast function, and the multicast source network includes the virtual multicast router system.

16. The system as recited in claim 2, wherein the backbone network supports the multicasting function,

wherein the multicast source network includes a multicast router,

wherein the tunneling unit has the tunnel source address and the tunnel destination address set up between the virtual multicast router system and the multicast router through static tunneling, and

wherein the multicast relaying unit transmits the encapsulated multicast data, which are transmitted from the multicast router system through static tunneling, to the

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client or virtual multicast router system in the membership information of the multicast group through a multicast router on a sub-network of the non-multicast network, to which the virtual multicast router system belongs.

17. A method for performing virtual multicast networking in a virtual multicast networking system, the method comprising the steps of:

a) at a virtual multicast router system included in the non-multicast network, transmitting or relaying encapsulated multicast data through tunneling with a multicast router or the nearest virtual multicast router system;

b) at a multicast agent system loaded on the client, receiving the encapsulated multicast data through dynamic tunneling with the nearest virtual multicast router system, extracting the multicast data transmitted from the multicast source server from the received encapsulated multicast data, and transmitting the extracted multicast data to an application program loaded on the client; and

c) at a multicast administration system included in the multicast source network, managing the IP addresses of the virtual multicast router system, and transmitting the address information of the virtual multicast router system to the virtual multicast router system or the multicast agent system.

18. The method as recited in claim 17, wherein the step a) includes the steps of:

a1) at a tunneling unit included in the virtual multicast router system, transmitting a dynamic tunneling request including the IP address of the virtual multicast router system to the nearest virtual multicast router system;

a2) at the tunneling unit, setting up the tunnel

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source address and the tunnel destination address for dynamic tunneling based on the dynamic tunneling request transmitted from the nearest virtual multicast router system or the multicast agent system; and

a3) at a multicast relaying unit included in the virtual multicast router system, managing the membership information of the multicast group, and transmitting the encapsulated multicast data, which are transmitted from the nearest virtual multicast router system through dynamic tunneling, to the client or virtual multicast router system in the membership information of the multicast group through a multicast router on a sub-network of the non-multicast network, to which the virtual multicast router system belongs.

19. The method as recited in claim 18, wherein the step a) further comprises the step of:

a4) the multicast routing unit included in the virtual multicast router system, routing the encapsulated multicast data, if there is no multicast router or virtual multicast router system on the non-multicast network.

20. The method as recited in claim 19, wherein the step b) comprises the steps of:

b1) at a dynamic tunneling unit included in the multicast agent system, transmitting a multicast group joining request including the IP address of the multicast agent system to the virtual multicast router system; and

b2) at a multicast data receiving unit included in the multicast agent system, receiving the encapsulated multicast data from the virtual multicast router system, removing the header that includes the tunnel source address and the tunnel destination address from the received data, and transmitting the multicast data, which is transmitted from the multicast source server, to an application program

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of the client.

21. The method as recited in claim 20, wherein in the step b2), the multicast data transmitted from the multicast source server are transmitted to the application program of the client by setting time to live (TTL) at zero using IP multicast.

22. The method as recited in claim 21, wherein the step c) includes the steps of:

c1) caching the IP address information of all virtual multicast router systems in the network environment and storing the cached data in the database in the form of a table; and

c2) at the virtual multicast router data administration unit, searching the database and transmitting the data on the nearest virtual multicast router to the tunneling unit or the dynamic tunneling unit, upon a request for data on the nearest virtual multicast router system from the tunneling unit or the dynamic tunneling unit.

23. The method as recited in claim 22, wherein the step c) further includes the step of:

c3) at the virtual multicast router data administration unit, searching the database upon the request for data on the nearest virtual multicast router system, and if there is no information on the nearest virtual multicast router, transmitting the address information of all virtual multicast router systems stored in the table to the tunneling unit or the dynamic tunneling unit.

24. The method as recited in claim 23, wherein the step a2) further includes the steps of:

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a2-1) at the tunneling unit, obtaining the address information of the nearest virtual multicast router system by calculating hop counters based on the address information of all virtual multicast router systems received by the process of the step c3); and

a2-2) at the tunneling unit, transmitting the obtained address information of the nearest virtual multicast router system to the virtual multicast router data administration unit, and

wherein the step b1) further includes the steps of:

b1-1) at the dynamic tunneling unit, obtaining the address information of the nearest virtual multicast router system by calculating hop counters based on the address information of all virtual multicast router systems received by the process of the step c3); and

b1-2) at the dynamic tunneling unit, transmitting the obtained address information of the nearest virtual multicast router system to the virtual multicast router data administration unit.

25. The method as recited in claim 22, wherein the step c) further includes the step of:

c4) the virtual multicast router data administration unit, searching the database upon the request for information on the nearest virtual multicast router system, and if there is no information on the nearest virtual multicast router, transmitting to all the virtual multicast router systems in the network environment a command to send data for checking out distance to the tunneling unit or the dynamic tunneling unit at a predetermined time point.

26. The method as recited in claim 25, wherein the step c) further includes the step of:

c5) at the virtual multicast router data administration unit, periodically obtaining the average

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round trip time (RTT) and the maximum RTT of all the virtual multicast router systems in the network environment, and transmitting the average RTT and the maximum RTT to all the virtual multicast router systems included in the network environment, and

wherein the predetermined time point is a time subtracting the average RTT value from the maximum RTT value based on the time point when the command is received is passed.

27. The method as recited in claim 26, wherein the step a2) further includes the steps of:

a2-1) at the tunneling unit, obtaining the address information of the nearest virtual multicast router system based on the data that has arrived first among other data transmitted from all the virtual multicast router systems included in the network environment to check out the distance; and

a2-2) at the tunneling unit, transmitting the obtained address information of the nearest virtual multicast router system to the virtual multicast router data administration unit, and

wherein the step b1) further includes the steps of:

b1-1) at the dynamic tunneling unit, obtaining the address information of the nearest virtual multicast router system based on the data that has arrived first among other data transmitted from all the virtual multicast router systems included in the network environment to check out the distance; and

b1-2) at the dynamic tunneling unit, transmitting the obtained address information of the nearest virtual multicast router system to the virtual multicast router data administration unit.

28. The method as recited in claim 24 or 26, wherein

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the step c) further comprises the step of:

c6) at the virtual multicast router data administration unit, updating the IP address information of the virtual multicast router systems, which are stored in the database in the form of a table, based on the address information of the nearest virtual multicast router system transmitted from the tunneling unit or the dynamic tunneling unit.

29. The method as recited in claim 28, wherein in the step a), the tunneling is performed based on the network environment, to which the multicast agent system or the nearest virtual multicast router system that receives the encapsulated multicast data transmitted from the virtual multicast router system belongs, and the encapsulated multicast data are transmitted.

30. The method as recited in claim 29, wherein in the step a), the virtual multicast router system emulates the Internet group management protocol (IGMP) snooping function of L2 switch, in case where the non-multicast network supports a broadcast or unicast function.

31. The method as recited in claim 18, wherein the backbone network does not support the multicasting function, and the multicast source network includes the virtual multicast router system.

32. The method as recited in claim 18, wherein the backbone network supports the multicasting function,

wherein the multicast source network includes a multicast router,

wherein the tunneling unit has tunnel source address and tunnel destination address set up between the virtual multicast router system and the multicast router through

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static tunneling, and

wherein the step a3) includes the step of:

a3-1) at the multicast relaying unit, transmitting the encapsulated multicast data, which are transmitted from the multicast router system through static tunneling, to the client or virtual multicast router system in the membership information of the multicast group through a multicast router included in a sub-network of the non-multicast network, to which the virtual multicast router system belongs.

33. A virtual multicast networking system including a client and a multicast source network having a multicast source server, for providing a virtual multicast network in a network environment wherein a non-multicast network that does not support a multicast function is connected through a backbone network, the virtual multicast networking system comprising:

a virtual multicast router system included in the non-multicast network, for transmitting or relaying encapsulated multicast data through tunneling with a multicast router or the nearest virtual multicast router system; and

a multicast agent system loaded on the client, for receiving the encapsulated multicast data through dynamic tunneling with the nearest virtual multicast router system, extracting the multicast data transmitted from the multicast source server from the encapsulated multicast data, and transmitting the extracted multicast data to an application program loaded on the client.

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FIG. 1

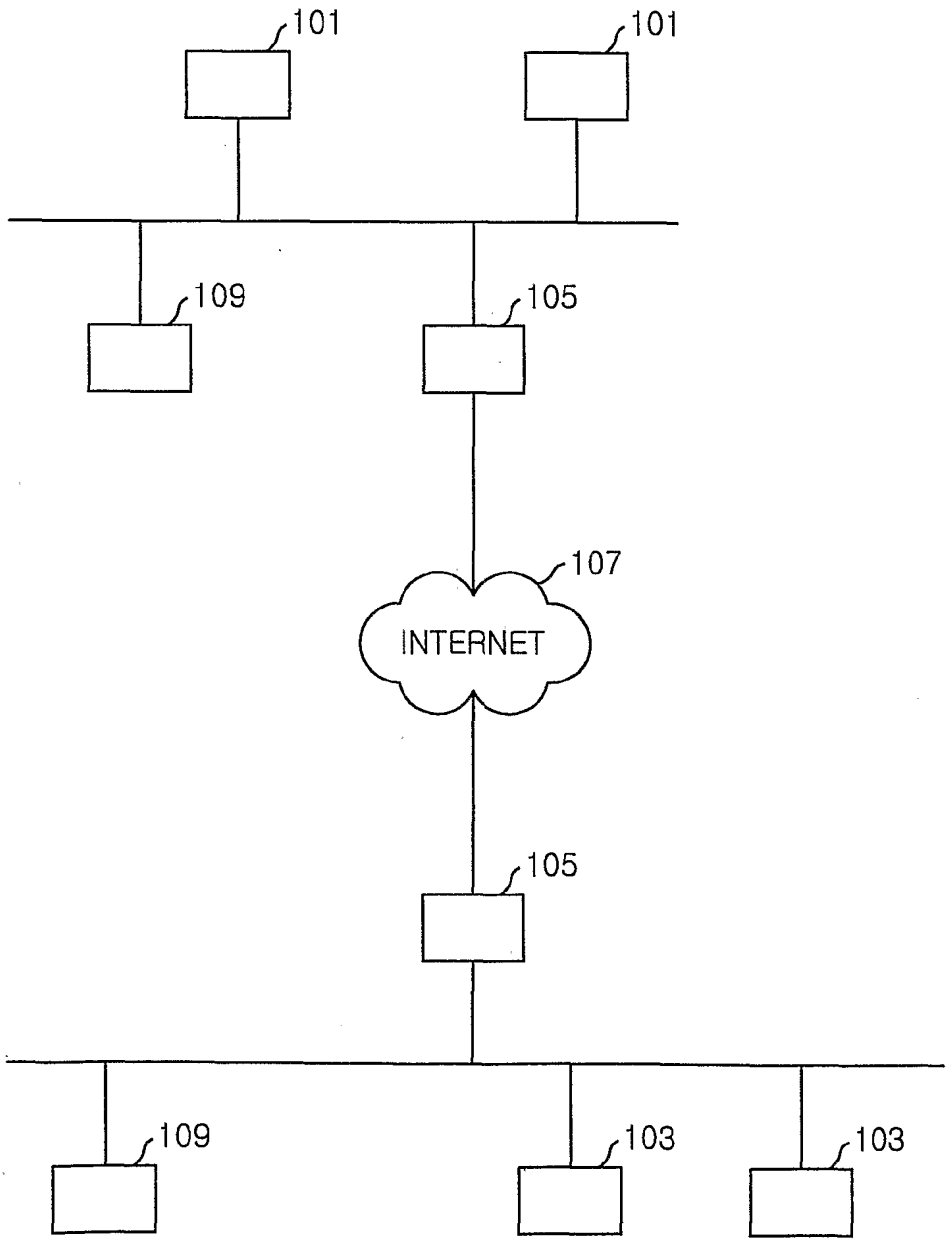


FIG. 2

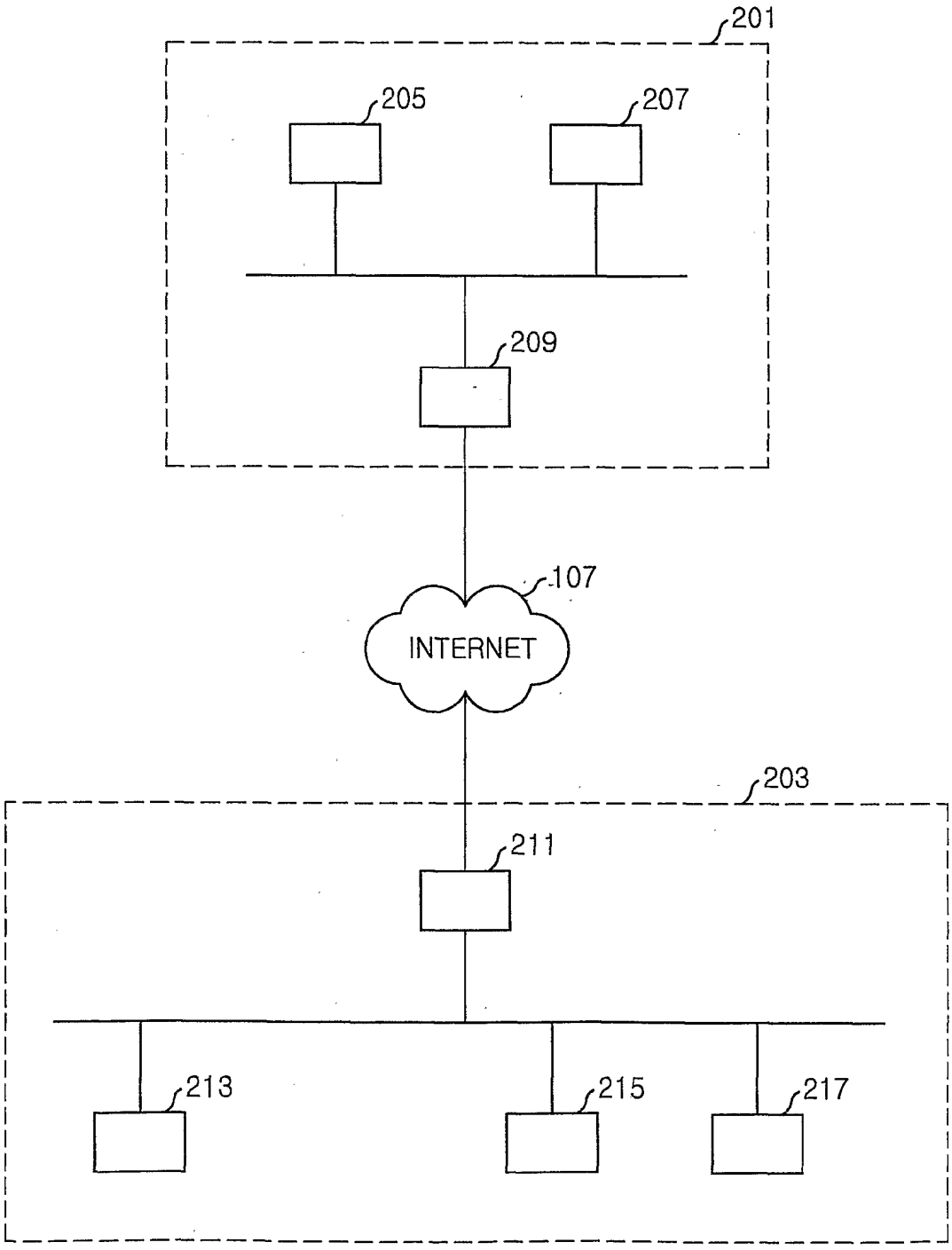
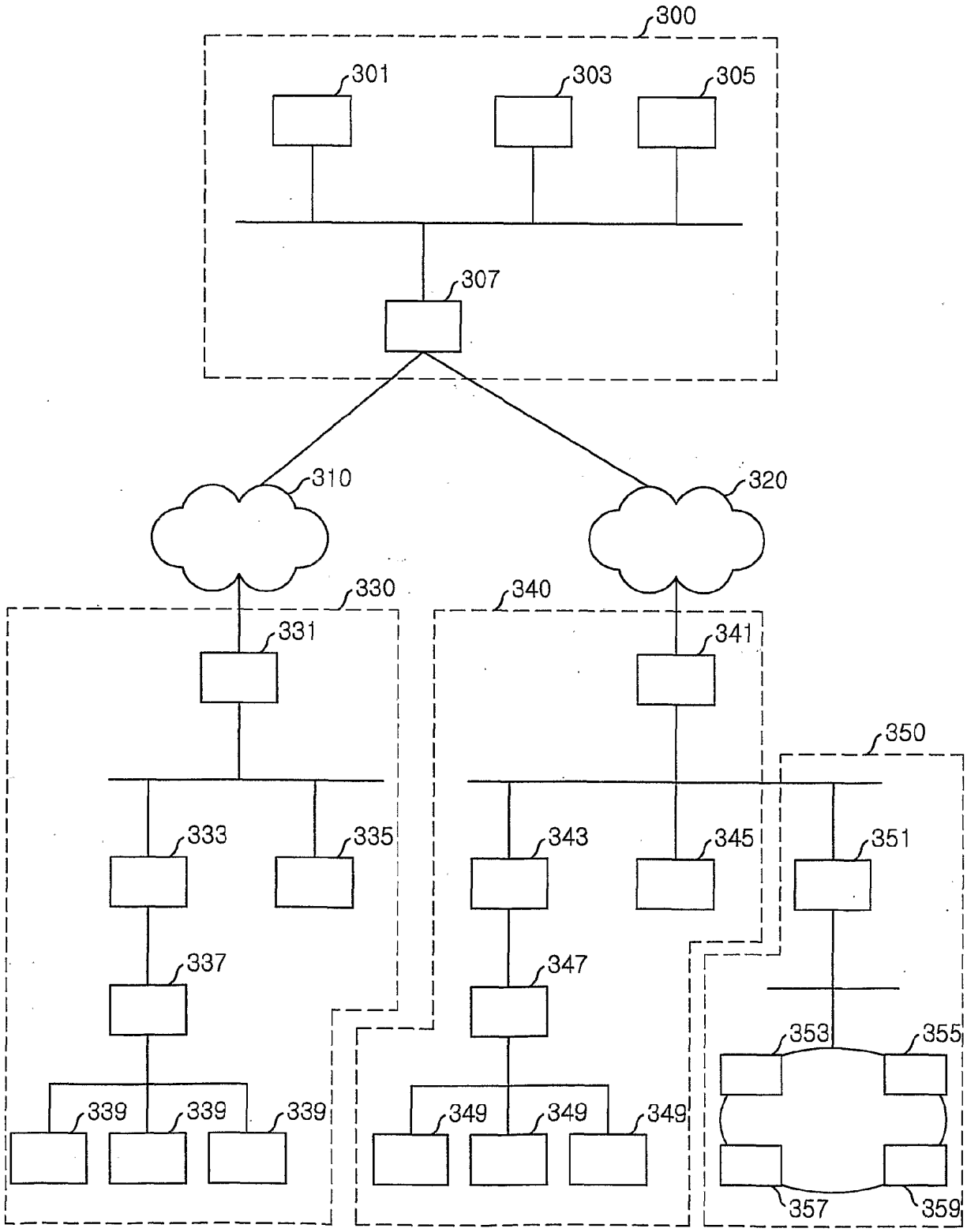


FIG. 3



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FIG. 4

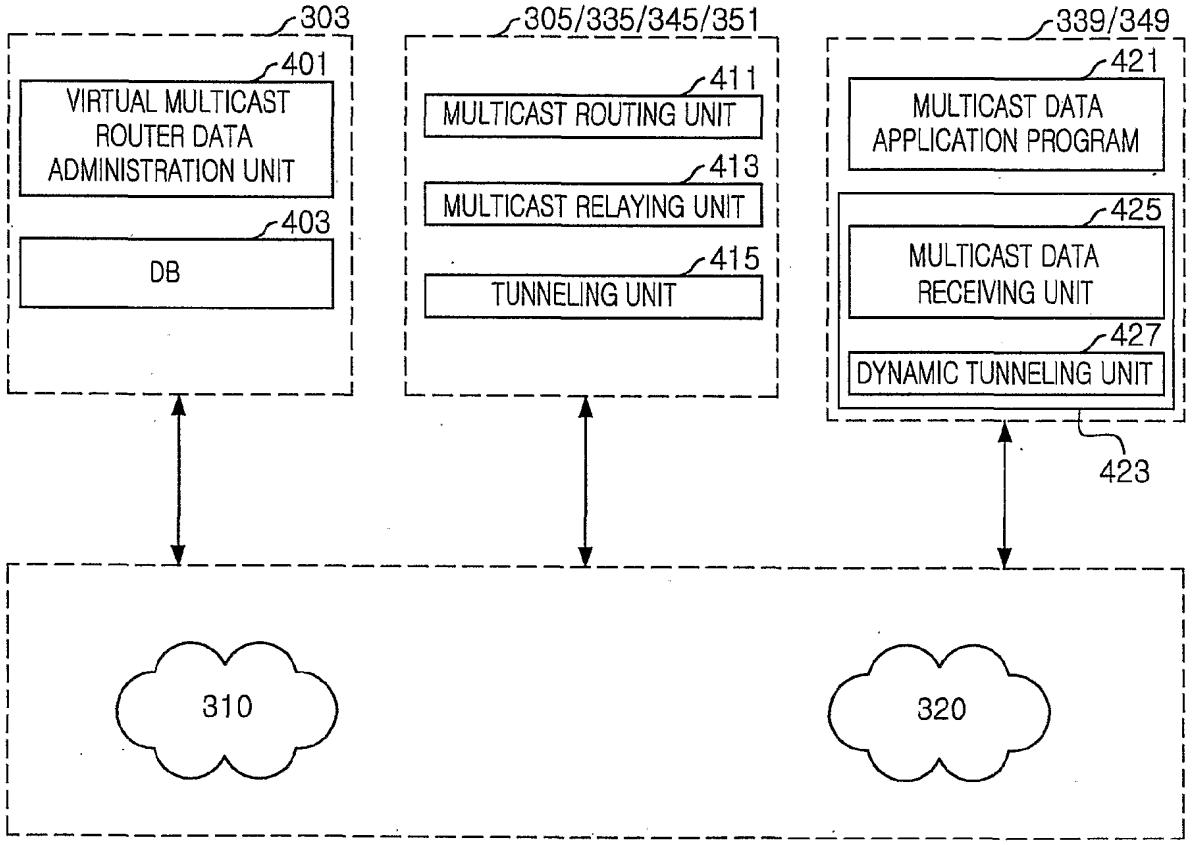
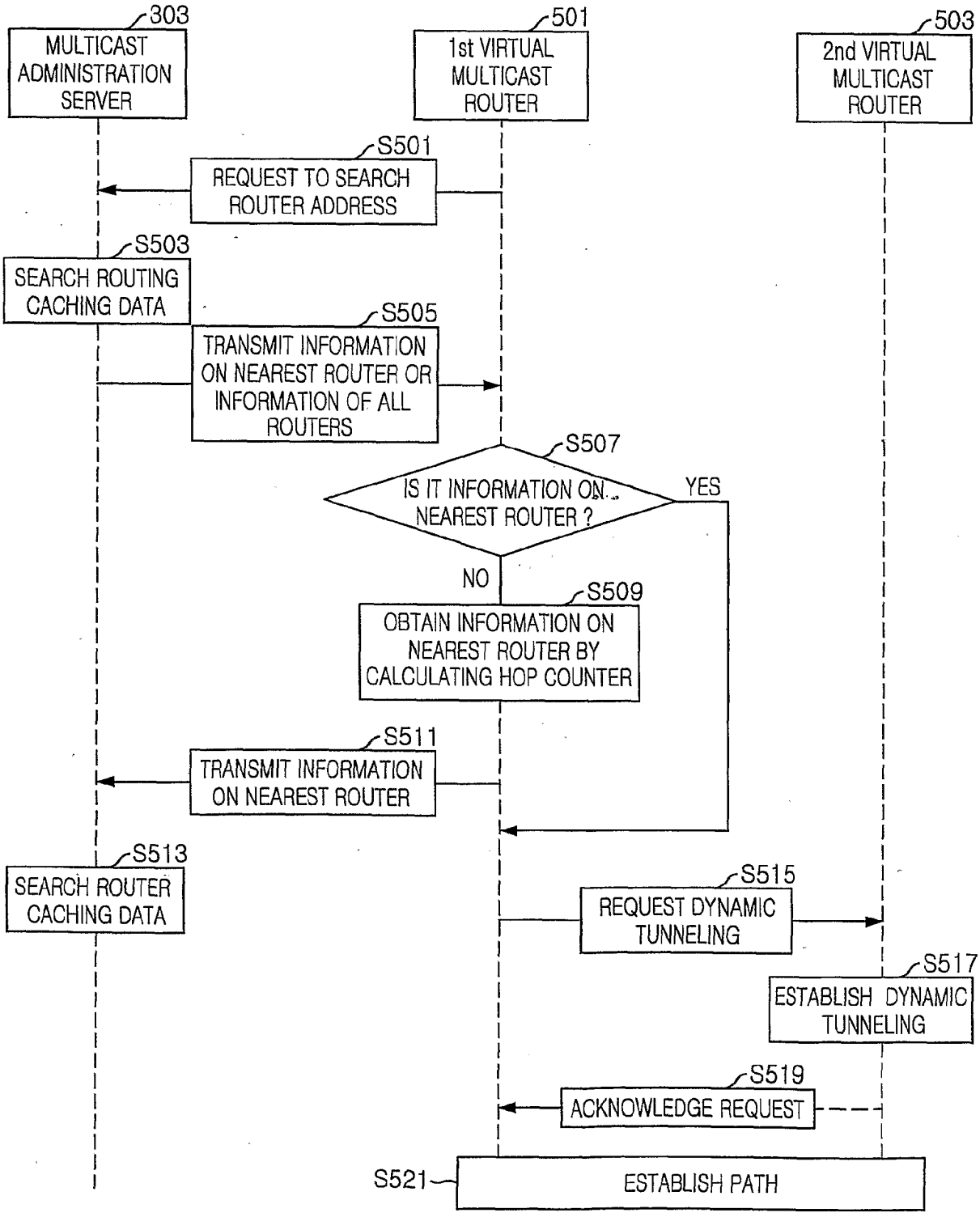
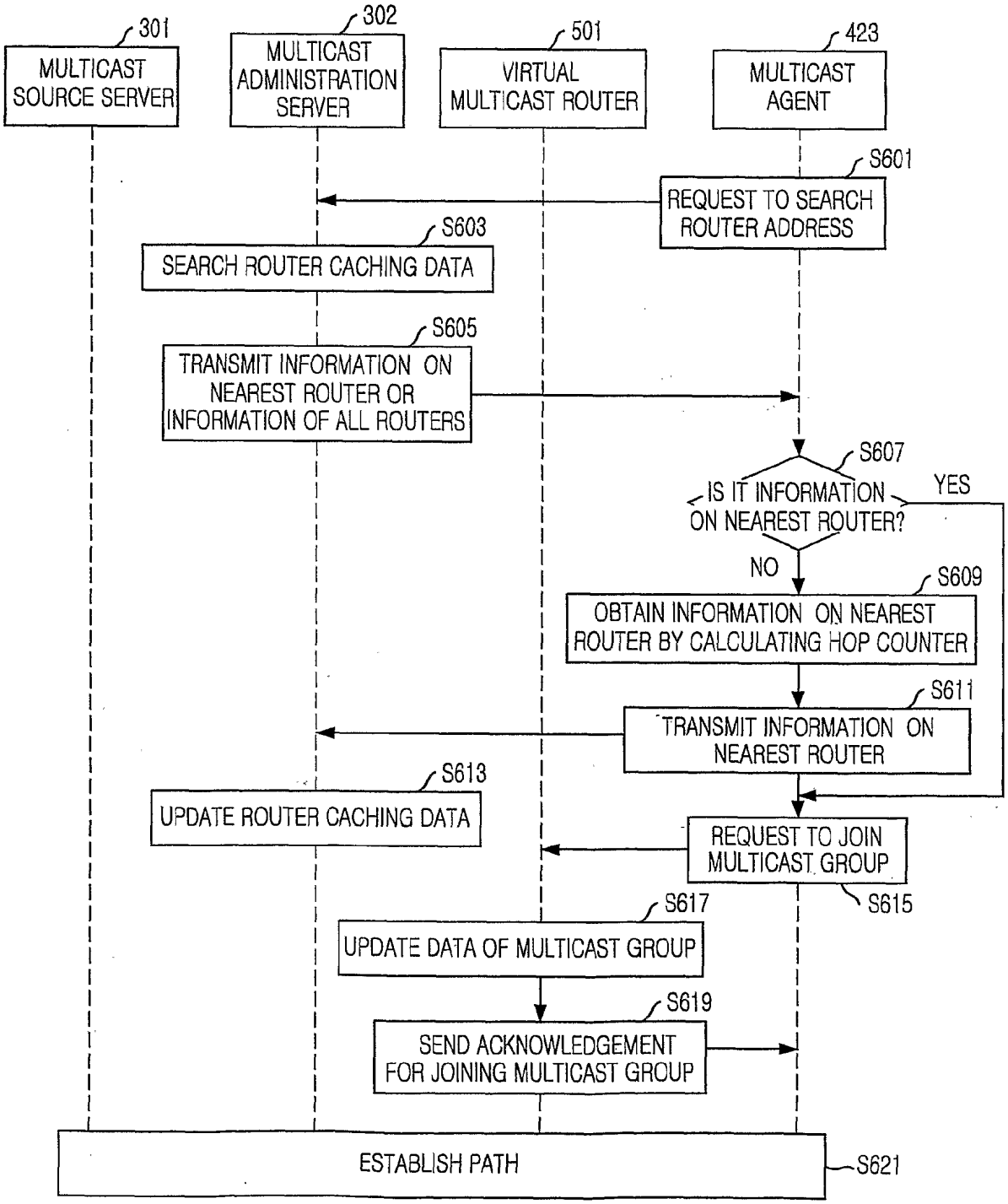

303
401
VIRTUAL MULTICAST ROUTER DATA ADMINISTRATION UNIT
403
DB
305/335/345/351
411
MULTICAST ROUTING UNIT
413
MULTICAST RELAYING UNIT
415
TUNNELING UNIT
339/349
421
MULTICAST DATA APPLICATION PROGRAM
425
MULTICAST DATA RECEIVING UNIT
427
DYNAMIC TUNNELING UNIT
423
310
320

FIG. 5



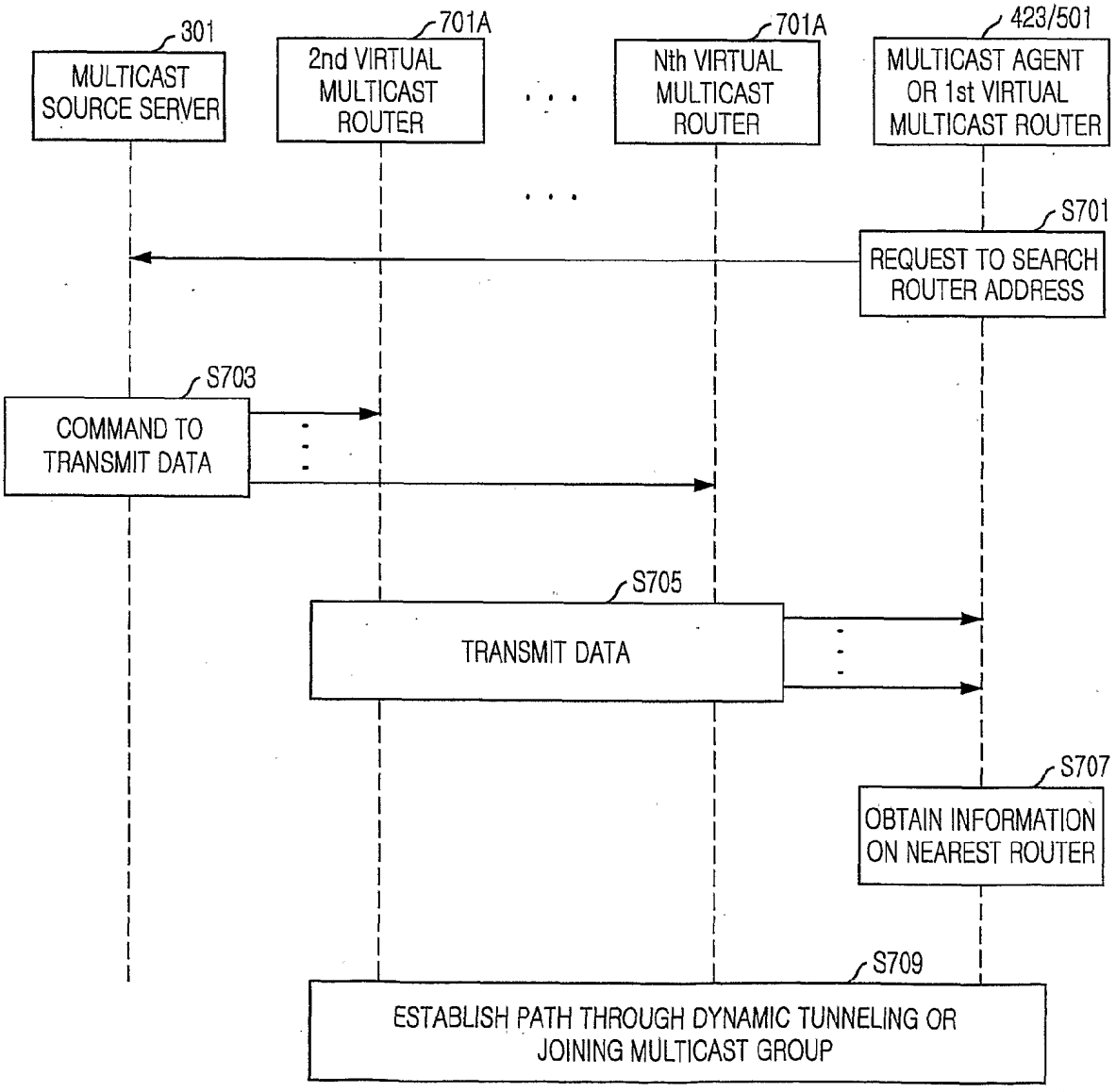
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FIG. 6



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FIG. 7



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INTERNATIONAL SEARCH REPORT

nternational application No.
PCT/KR02/01003

A. CLASSIFICATION OF SUBJECT MATTER

IPC7 H04L 12/28

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC7: H04L, H04M, G06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Korean Patents and Applications for Inventions since 1975
Korean Utility Models and Applications for Utility Models since 1975

Electronic data base consulted during the intertnational search (name of data base and, where practicable, search terms used)
IEL(IEEE/IEE Electronic Library)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 6,047,330 (Netscape Communication Corp.) 4. April 2000: abstract, column 1-2(summary of the invention) claim	1-32
A	JP2000-83030 (Nippon Electric Corp. Ltd.) 21. March 2000: abstract, claims, figures	1-14
A	WO 97/18657 (Cabletron Systems Inc.) 22. May 1997: abstract, summary of the invention	1-33
A	US 5,305,311(Xerox Corp..) 19. April 1994 : abstract detail description	1-33

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevence
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevence; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevence; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents,such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
24 SEPTEMBER 2002 (24.09.2002)	25 SEPTEMBER 2002 (25.09.2002)

Name and mailing address of the ISA/KR	Authorized officer
Korean Intellectual Property Office 920 Dunsan-dong, Seo-gu, Daejeon 302-701, Republic of Korea Facsimile No. 82-42-472-7140	LEE, Saang Woong Telephone No. 82-42-481-5714

Form PCT/ISA/210 (second sheet) (July 1998)

Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1005 – 138

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/KR02/01003

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 6,047,330A	4. 4. 2000	None	
JP2000-83030A	21. 3. 2000	None	
WO 97/18657	22. 5. 1997	None	
US 5,305,311A	19. 4. 1994	None	

Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1005 – 139

Electronic Patent Application Fee Transmittal

Application Number:	13674233
Filing Date:	12-Nov-2012
Title of Invention:	AUDIO-VIDEO MULTI-PARTICIPANT CONFERENCE SYSTEMS USING PSTN AND INTERNET NETWORKS
First Named Inventor/Applicant Name:	Thomas Dye
Filer:	Brent David Martin/Chloe Hong
Attorney Docket Number:	207.0002-03000

Filed as Small 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($)
Miscellaneous:				
Submission- Information Disclosure Stmt	2806	1	90	90
		Total in USD ($)		**90**

Electronic Acknowledgement Receipt

EFS ID:	22511168
Application Number:	13674233
International Application Number:	
Confirmation Number:	5197
Title of Invention:	AUDIO-VIDEO MULTI-PARTICIPANT CONFERENCE SYSTEMS USING PSTN AND INTERNET NETWORKS
First Named Inventor/Applicant Name:	Thomas Dye
Customer Number:	22882
Filer:	Brent David Martin/Chloe Hong
Filer Authorized By:	Brent David Martin
Attorney Docket Number:	207.0002-03000
Receipt Date:	02-JUN-2015
Filing Date:	12-NOV-2012
Time Stamp:	14:56:07
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$90
RAM confirmation Number	1253
Deposit Account	501068
Authorized User	FERRARO, AMADEO

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)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		Amendment.pdf	78815 f3983764800dcc616cae8958e285020cd627baad	yes	7

Multipart Description/PDF files in .zip description		
Document Description	**Start**	**End**
Amendment after Notice of Allowance (Rule 312)	1	1
Claims	2	6
Applicant Arguments/Remarks Made in an Amendment	7	7

Warnings:

Information:

2	Transmittal Letter	IDS.pdf	97957 ac9e8e8fb863a218788c5df8a71d22764a9d716c	no	3

Warnings:

Information:

3	Information Disclosure Statement (IDS) Form (SB08)	SB08.pdf	102108 3a0df881e418ed1463b90ad04d5da2a8d138dab1	no	2

Warnings:

Information:

This is not an USPTO supplied IDS fillable form

4	Foreign Reference	WO0191397A2.pdf	2175887 56c963859071b9effbacadfd9d5b92409261ac3e	no	48

Warnings:

Information:

5	Foreign Reference	WO02098063A1.pdf	2081209 52828b5f479e1aa6153ca9af6fd3cbcfd642d5da	no	48

Warnings:

Information:

6	Non Patent Literature	VPN_v_ATT_Plainttifs_Response_to_First_Set_214-cv-01013-01014_Apr_14_2015_28pgs.pdf	955983 4cfd253c44c10d1b404167691b4c28cf7b701d78	no	28
Warnings:					
Information:					
7	Non Patent Literature	ATT_Invalidity_Contentions_w_Claim_Charts_214-cv-1013-1014_Apr_16_2015_2274pgs.pdf	15130189 0917dad80a455187798ef07b1904b3d324a8de34	no	2274
Warnings:					
Information:					
8	Non Patent Literature	ATT_Objections_and_Responses_to_VPNs_First_Set_214-cv-1013-1014_Apr_23_2015_20pgs.pdf	149675 e5678af5f9aca0190a48e64ee6049c312f185be7	no	20
Warnings:					
Information:					
9	Non Patent Literature	Alchaal_Offering_a_Multicast_Delivery_Service_in_a_Programmable_2002_6pgs.PDF	433017 c88739523d4b6e1848b63da997ae62962b6bedd4	no	6
Warnings:					
Information:					
10	Non Patent Literature	Bokun_The_MECCANO_Internet_Multimedia_Conferencing_Architecture_Dec_1999_67pgs.PDF	7860161 d26009fbc1e751cd5a9cb02a4034931cca801922	no	67
Warnings:					
Information:					
11	Non Patent Literature	Cisco_Systems_Inc_Multicast_VPN_Design_Guide_Aug_2003_25pgs.PDF	3484072 da8f026d0329b72956ebae26d963e13ac6310cf0	no	25
Warnings:					
Information:					
12	Non Patent Literature	Cisco_Systems_Inc_Multicast_VPN_IP_Multicast_Support_for_MPLS_VPNs_2002_86pgs.PDF	4770178 d2c79bc1fd9e7de40de35779ca1ad13a21766066	no	86
Warnings:					
Information:					
13	Non Patent Literature	Cisco_Systems_Inc_Networkers_Multicast_for_MPLS-BGP_VPNs_2001_89pgs.pdf	4428809 9174256d92ce995db2f2e79f77bd1f32b4d3729e	no	89
Warnings:					
Information:					
14	Non Patent Literature	Comer_Internetworking_with_TCP-IP_Vol_I_3ed_Mar_1995_628pgs.pdf	22720707 a22d80643b9ed9bdab1d50eeebd2c6b35e390341	no	628
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Information:					

15	Non Patent Literature	Costa_An_Introduction_to_Virtual_Private_Networks_June_2000_20pgs.PDF	1362069 18f1ca99d3057b3012aadb8edf4e76377811a7c2	no	20
Warnings:					
Information:					
16	Non Patent Literature	Eriksson_MBONE_The_Multicast_Backbone_Aug_1994_11pgs.PDF	2135102 bd5a87be2e6ddb59eb3faf69956bec95329751a6	no	11
Warnings:					
Information:					
17	Non Patent Literature	Finlayson_The_UDP_Multicast_Tunneling_Protocol_Nov_19_6pgs.PDF	245592 8cb9e9f154105a75346b09d81bdfaa6f2f0e8143	no	6
Warnings:					
Information:					
18	Non Patent Literature	Kent_Security_Architecture_for_the_Internet_Protocol_Nov_1998_61pgs.PDF	2595543 aca16f555c24c9dcc647267d2e9f512559e4121e	no	61
Warnings:					
Information:					
19	Non Patent Literature	Kirstein_The_RadioActive_Networking_Architecture_May_2000_16pgs.PDF	2267333 a2bd2c50d0083f8f571a7342cf0f33d4befd3627	no	16
Warnings:					
Information:					
20	Non Patent Literature	Kumar_Mbone_Interactive_Multimedia_on_the_Internet_1996_242pgs.pdf	8509280 bef19882afee5313f948b4af98f55cc94d173a9a	no	242
Warnings:					
Information:					
21	Non Patent Literature	Labonte_Group_Management_Strategies_for_Secure_Multicasting_IEEE_Nov_2000_10pgs.PDF	1469141 435e32417475b5686fca848ef50b723001a47aee	no	10
Warnings:					
Information:					
22	Non Patent Literature	Lamaster_Internet_technologies_and_requirements_for_telemedicine_1997_8pgs.PDF	756846 2a1ab4da56077cb9af6684b96696337b25d19712	no	8
Warnings:					
Information:					
23	Non Patent Literature	Macedonia_Mbone_Provides_Audio_and_Video_Across_the_Internet_Apr_1994_8pgs.PDF	2799146 1989dbfc2c952f76ba256fe63452033646 4b0a1a	no	8
Warnings:					
Information:					

24	Non Patent Literature	Rosen_Multicast_in_MPLS-BGP_VPNs_Nov_2000_17pgs.PDF	713232 38dd021dc665c6d5ffd2611f9f6440f68efe8a2e	no	17
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Information:					
25	Non Patent Literature	Savetz_MBONE_Multicasting_Tomorrows_Internet_1996_259pgs.pdf	12177654 b1def7860e099d698af494b574fa7174898899b9	no	259
Warnings:					
Information:					
26	Non Patent Literature	Waitzman_Distance_Vector_Multicast_Routing_Protocol_RFC_1075_Nov_1988_24pgs.PDF	905863 8f958b20a71b0351de9885e0591536ddfa8761f5	no	24
Warnings:					
Information:					
27	Non Patent Literature	Wittmann_Multicast_Communication_Protocols_and_Applications.pdf	13065214 0056822ae7ba1b1c7ebd3aa5f6d29c93cb59dafd	no	362
Warnings:					
Information:					
28	Fee Worksheet (SB06)	fee-info.pdf	30890 6d943fd4e972fa14b63971140cf024f6b34fad0b	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	113501672		

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.

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)

22882 7590 03/02/2015
MARTIN & FERRARO, LLP
1557 LAKE O'PINES STREET, NE
HARTVILLE, OH 44632

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.
13/674,233	11/12/2012	Thomas Dye	207.0002-03000	5197

TITLE OF INVENTION: AUDIO-VIDEO MULTI-PARTICIPANT CONFERENCE SYSTEMS USING PSTN AND INTERNET NETWORKS

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	$480	$0	$480	$480	06/02/2015

EXAMINER	ART UNIT	CLASS-SUBCLASS
NI, SUHAN	2656	370-260000

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 Martin & Ferraro, LLP
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: VPN Multicast Technologies LLC

(B) RESIDENCE: (CITY and STATE OR COUNTRY): Plano, TX

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 50-1068 (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 /Brent D. Martin/ Date June 2, 2015

Typed or printed name Brent D. Martin Registration No. 62,717

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Exhibit 1005 - 147

Electronic Patent Application Fee Transmittal

Application Number:	13674233
Filing Date:	12-Nov-2012
Title of Invention:	AUDIO-VIDEO MULTI-PARTICIPANT CONFERENCE SYSTEMS USING PSTN AND INTERNET NETWORKS
First Named Inventor/Applicant Name:	Thomas Dye
Filer:	Brent David Martin/Chloe Hong
Attorney Docket Number:	207.0002-03000

Filed as Small 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	2501	1	480	480

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
			Total in USD ($)	**480**

Electronic Acknowledgement Receipt

EFS ID:	22515470
Application Number:	13674233
International Application Number:	
Confirmation Number:	5197
Title of Invention:	AUDIO-VIDEO MULTI-PARTICIPANT CONFERENCE SYSTEMS USING PSTN AND INTERNET NETWORKS
First Named Inventor/Applicant Name:	Thomas Dye
Customer Number:	22882
Filer:	Brent David Martin/Chloe Hong
Filer Authorized By:	Brent David Martin
Attorney Docket Number:	207.0002-03000
Receipt Date:	02-JUN-2015
Filing Date:	12-NOV-2012
Time Stamp:	17:29:36
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$480
RAM confirmation Number	4669
Deposit Account	501068
Authorized User	FERRARO, AMADEO

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)

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)	Issue_Fee.pdf	163210 ff913824c4945b618797464f202726c64c8204a	no	1
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	30796 320c193dda49f063650104c151ac9c4f3f151ab1	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	194006		

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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

In re Application of:	)	Confirmation No.: 5197
Thomas Dye et al.	)	
Serial No.: 13/674,233	)	Group Art Unit: 2656
Filed: February 12, 2012	)	Examiner: Suhan Ni
For: AUDIO-VIDEO MULTI-PARTICIPANT CONFERENCE SYSTEMS USING PSTN AND INTERNET NETWORKS	)	

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

Sir:

AMENDMENT AFTER ALLOWANCE

Pursuant to 37 C.F.R. § 1.312 and subject to the recommendation of the Examiner and the approval of the Commissioner, and without withdrawing the case from issue, kindly amend the subject application as follows:

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

Remarks begin on page 7 of this paper.

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Exhibit 1005 – 152

Amendments to the Claims:

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

Listing of Claims:

Claims 1-19. (Cancelled)

20. (Previously Presented) A system for supporting a multi-participant conference call comprising:

a first mixer that mixes a Public Switched Telephone Network (PSTN) client audio data stream with a moderator audio-video data stream into a first mixed data stream;

a first transport output that transmits the first mixed data stream to at least one remote client that receives the first mixed data stream, the at least one remote client communicatively coupled to the Internet, which generates a remote client audio-video data stream;

a second mixer that mixes the moderator audio-video data stream with the remote client audio-video data stream into a second mixed data stream; and

a second transport output that transmits a mixed audio data stream, corresponding to the second mixed data stream, to the PSTN client.

21. (Previously Presented) The system of claim 20 further comprising a third mixer that mixes the audio data from the PSTN client with the audio-video data stream from the remote client into a third mixed data stream and communicates the third mixed data stream to the moderator.

22. (Presently Amended) The system of claim 20 further comprising a VoIP decoder that receives IP packets including the audio data stream generated by the PSTN client, the VoIP ~~decodes~~ decoder decodes the IP packets including the audio

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data from the PSTN client.

23. (Previously Presented) The system of claim 20 further comprising at least one audio decompressor that decodes IP packets including the audio-video data stream generated by the remote client.

24. (Previously Presented) The system of claim 20 wherein the PSTN client audio data stream and the moderator audio-video data stream are transported across a virtual private network tunnel.

25. (Previously Presented) The system of claim 20 wherein the moderator audio-video data stream and the remote client audio-video data stream are transported across a virtual private network tunnel.

26. (Previously Presented) The system of claim 25 further comprising an encoder that receives the first mixed data stream and encodes the first mixed voice data before transmitting the first mixed data stream to the remote client.

27. (Presently Amended) The system of claim 24 further comprising a VoIP encoder that encodes the second mixed data stream and ~~encode~~ encodes the second mixed voice data before transmitting the second mixed data stream to the PSTN client.

Claims 28-35 (Cancelled).

36. (Previously Presented) A non-transitory computer-readable medium including instructions for a multi-participant conference process to be executed by a local moderator computer, the process comprising:

receiving audio data from a telephone through a public switched telephone network (PTSN);

receiving audio data and video data from a first remote computer through an Internet;

receiving audio data and video data from a second remote computer through the Internet;

receiving audio data from a local audio input device communicatively connected to the local moderator computer;

receiving video data from a local video input device communicatively connected to the local moderator computer;

mixing the audio data received from the telephone with the audio data received from the local audio input device and the video data received from the local video input device into mixed audio-video data;

transmitting the mixed audio-video data to the first remote computer and the second remote computer;

mixing the audio data received from the first remote computer and the audio data received from the second remote computer with the audio data received from the local audio input device into mixed audio data;

compressing the mixed audio data;

transmitting the compressed mixed audio data to the telephone; and

transmitting collaboration data to the first remote computer and the second remote computer.

37. (Previously Presented) The process of claim 36, further comprising mixing the audio data received from the telephone with the audio data received from the first and second remote computers into a second mixed audio data.

38. (Previously Presented) The process of claim 36, wherein the receiving audio data from the telephone includes receiving internet protocol (IP) packets, the process further comprising decoding the IP packets.

39. (Previously Presented) The process of claim 36, wherein the receiving audio data and video data from the first remote computer includes receiving internet protocol (IP) packets, the process further including decoding the IP packets.

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40. (Previously Presented) The process of claim 36, wherein the transmitting the mixed audio-video data includes transmitting the mixed audio-video data through a Virtual Private Network (VPN).

41. (Previously Presented) The process of claim 36, wherein the transmitting the mixed audio data includes transmitting the mixed audio data through a Virtual Private Network (VPN).

42. (Previously Presented) The process of claim 36, further comprising encoding the mixed audio-video data before the transmitting of the mixed audio-video data to the first and second remote computers.

43. (Previously Presented) The process of claim 36, further comprising encoding the compressed mixed audio data before the transmitting of the mixed audio data to the telephone.

44. (Presently Amended) A computer-implemented multi-participant conference system utilizing a local moderator computer, the system comprising:

a voice over IP decoder configured to decode audio data received by the local moderator computer from a telephone through a public switched telephone network (PSTN);

a voice over IP encoder configured to compress audio data transported from the local moderator computer to the telephone through the ~~PTSN~~PSTN;

a first mixer configured to mix decoded audio data received by the local moderator computer from the telephone through the ~~PTSN~~ PSTN with audio data received by the local moderator computer from a local audio input device and video data received by the local moderator computer from a local video input device into an audio-video stream for transmission through an Internet to a first remote computer and a second remote computer;

a second mixer configured to mix audio data received by the local moderator computer from the first remote computer and the second remote

computer through the Internet with audio data received by the local moderator computer from the local audio input device into an audio stream for transmission to the telephone through the PSTN; and

a data collaboration unit configured to transmit collaboration data from the local moderator through the internet to the first remote computer and the second remote computer.

45. (Previously Presented) The system of claim 44, further comprising a third mixer configured to mix the decoded audio data received from the telephone with the audio data received from the first and second remote computers.

46. (Presently Amended) The system of claim 44, wherein the audio data received by the local moderator computer from the telephone through the ~~PTSN~~ PSTN is transported through a virtual private network (VPN) tunnel.

47. (Previously Presented) The system of claim 44, wherein audio data transported from the local moderator computer to the telephone is transported through a virtual private network (VPN) tunnel.

REMARKS

The above-identified application was allowed in the Notice of Allowance mailed March 2, 2015. The issue fee has not been paid.

Subsequent to the receipt of the Notice of Allowance, applicant noted five unintentional typographical errors in the claims. The requested amendment is submitted to correct the noted typographical errors.

Each of the requested amendments is fully supported by the specification and drawings, will not require an additional search, and does not raise new issues. Therefore, applicant respectfully requests that this Amendment be entered and the requested changes made.

To the extent any extension of time under 37 C.F.R. § 1.136 is required to obtain entry of this reply, such extension is hereby respectfully requested. If there are any fees due under 37 C.F.R. §§ 1.16 or 1.17 which are not enclosed herewith, including any fees required for an extension of time under 37 C.F.R. § 1.136, please charge such fees to our Deposit Account No. 50-1068.

Respectfully submitted,

MARTIN & FERRARO, LLP

Dated: June 2, 2015

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	)	Confirmation No.: 5197
Thomas Dye et al.	)	
Serial No.: 13/674,233	)	Group Art Unit: 2656
Filed: November 12, 2012	)	Examiner: Suhan Ni
For: AUDIO-VIDEO MULTI-PARTICIPANT CONFERENCE SYSTEMS USING PSTN AND INTERNET NETWORKS	)	

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

Sir:

INFORMATION DISCLOSURE STATEMENT UNDER 37 C.F.R. § 1.97(d)

Pursuant to 37 C.F.R. §§ 1.56 and 1.97(d), Applicant brings to the attention of the Examiner the documents listed on the attached Form PTO/SB/08. This Information Disclosure Statement is being filed after a Notice of Allowance but before payment of the issue fee and is accompanied by the required fee of $180.00 (to be charged to Deposit Account No. 50-1068 and a certification as specified under 37 C.F.R. § 1.97(e).

The present Application is a continuation of Application No. 12/646,892, filed December 23, 2009, now U.S. Patent No. 8,339,997; which is a continuation of Application No. 10/796,560, filed March 9, 2004, now U.S. Patent No. 7,664,056.

Applicant brings to the Examiner's attention Application Nos. 10/772,012, filed February 4, 2004, now U.S. Patent No. 7,444,425; 12/237,286, filed September 24, 2008, now U.S. Patent No. 8,477,778 ("'778 patent"); 13/674,227, filed November 12, 2012 (Publication No. 2013/0163480), which is pending; and 14/590,791, filed January 6, 2015, which is pending.

Applicant also brings to the attention of the Examiner the file history (the Office Actions and responses) of each of the above-referenced patents and applications. While the individual Office Actions and responses are not attached hereto, they are

available in each of the file wrappers in the Patent Office, through PAIR, or will be provided by the Applicant at the Examiner's request.

No item of information contained in this Information Disclosure Statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the undersigned after making reasonable inquiry, no item of information contained in this Information Disclosure Statement was known to any individual designated in 37 C.F.R. § 1.56(c) more than three months prior to the filing date of this Information Disclosure Statement.

Copies of the listed non-U.S. patent documents are attached. Applicant respectfully requests that the Examiner consider the listed documents and indicate that they were considered by making appropriate notations on the attached form.

Applicant brings to the Examiner's attention that the '778 patent is the subject of litigation in the United States District Court for the Eastern District of Texas, Marshall Division, Civil Action No. 2:14-cv-1013 hereinafter referred to as Litigation 1. The documents associated with Litigation 1 are identified by the designation "Lit. 1" in the Examiner Initial column of the attached Form PTO/SB/08.

The '778 patent is also the subject of litigation in the United States District Court for the Eastern District of Texas, Marshall Division, Civil Action No. 2:14-cv-1014 hereinafter referred to as Litigation 2. The documents associated with Litigation 2 are identified by the designation "Lit. 2" in the Examiner Initial column of the attached Form PTO/SB/08.

Applicant hereby respectfully requests the Examiner to advise Applicant of any additional types of litigation documents beyond those already provided that the Examiner may desire in association with the present application.

This submission does not represent that a search has been made or that no better art exists and does not constitute an admission that each or all of the listed documents are material or constitute "prior art." If the Examiner applies any of the documents as prior art against any claims in the application and Applicant determines that the cited documents do not constitute "prior art" under United States law, Applicant reserves the right to present to the office the relevant facts and law regarding the appropriate status of such documents.

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Applicant further reserves the right to take appropriate action to establish the patentability of the disclosed invention over the listed documents, should one or more of the documents be applied against the claims of the present application.

If there is any fee due in connection with the filing of this Statement, please charge the fee to our Deposit Account No. 50-1068.

Respectfully submitted,

MARTIN & FERRARO, LLP

Dated: June 2, 2015

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OMB 0651-0031

Substitute for FORM PTO-1449	Attorney Docket Number 207.0002-03000	Customer No. 22882	
INFORMATION DISCLOSURE STATEMENT IN AN APPLICATION	Applicant Thomas Dye et al.	Application Number 13/674,233	
(Use several sheets if necessary) Sheet 1 of 2	Filing Date November 12, 2012	Group Art Unit 2656	Examiner Suhan Ni

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
Lit. 1; Lit. 2	6,526,056	2/2003	Rekhter et al.			
Lit. 1; Lit. 2	6,778,531	8/2004	Kodialam et al.			
Lit. 1; Lit. 2	7,203,957	4/2007	Balissat et al.			
Lit. 1; Lit. 2	7,281,058	10/2007	Shepherd et al.			
Lit. 1; Lit. 2	7,330,468	2/2008	Tse-Au			
Lit. 1; Lit. 2	7,366,894	4/2008	Kalimuthu et al.			
Lit. 1; Lit. 2	7,447,203	11/2008	Chen et al.			
Lit. 1; Lit. 2	7,447,901	11/2008	Sullenberger et al.			
Lit. 1; Lit. 2	7,562,386	7/2009	Balissat et al.			
Lit. 1; Lit. 2	7,570,648	8/2009	Hu et al.			
Lit. 1; Lit. 2	7,830,787	11/2010	Wijnands et al.			

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION (YES/NO)
Lit. 1; Lit. 2	WO 01/91397 A2	11/2001	WIPO			N/A
Lit. 1; Lit. 2	WO 02/098063 A1	12/2002	WIPO			N/A

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

Lit. 1; Lit. 2	VPN Multicast Technologies LLC v. AT&T Corp.; VPN Multicast Technologies LLC v. Dimension Data North America, Inc., et al., Plaintiff's Responses to Defendants' First Set of Common Interrogatories to VPN Multicast Technologies LLC, Case Nos. 2:14-cv-1013 and 2:14-cv-1014, April 14, 2015, 28 pgs.
Lit. 1; Lit. 2	VPN Multicast Technologies LLC v. AT&T Corp.; VPN Multicast Technologies LLC v. Dimension Data North America, Inc., et al.; Defendants' Invalidity Contentions including Appendix A and Claim Charts; Case Nos. 2:14-cv-1013 and 2:14-cv-1014; April 16, 2015; 2,274 pages.
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Lit. 1; Lit. 2	Alchaal et al., "Offering a Multicast Delivery Service in a Programmable Secure IP VPN Environment," Fourth International Workshop on Networked Group Communication (NGC '02), 2002, 6 pgs.
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Lit. 1; Lit. 2	Eriksson, "MBONE: The Multicast Backbone," ACM Communications of the ACM 37, 8, August 1994, Pages 54-60, 11 pgs.
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Lit. 1; Lit. 2	Labonte et al., "Group Management Strategies for Secure Multicasting on Active Virtual Private Networks," IEEE, 25th annual IEEE Conference on Local Computer Networks, Pages 213-222, November 2000, 10 pgs.
Lit. 1; Lit. 2	Lamaster et al., "Internet technologies and requirements for telemedicine," Minimally Invasive Therapy and Allied Technologies 1997, Vol. 6, No. 5-6, Pages 436-443, 1997, 8 pgs.
Lit. 1; Lit. 2	Macedonia et al., "MBone Provides Audio and Video Across the Internet," U.S. Naval Post Graduate School Website, available at http://www.nps.edu/library, April 1994, 8 pgs.
Lit. 1; Lit. 2	Rosen et al., "Multicast in MPLS/BGP VPNs," Network Working Group, Internet Draft, November 2000, 17 pgs.
Lit. 1; Lit. 2	Savetz et al., "MBONE: Multicasting Tomorrow's Internet," IDG Books Worldwide, Inc., 1996, 259 pgs.
Lit. 1; Lit. 2	Waitzman et al., "Distance Vector Multicast Routing Protocol," Networks Working Group, Request For Comments: 1075, November 1988, 24 pgs.
Lit. 1; Lit. 2	Wittmann et al., "Multicast Communication: Protocols and Applications," Morgan Kaufmann Publishers, 1999, 362 pgs.

EXAMINER	**DATE CONSIDERED**

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

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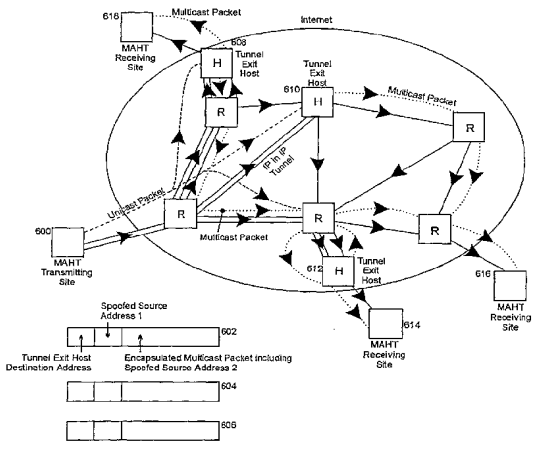
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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: METHOD AND SYSTEM FOR ANTI DENIAL OF SERVICE AND ANTI TRAFFIC ANALYSIS CAPABILITIES FOR IP BASED VIRTUAL PRIVATE NETWORKS AND DATA DISTRIBUTION THROUGH USE OF AN IP MULTICAST ADDRESS HOPPING TECHNIQUE



(57) Abstract: A method and system for Internet Protocol network communications and uses thereof for protecting Internet sites against denial of service and traffic analysis attacks on insecure public networks such as the Internet are provided. The method provides for communicating multicast packets between end stations, in a multicast IP network, on a chosen multicast IP address from a plurality of multicast IP addresses for multicast communication using a multicast address hopping technique. The technique selectively varies the chosen multicast IP address from the plurality of multicast IP addresses according to a predetermined scheme known to the end stations but not to unauthorized endstations. The packets are then communicated on the chosen multicast IP address. Indicia normally capable of identifying the source of the packets may be selectively varied to conceal the source of the packets. Further, the packets may be communicated to an end station having subscribed to a set of multicast IP addresses comprising at least one multicast IP address from the plurality of multicast IP addresses for multicast communication and including the chosen multicast IP address for transmitting the packets. The set of multicast IP addresses may also be selectively varied according to a secret predetermined scheme known to the end stations, particularly by randomly adding to and dropping from the set of multicast IP addresses. Multiple sets of communicating groups all utilizing the same address space can coexist such that their respective traffic is intermingled on the various addresses, making traffic analysis very difficult. In another embodiment, a data coding scheme such as code division multiplexing may be employed on the individual multicast packets data fields to allow data for individual destinations to be mixed together in one packet that is multicast to a plurality of receivers. Each receiver then decodes its applicable data by passing the received multicast data field through the appropriate decoding scheme such as a code division de-multiplexing process. In further aspects of the invention, various uses of the invention for Virtual Private Networks and other secure communication systems are also provided.

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TITLE OF THE INVENTION

METHOD AND SYSTEM FOR ANTI DENIAL OF SERVICE AND ANTI TRAFFIC ANALYSIS CAPABILITIES FOR IP BASED VIRTUAL PRIVATE NETWORKS AND DATA DISTRIBUTION THROUGH USE OF AN IP MULTICAST ADDRESS HOPPING TECHNIQUE

FIELD OF THE INVENTION

The present invention generally relates to a method and system for Internet Protocol network communications and uses thereof for providing enhanced virtual private network capabilities on insecure public networks such as the Internet.

BACKGROUND OF THE INVENTION

An ever-increasing trend is the use of the Internet Protocol (IP) based Internet as a communications network for business to consumer (B2C), business to business (B2B), and consumer to consumer (C2C) interaction and transactions. There is a constantly evolving gamut of threats encountered with respect to IP networks, particularly the Internet. Although a network is just the communication channel through which information is accessed or flows, the interconnection of systems worldwide through networks, especially the Internet, has become so widespread that it has become a key component of modern military, industrial, government, and private systems. The growing dependence of the various systems on a properly functioning network increases their operational vulnerability through disruption of the network. The gamut of threats to IP network based systems includes techniques to steal information, corrupt or alter information, destroy information, deny use of services or information, gather indicators of future action, and affect the public's view of various issues, including social, political, and even confidence in a country's government. The Internet, in particular, is an insecure public network and presents various weaknesses that can

be exploited by criminals or other elements to disrupt or monitor the normal communications between parties on the Internet. Some of these weaknesses include vulnerabilities to various types of Denial of Service (DoS) attacks. Recently, such attacks have successfully disrupted commercial services offered by prominent vendors.

Other vulnerabilities in using a public network for private communications include traffic analysis. Traffic analysis can be defined as the analysis of messages, typically encrypted messages, to determine: where they come from, where they go to, how long they are, when they are sent, how frequent or infrequent they are, whether they coincide with outside events like meetings, and more. There is increasing pressure for industries to gain competitive intelligence (CI) about competitors. This could involve traffic analysis of communications between their competitor various sites or to suppliers or customers. As well, national, military, or criminal entities may use traffic analysis to gain insight into intentions or actual operations of potential or real opponents. Encryption technology is well known and available to provide confidentiality, authentication, and integrity of data transmitted over the Internet. Confidentiality is defined as ensuring only the authorized parties can read the communications. Authentication is defined as ensuring that the communication was actually originated by the party it was purportedly sent by. Integrity is defined as ensuring that the data has not been changed by anyone during the communication process.

Encryption technology forms the basis for Virtual Private Technology (VPN) currently in use on the Internet. A Virtual Private Network is defined as a secure, private network running over a public network such as the Internet. It is created by using software, hardware, or a combination of the two to create a secure link between computers over a public insecure network. This is done through encryption, packet tunneling, and firewalls. Since users can eliminate leased line costs by using the Internet as a Wide Area Network (WAN), a VPN is a cost-effective solution to secure wide area network connectivity. A major disadvantage of such a system under Internet Protocol (IP) is that the packets travel between the two or more sites with identifiable source and destination

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addresses. Knowledge of the source and destination addresses allows an attacker to perform certain types of Denial of Service attacks against these sites. Note also that an eavesdropper can observe the volume and timing of the packets. This allows an attacker to perform traffic analysis on this information flow. Thus users of VPN technology are desirous of having a method to prevent traffic analysis against their communications and also to prevent or alleviate the effects of a denial of service attack against their communications.

Denial of Service (DoS) can be defined as action(s) which prevent any part of an automated information system (AIS) from functioning in accordance with its intended purpose or intentional degradation or blocking of computer or network resources. The Computer Emergency Response Team (CERT) at Carnegie Mellon University divides Denial of Service into three modes of attack with sub categories. CERT notes that a Denial of Service may only be a component of a larger attack. The three modes are classified under consumption of scarce resources, destruction or alteration of configuration information, and consumption of other resources. This invention particularly relates to the category of Consumption of Scarce Resources, specifically the sub categories of Bandwidth Consumption, Network Connectivity, and Consumption of Other Resources.

Denial of Service (DoS) attacks are often done through the use of scripts also called tools. A few examples of such tools are Capi, Back Orifice 2000 (BO2K), Domain Name System Attack, and Internet Control Message Protocol (ICMP) ECHO which is based on the ping-flooding concept. These tools are freely available for download from the Internet.

Distributed Denial of Service (DDoS) is an enhanced version of a Denial of Service attack where the DoS tools are distributed to multiple hosts, which can then be coordinated to anonymously perform an attack on the target host simultaneously, typically after some time delay. Some of the currently known Distributed Denial of Service Tools are: Trinoo, Tribe Flood Network (TFN) and Tribe Flood Net 2K, and Stacheldraht (meaning "barbed wire" in German).

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Users of the Internet as a communications medium wish to have immunity from Denial of Service attacks that prevent them from using the Internet as they desire. Disruption of this service can be very costly as certain attacks in early February 2000 against major commercial Internet sites demonstrated. Some estimates range as high as $1.2 Billion loss for the several days of attacks.

Users of VPN technology on the Internet still must have identifiable IP addresses used to route the VPN encrypted packets through the network between the VPN nodes. However attackers can use these addresses to direct Denial of Service or traffic analysis attacks against these nodes.

UNICAST IP PACKET ROUTING AND DELIVERY

Traditional Internet protocol (IP) networks rely mostly on the use of unicast protocol (also known as point to point) packet routing and delivery for communications between end stations (for example, a user and a host site). For unicast, a packet is generated and passed into the network by a first end station having the destination address of the second end station as a parameter. This packet is then routed through the network until it is delivered to the end station computer (or is discarded within the network if it times out or a route to the specified address is not found). The destination end station may or may not have been expecting this packet. For example, a ping packet or connection request packet is typically not expected by its recipient. On the other hand, once a connection-oriented communication like TCP/IP (Transmission Control Protocol) has been initiated between the two stations, then each station is in effect expecting packets from the other station and actively accounts for and sends acknowledgements for these packets.

Unicast Packet Routing and Denial of Service Attacks

The important thing to note is that the unicast delivery of packets is based on a "push" system. Packets can be generated and inserted into the

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network for delivery to an end station. The end station has little or no control to stop or regulate the flow of certain types of these packets, even if they are causing problems i.e. during an active Denial of Service attack. This "push" protocol forms the weakness that is exploited in many Denial of Service and Distributed Denial of Service attacks occurring on the Internet.

A Denial of Service attack can take the form of a storm of packets addressed to the victim host. This storm of packets can completely clog the communications links into the victim system thus effectively denying service to any legitimate users. The attack can also take the form of using up resources on the target computer such as maximum number of TCP connections. Such an attack can consist of creating multiple TCP connections and then leaving them hanging until they time out. This can use up all the available connection slots thereby denying legitimate users any connections.

Multicast Technology

In contrast to unicast protocol, multicast protocol within an IP network uses a "pull" type system. The destination end station must actively request the reception of these multicast packets by "subscribing" to the router network with special subscription request packets (Internet Group Management Protocol or IGMP) for each multicast address of interest. Once a subscription message is received by a given router from an attached end station the router will autonomously communicate within the network of routing devices to receive the multicast packets with the applicable address. There can be multiple recipients of this traffic flow. If a subscription for a particular address is not renewed periodically by the attached host (typically, in the order of 10's of seconds) then the subscription for that particular address will time out and the router network will no longer route packets for delivery to that particular host. Alternately a host can "de-subscribe" from a given multicast address with a special de-subscribe message to the router which has an immediate impact on the delivery of multicast packets. The important difference between multicast and unicast packet delivery is that

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under multicast, the end computer station has control over the addresses from which it will accept data.

Under the current version of the Internet Protocol (IP Version 4 or IPv4), the addresses assigned for multicast are known as Class D addresses and range from the 224.0.0.0 to 239.255.255.255. The Internet Assigned Numbers Authority (IANA) maintains a list of registered users and assigns new numbers for new uses. The range from 224.0.0.0 to 224.0.0.25 is reserved for permanent assignment for various applications, including use by routing protocols. The set from 239.0.0.0 to 239.255.255.255 is reserved for various administratively scoped applications; much the same way as the 192.168.0.0 address range is assigned for administratively scoped unicast purposes. Under IPv6, the emerging new IP version, it is anticipated that there will be 112 bits of information to designate a multicast group. This is a much expanded address space over the current IPv4 allocation that only has 28 bits for address space.

MULTICAST ROUTING PROTOCOLS

Routers in a network or internetwork use multicast routing protocols to efficiently route multicast packets through the network or internetwork much the same as they use unicast (point-to-point) routing protocols to efficiently route unicast packets through the network. The multicast protocols are used to deliver multicast packets from the multicast source to multiple destinations that consist of the members of the multicast group.

Unicast routing protocols use one of two basic techniques, either distance vector (e.g. Routing Information Protocol - RIP), or link state (e.g. Open Shortest Path First - OSPF). Multicast routing protocols can be divided into three categories, distance vector (derived from unicast protocols like RIP), link state (derived from protocols like OSPF), and the newer shared-tree protocols. The multicast protocols in use include: the Distance Vector Multicast Routing Protocol (DVMRP) and Protocol Independent –Dense Mode (PIM-DM) based on distance vector, Multicast Open Shortest Path First (MOSPF) based on link state, and

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Protocol Independent – Sparse Mode (PIM-SM) and Core-Base Tree (CBT) based on shared trees. Each of these protocols has their strengths and weaknesses and is employed on various parts of the Internet.

Normally, in any Autonomous System (or domain) within the Internet, there is only one multicast protocol used. An Autonomous System is defined as a network administered by one entity and operating under one unicast routing protocol. A protocol used only within an Autonomous System is referred to as an interior gateway protocol (IGP). The administrative authority for a given Autonomous System specifies which unicast and multicast protocol is to be used within the Autonomous System. The decision is based on a number of factors including the type of routing equipment used in the Autonomous System, personnel experience with the various protocols, expected number of users and groups, and dispersion of users. There are protocols in place for routing unicast between autonomous systems, known as exterior gateway protocols (EGP). Autonomous Systems within the Internet are linked together by routers that use these unicast EGP that enforce routing policies. One weakness of multicast is the lack of an EGP for routing multicast between Autonomous Systems. There is work underway to define interdomain routing protocols, notably the Border Gateway Multicast Protocol (BGMP).

TUNNELING

An IP packet tunneling technique can be used to, among other things, tunnel multicast packets from one area of the Internet to another area of the Internet through an area that does not support multicast. In this technique, the multicast packets are received by a router or host on one end of a tunnel, encapsulated in a unicast IP packet and sent by normal IP unicast to the router or host at the other end of the tunnel where the packets are de-encapsulated and sent back out into the network as multicast packets. This technique is effective but requires a significant amount of administrative overhead. There are various

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existing and implemented protocols for IP tunneling in use on the Internet including "IP in IP".

SCOPING

Scoping of multicast packets refers to methods of limiting the range to which a multicast packet can travel in a network. There are presently two main methods used for scoping multicast packets, administrative and Time To Live (TTL) scoping. Administrative scoping involves using the multicast addresses on packets in the address space from 239.0.0.0 to 239.255.255.255. Multicast packets in this range do not cross administrative boundaries. Since multicast addresses are assigned locally within the Autonomous System they need not be unique between areas thus allowing for reuse of address space. TTL scoping refers to placing a low value in the TTL field of a packet when it is initially created. Every IP packet has a data field of one byte that defines a time to live for the packet. Every time the packet crosses a router or similar device or is held in a queue for 30 seconds, the TTL field is decremented. If the TTL reaches zero before the packet reaches its ultimate destination the packet is discarded wherever it is when the TTL reaches zero. Placing a low initial value within the TTL of the packet limits the range to which it can travel.

MULTICAST ADDRESS ALLOCATION

Currently there are very few permanently allocated multicast addresses. Multicast applications are quite free to choose nearly any multicast address for their use. There is a danger of address collision with other applications, so applications must be designed to detect and handle erroneous packets from other applications using the same multicast address. There are methods currently being researched to prevent this problem by providing dynamic multicast address allocation. The current research has defined a three level allocation hierarchy. Within an Allocation Domain, the lower level multicast

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applications running on hosts use a Multicast Dynamic Host Control Protocol (MDHCP) (based on the Dynamic Host Control Protocol) to request multicast addresses from the next level Multicast Address Allocation Servers (MAAS). An Allocation Domain normally coincides with the boundaries of the Autonomous System in which it is located. The MAAS's claim multicast addresses allocated through the use of the multicast Address Allocation Protocol (AAP). Certain nodes within the Autonomous System, usually routers, use the Multicast Address Set Claim (MASC) protocol to claim multicast address sets which they allocate to the MAAS's through the AAP. This architecture is experimental and no devices are known that currently support this architecture.

ROUTER INTERFACES

Routers are complex devices designed to efficiently receive and transmit data packets across multiple physical communication channels. These channels can include Ethernet, token ring, serial lines, ATM links, or Frame relay, all with varying characteristics and set up requirements. These channels are normally physically connected to the routers on what are called interfaces. The routers run various protocols that determine how they will receive, process, and transmit packets. These protocols can include the unicast routing protocols such as RIP or OSPF, and the multicast protocols such as DVMRP or MOSPF. Normally routers communicate between each other to exchange status and routing information in order to optimize delivery of packets. This data exchange can include advertising routes the router is aware of to reach an end destination.

ROUTER LIMITATIONS

There are some physical implementation limitations in routers depending on the manufacturer and the model. For example in the Cisco 3600 series of routers, there is a maximum of 7000 entries allowed by default in the multicast routing table. Configuring the router can change this parameter.

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Thus, in the Internet Protocol network, having a publicly available communications address is problematic as undesirable third parties may launch an attack, overwhelming the particular address or monitor the address for information not intended for the third party.

Transmitting IP packets to an IP address is somewhat akin to transmitting a radio signal at a particular frequency. A third party to the communication can monitor the frequency to eavesdrop on the communication or attempt to overwhelm or jam the frequency with a jamming signal. In the radio communications field, a technique known as spread spectrum communications employs a frequency hopping system where a transmitting station transmits bursts of data sequentially on a prearranged set of channels in a predetermined random pattern at specific times. The receiving station listens to the appropriate channels at the appropriate time in order to receive the communications. Frequencies can be shared among many users, as there can be many groups all hopping around in the frequency channels in a coordinated fashion. Spread spectrum techniques permit secure communications, reducing information gathering and denial of communications abilities. However such techniques require coordinated efforts between transmitting and receiving parties.

Thus, it is desirable for end stations to be able to communicate in an IP network having the limitations described herein, particularly where the address for communication is publicly known, having a method or system to alleviate most or all of the effects of certain types of Denial of Service attacks or information gathering.

SUMMARY OF THE INVENTION

The present invention provides a method and system for Internet Protocol network communications and a use thereof for protecting Internet sites

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against denial of service and traffic analysis attacks on insecure public networks such as the Internet.

In an embodiment, the present invention provides a method for transmitting multicast packets between a transmitting end station and one or more receiving end stations, in a multicast IP network, on a chosen multicast IP address from a plurality of multicast IP addresses for multicast communication using a multicast address hopping technique. The technique selectively varies the chosen multicast IP address from the plurality of multicast IP addresses according to a predetermined scheme known to the end stations but not to unauthorized end stations. The packets are then communicated on the chosen multicast IP address. In an aspect of the invention, indicia normally capable of identifying the source of the packets may be selectively varied to conceal the source of the packets.

In another embodiment, there is provided a method for receiving multicast packets from a transmitting end station on a chosen multicast address from a plurality of multicast IP addresses for multicast communication using a multicast addressing hopping technique and where indicia normally capable of identifying the source of the packets may be selectively varied to conceal the source of the packets. The packets may be communicated to an end station having subscribed to a set of multicast IP addresses comprising at least one multicast IP address from the plurality of multicast IP addresses for multicast communication and including the chosen multicast IP address for transmitting the packets. The set of multicast IP addresses may also be selectively varied according to a secret predetermined scheme known to the end stations, particularly by randomly adding to and dropping from the set of multicast IP addresses.

The invention provides protection from unauthorized personnel who may determine which address to disrupt or monitor for traffic between the end stations. Even if the unauthorized personnel can discover a particular multicast address chosen, addresses are dropped and new ones generated in a random fashion thus limiting the time in which the attacker can monitor packets or direct packets against an end station. Multiple sets of communicating groups all utilizing

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the same address space can coexist such that their respective traffic is intermingled on the various addresses, making traffic analysis very difficult.

In an aspect of the invention, the indicia may be chosen from the Time To Live (TTL) field and the IP Source address of individual IP multicast packets. The TTL field may be randomly set (jittered) to prevent eavesdroppers from deducing the separate sources of a packet stream through correlation of the TTL fields.

The IP Source Address of multicast IP packets may be "spoofed", that is filled in with a false source address, which can be changed in a random appearing method. Random appearing spoofed IP addresses prevent eavesdroppers from determining the real source of the packets.

In another embodiment, a data coding scheme such as code division multiplexing may be employed on the individual multicast packets data fields to allow data for individual destinations to be mixed together in one packet that is multicast to a plurality of receivers. Each receiver then decodes its applicable data by passing the received multicast data field through the appropriate decoding scheme such as a code division de-multiplexing process.

In further aspects of the invention, various uses of the invention for Virtual Private Networks and other secure communication systems are also provided.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing and other features and advantages will be better understood from the following detailed description of the MAHT technique and of certain preferred embodiments of the invention with reference to the drawings, in which:

FIG. 1 is a schematic diagram showing the general architecture of a system using the multicast address hopping technique;

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FIG. 2 is a schematic diagram showing the general conceptual architecture of an MAHT receiving device implementing a multicast address hopping technique;

FIG. 3 is a schematic diagram showing the general conceptual architecture of an MAHT transmitting device implementing a multicast address hopping technique;

FIG. 4 is a schematic diagram showing the general architecture of an enhanced VPN system using MAHT to provide protection against a traffic analysis attack;

FIG. 5 is a schematic diagram showing the configuration of an enhanced VPN using MAHT with spoofed IP address and IP in IP tunnels to provide protection against traffic analysis;

FIG. 6 is a schematic diagram showing the configuration of an enhanced VPN using MAHT with spoofed IP addresses and multiple IP in IP tunnels to provide protection against traffic analysis;

FIG. 7 is a schematic diagram showing an MAHT system transmitting multiple data streams to a plurality of MAHT receivers such that only authorized subscribers correctly receive a given data stream;

FIG. 8 is a schematic diagram showing an MAHT system using code division multiplexing to transmit data to a plurality of MAHT receivers; and

Fig. 9 is a schematic diagram showing an overview of the existing prototype test bed.

DETAILED TECHNICAL DESCRIPTION

The following are features of the MAHT technology to aid in anti DoS attacks and anti traffic analysis for communications between end stations on a public network:

data is communicated between the stations by multicast protocol having multicast addressing which hides a receiving station's actual IP address;

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multicast address hopping prevents others from discovering and monitoring or attacking a particular multicast address;

indicia within the packets normally capable of indicating the source of the packets may be selectively varied to conceal the source of the packets. For example, TTL fields may be jittered to prevent traffic analysis by correlation of TTLs, and IP Source Addresses may be spoofed (with or without the use of IP Tunneling) to conceal the IP Source Address of the transmitting station;

unicast routes to the stations forming a VPN may be suppressed to avoid a unicast based attack on the stations;

data coding of packet data, such as by CDMA techniques, may be employed to make analysis difficult.

The MAHT can be implemented in various configurations to give protection against different types of threats. Configuration possibilities depend on the type of in place network infrastructure particularly the multicast routing protocol and IP packet filtering definitions.

Referring now to the drawings and more particularly to FIG 1., there is shown, in a schematic diagram form, the general architecture of a system that uses the MAHT to communicate within an Autonomous System of the Internet. The MAHT Receiver, Block 100, is connected to an Autonomous System, Block 104, of the Internet through Router 1, Block 106. The MAHT Transmitter, Block 102 is connected to the same Autonomous System through Router 4, Block 108. There is a plurality of routers interconnected together that form the Autonomous System router network, Block 104.

The MAHT Receiver, Block 100, subscribes to a set of multicast addresses, from the plurality of available multicast addresses in the Autonomous System, by sending the appropriate IGMP subscribe messages to Router 1, Block 106. The MAHT Transmitter, Block 102, encapsulates data in a multicast packet with an address known to be in the current set of multicast addresses to which the MAHT Receiver, Block 100, has subscribed. The data may comprise unicast IP packets destined for the MAHT Receiver, Block 100, or another site with which the

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Receiver is familiar (e.g. a site to be protected from a Denial of Service attack) or other data.

Router 1, Block 106 communicates with the other routers within the Autonomous System, Block 104, to request delivery of any multicast packets in the set of addresses in current use by the MAHT Receiver, Block 100. The Routers use the standard multicast routing protocol in use within the Autonomous System, Block 104, to communicate, e.g. PIM-DM, DVMRP, MOSPF, etc. In the example illustrated in Fig. 1, the MAHT Receiver, Block 100, has subscribed to a set of addresses starting with 224.1.6.4 and including 229.5.34.21. The MAHT Transmitter, Block 102, transmits the encapsulated data in multicast packets having an address selected from the same set of multicast addresses. After a time, a further address is selected for communicating with the Receiver. These multicast packets are then routed through the Autonomous System, Block 104, by the plurality of routers to be ultimately delivered to the MAHT Receiver, Block 100. If the encapsulated data comprised unicast data, the original unicast packets may then be recovered and passed on as may be necessary.

The set of addresses used by the MAHT Receiver, Block 100, and the MAHT Transmitter, Block 102, includes at least one address and preferably a larger number of addresses. The size of the set may vary depending on the capacity of the Receiver to maintain the set and the expected ability of third parties who may be monitoring the Receiver's communications. By choosing a sufficiently large number of addresses, the Receiver cloaks the particular addresses actually used for communication among those addresses to which it subscribes while lessening the chances that a person monitoring the communications can determine meaningful information about the communications.

In a preferred embodiment, addresses may be dropped from the set of addresses and new ones added to the set from the plurality of available multicast addresses in an agreed upon synchronized change scheme between the MAHT Receiver and Transmitter. Addresses for the set of addresses and particular address selected for a period of time for actual communication are selected in a fashion that is not known to parties not intended to be capable of

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receiving the data, such as by random selection according to a prescribed scheme known to the MAHT Receiver and Transmitter.

The duration of the subscription by the MAHT Receiver to any address or addresses from the set of addresses and the length of time that a particular address is selected for actual communication is preferably of random length. This random addressing scheme makes it difficult, if not impossible, for a remote attacker to determine which multicast address to attack to carry out a denial of service attack on the MAHT Receiver or which address to monitor for information gathering purposes as data may be spread over multiple addresses. While in the preferred example, the Receiver subscribes to multiple addresses at any one time, it is understood that the receiver may subscribe to the selected address for communication in sufficient time prior to its use, dropping the address upon termination of its use. However, such a method does not hide the selected address among a set of potential addresses, should a third party be monitoring the subscription traffic from the Receiver.

Preferably, when the MAHT is used for anti Denial of Service of a unicast-based service supplied from an end station (as described more fully below), Router 1, Block 106, (and any router adjacent to a MAHT receiver, Block 100, or transmitter Block 102) is configurable such that it does not advertise an IP route to itself nor to any downstream connected devices. This means that even though there is a physical communication link between itself and a neighboring upstream router, Router 2, Block 110, or Router 5, Block 112, the upstream router is not aware of the address of the downstream router. However, the downstream router can still pass IP packets addressed to remote network hosts through the physical communication link to the upstream router that forwards them on to the remote hosts. This in effect leaves a one-way unicast route from the downstream router, e.g. Router 1, Block 106, and any connected downstream hosts, e.g. the MAHT Receiver, Block 100, into the Internet. No unicast packets can be delivered to the downstream router, e.g. Router 1, Block 106, or connected hosts, e.g. the MAHT Receiver, Block 100, since there are no unicast routes available to route them from the upstream router e.g. Router 2 or Router 5. This means that no

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attack packets can be directed against the router or protected host since no route exists to them. The ability to configure a router in this mode is a built in capability to most commercial routing equipment.

It is understood that for multicast protocol within the IP network, routers, e.g. Router 1, Block 106, permit multicast subscribe or de-subscribe (IGMP) packets to be passed from the downstream router, Router 1 to the upstream router through the physical communication link connected to the applicable interface. The upstream router e.g. Router 2 or Router 5, receives these IGMP subscribe or de-subscribe messages on the interface corresponding to the physical communication link to the downstream router, e.g. Router 1. This upstream router will then become aware that there is a multicast subscriber for that particular multicast address somewhere through that interface even though the router is not aware of the addresses of any hosts or subnets reachable through that interface. The upstream router, e.g. Router 2 or Router 5, then processes a request through to the other routers within the Autonomous System to receive any packets destined for that multicast address. When the router receives these multicast packets from senders elsewhere within the Autonomous System, Block 104, e.g. the MAHT Transmitter, Block 102, it will forward these multicast packets through the interface to the downstream router, e.g. Router 1, Block 106. In this example, Router 1, Block 106, will then pass these multicast packets on to the MAHT Receiver, Block 100. The ability to configure a router in this mode is a built-in capability to most commercial routing equipment.

Referring now to FIG. 2, there is shown a representative schematic diagram of a general conceptual architecture for a MAHT Receiver implementing the multi address hopping technique for receiving data from a MAHT Transmitter. The MAHT Receiver, Block 200, could be built as a specialized device or run as a software program on a general- purpose computer.

The MAHT Receiver, Block 200, includes a multicast address generating function comprising means to selectively vary the choice of multicast addresses on which to receive multicast data from the plurality of available multicast addresses for communicating with another end station. The Receiver

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further comprises means to synchronize with the Transmitter for coordinated communication on the selected multicast addresses. In the preferred embodiment, the means to selectively vary the choice of addresses comprises means to generate addresses according to a secret predetermined scheme known to the Receiver and a Transmitter, which means may be initiated by a cryptographic key. The predetermined scheme is secret in that it may be known by the Receiver, Transmitter and other selected end stations but not by another who may wish to monitor or disrupt the traffic of the selected end stations.

The MAHT Receiver, Block 200, may be connected into the IP based public network (e.g. Internet) through one or more interfaces such as an Ethernet port shown at Block 202. Configuration File, Block 204, and a current Cryptographic Key, Block 206, contain the necessary information to initialize and start the MAHT. The Configuration File may include such things as number of active Wide Area Network, (WAN), multicast ports to open, cryptographic algorithms to use, and logging settings. The System Initializer process, Block 208, reads in the Configuration File, Block 204, and the current Cryptographic Key, Block 206, and then creates the other processes with the appropriate parameters. Listen Address Generator, Block 210, generates the appropriate multicast addresses to listen to in accordance with the predetermined scheme and any configuration parameters. These parameters include the current time, number of addresses to open, and current cryptographic key. The Time Synchronization process, Block 212 provides the current time to the Listen Address Generator, Block 210, so that the addresses are subscribed to and dropped in synchronization with the remote MAHT Transmitter. The time synchronization could be based on the system clock, an externally supplied more accurate time standard, e.g. from a Global Positioning Satellite receiver, a network time standard such as the Network Time Protocol (NTP), or a time synchronization method with the MAHT process potentially based on the NTP technique for synchronizing time across an IP network.

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The WAN Listener processes, (Block 214 through 218), are created by the Listener Address Generator, Block 210. The number of WAN Listener processes created is determined by the configuration file parameters, Block 204. Each of these WAN Listener processes will listen to a different multicast address by subscribing to the upstream router using an IGMP subscribe packet sent through the Ethernet port, Block 202. Each WAN Listener process will drop their current address and subscribe to a new one in accordance with the control signals from the Listen Address Generator, Block 210. Each WAN Listener, Block 214 through 218 passes any received multicast packets to the Packet De-encapsulator, Block 220.

The Packet De-encapsulator takes the data, for example a unicast packet, from the multicast packet and performs any checks or processing on the packet including decryption and authentication if so configured. Packets are checked to ensure that they actually originated with the appropriate MAHT Transmitter. If they are actually from another multicast transmitter using the same address, these packets are discarded. If the multicast packet is from the appropriate MAHT Transmitter and the data is a unicast packet intended for a host site familiar to the MAHT Receiver, Block 200, the Packet De-encapsulator, Block 220, may pass the de-encapsulated unicast packet on to the LAN Transmitter, Block 224, to send the packet out through the Ethernet Port, Block 202, in its original unicast format, to be delivered to the unicast destination host.

Optionally, in the preferred embodiment, the processing of packets in the Packet De-encapsulator is monitored by the Collision Detection process, Block 222. This process determines if there are too many packets arriving on a multicast address that are actually from another multicast transmitter using the same address, in effect an address collision. If there is too much traffic on this address then the Collision Detection process, Block 222, can instruct the Listen Address Generator, Block 210, to drop this particular address and add a new one before the normal scheduled address drop time. The remote MAHT Transmitter can be notified that this particular address has been dropped via a control packet sent from the MATH Receiver, Block 200, to the MAHT Transmitter.

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Referring now to FIG. 3, there is shown a representative schematic diagram of a preferred architecture for a MAHT Transmitter, Block 300, implementing the multicast address hopping technique for transmitting data to a MAHT Receiver. The MAHT Transmitter, Block 300, could be built as a specialized device or run as a software program on a general purpose computer.

The MAHT Transmitter, Block 300, includes a multicast address generating function comprising means to selectively vary the choice of multicast addresses on which to transmit multicast data from the plurality of available multicast addresses for communicating with another end station. The MAHT Transmitter, Block 300, further comprises means to synchronize with the MAHT Receiver for coordinated communication on the selected multicast addresses. In the preferred embodiment, the means to selectively vary the choice of addresses comprises means to generate addresses according to the secret predetermined criteria known to the MAHT Receiver and the MAHT Transmitter, which means may be initiated by a cryptographic key as described herein above. The MAHT Transmitter may be connected into the Internet through one or more interfaces such as an Ethernet port shown at Block 302.

Configuration File, Block 304, and a current Cryptographic Key, Block 306, contain the necessary information to initialize and start the MAHT Transmitter, Block 300. The Configuration File may include such things as number of WAN multicast addresses to use, information for cryptographic steps, TTL jitter settings, IP spoofing settings, Retransmit Servers to use, and logging settings. The System Initializer process, Block 308, reads in the Configuration File and the current Cryptographic Key and then creates the other processes with the appropriate parameters.

For the case where the MAHT Transmitter, Block 300, is used to forward unicast data received from another host to the MAHT Receiver or a host with which the MAHT Transmitter and Receiver are familiar, LAN Listener process, Block 318, listens for appropriate unicast packets received on the Ethernet port,

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Block 302. The LAN Listener process, Block 318, then passes these packets on to the Packet Encapsulator, Block 316.

The Packet Encapsulator, Block 316, takes the original unicast packet from the LAN Listener process, Block 318, and performs processing on the packet including encryption and authentication, if so configured, to build a multicast packet. In other cases, the Packet Encapsulator may encapsulate and process other data it receives from other processes (not shown). The Transmit Address Generator, Block 310, generates the appropriate multicast addresses to transmit to in accordance with the configuration parameters. These parameters include the current time, number of addresses to use, hopping order, and current cryptographic key. The Time Synchronization process, Block 312 provides the current time to the Transmit Address Generator, Block 310 in accordance with a method discussed in relation to the Receiver, so that the addresses for transmission are selected and dropped in synchronization with the MAHT Receiver.

The TTL field is a mechanism used in IP packets to ensure packets do not loop endlessly around a network without ever reaching their destination. The TTL data field in an individual IP packet is decremented every time it passes through a router or spends a predetermined time (e.g. 30 seconds) waiting in a queue. Once the TTL field in a packet reaches 0 the router that is handling it automatically discards the packet. The maximum value of TTL is 255 but can be set lower to limit the hops a packet can travel. Setting the TTL to a low value to prevent distant travel is known as administrative scoping and is often used to limit how far multicast packets can travel. The Packet Encapsulator may set the Time To Live (TTL) field in individual IP multicast packets randomly (i.e. in a jittered manner) to prevent eavesdroppers from deducing the separate sources of a packet stream through correlation of the TTL fields. Of course, the value chosen should not be so low as to prevent reception of the packet by the intended receiving station. In a preferred embodiment, the TTL value is jittered around a nominal average value that is chosen such that the maximum range of jitter to be added and subtracted from the nominal average value will not be so low as to

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prevent reception of the packet by the intended receiving station nor so high as to be beyond the maximum value of 255. The average TTL value could be chosen depending on network topology and any administrative scoping requirements. The generated jitter values would preferably be in a uniform distribution for values to produce the maximum and minimum acceptable values of TTL. For example, the nominal TTL could be set to 128 with a uniform distribution for the generated TTLs from a minimum of 64 to a maximum of 192. The system could be further enhanced by including an adaptive process such that the individual nominal average TTL values are adaptively set so that the average TTL values arriving at a receiving site are adaptively adjusted to be the same for different transmitting sites. This adaptive process requires feedback from the MAHT receiving sites to the MATH transmitting sites. This adaptive process would further complicate any traffic analysis attempts by hiding any differential trends in average TTL for packets originating from different transmitting sites.

WAN Transmitter process, Block 314, is created by the Transmit Address Generator, Block 310. The WAN Transmitter receives encapsulated packets from the Packet Encapsulator, Block 316, and transmits them to the Internet through the Ethernet port, Block 302. Optionally, The MAHT Transmitter, Block 300, can be notified that a particular multicast address has been dropped, due to address collision, via a control packet sent from the MAHT Receiver to the MAHT Transmitter.

The MAHT may work with any of the IGP multicast routing protocols within an Autonomous System. Once an EGP, such as BGMP, has been defined and implemented the present invention can operate across Autonomous Systems. It is also currently possible to use well-known IP tunneling techniques to communicate multicast packets between two autonomous systems although this is an administration intensive process.

The MAHT does not necessarily require scoping but can use either TTL, administrative, or both types of scoping methods to increase the effectiveness of the system or to meet administrative requirements.

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The MAHT can work within the developmental Multicast Address Allocation architecture provided that the total number of multicast addresses available is sufficient and the allocation order can be randomized in some fashion. Until the dynamic address allocation problem is resolved and standardized the present invention can operate within an Autonomous System by defining it's own multicast addresses and ensuring detection and handling of packets from other applications using the same multicast address. If there is an address collision such that there are too many erroneous packets being delivered then that particular address can be dropped.

Physical router limitations, especially the simultaneous number of open multicast route entries, must be taken into account when planning and implementing this invention in a particular Autonomous System of the Internet. These limitations can impact the implementation configuration of the present invention. However routers typically have a default limit of several thousands of routes and can be configured for more if required. For example, the Cisco 3600 series of routers have a default limit of 7000 multicast route entries that is expected to be more than adequate for practical implementation of this invention.

The MAHT may be used in a system and method for protection against certain types of Denial of Service attacks for Internet sites using IP networks, especially the Internet, as a communications media.

In one embodiment, the system can provide anti-traffic analysis capabilities for communications between a site and a number of other sites. Referring now to Figure 4, there is shown a system that has a transmitting site and a number of receiving sites. The transmitting site, Block 400, uses the MAHT technique to transmit traffic to the plurality of receiving sites, Blocks 402, 404, and 406. Any attacker, Block 408, who monitors the transmitted packets, does not know to whom the packets are really destined thus denying him destination information to analyze. Notethat under normal multicast transmission schemes, the attacker does know from where the packets originated by observing the source address in the multicast packet.

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Depending on which multicast routing protocol is in effect in the Autonomous System, it may be possible to spoof the IP Source address for the multicast packets. Spoofing in this case means randomly putting in a false address for the IP Source address in the IP Source address field of the packet. This would deny the attacker knowledge of the source of the packets. Implementation of the IP Address Spoofing technique is straightforward for use with the Core Based Tree (CBT) multicast routing. The Packet Encapsulator, Block 316, of a transmitting end station may insert a spoofed IP Source Address, unconnected to the transmitting end station, in the multicast packet.

Spoofing the source address may have practical implementation aspects involving filtering at routers in the Internet and in the multicast routing protocol in use in the Autonomous System. Certain multicast routing algorithms, notably the Distance Vector Multicast Routing Protocol (DVMRP), cannot easily be used with IP spoofing techniques. This is due to the fact that they use a reverse path forwarding technique for multicast packets whereby a multicast packet is only forwarded on to other subscribing routers only if the packet is received on the physical interface through which a unicast packet destined for the source address in the multicast packet would be sent. The implementation configuration of the MAHT with spoofed IP addresses depends on which multicast routing protocol is in effect in the implementation area. For example, use of MAHT including IP spoofing in a DVMRP area will require use of additional infrastructure or techniques such as IP tunneling.

Referring now to Figure 5, there is shown a MAHT system that uses tunnels to allow IP spoofing to protect the IP Source address of the transmitting site. The Transmitting site, Block 500, takes the multicast packet and encapsulates it in a tunneling protocol such as IP in IP. The multicast packet has a spoofed IP Source address inserted in place of the normal IP Source address. The multicast packet is encapsulated in a unicast tunnel packet, Block 502. This unicast tunnel packet also has a spoofed IP Source address. This unicast packet is then delivered into the Internet to be delivered to the receiving tunnel exit host or router system, Block 504, at the other end of the tunnel. Once this unicast

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packet arrives at the other end of the tunnel the multicast packet is de-encapsulated and processed as a normal packet. By appropriate selection for the spoofed IP Source address in the multicast packet, the underlying multicast routing protocol will correctly process this de-encapsulated packet at the tunnel exit host and deliver it to the receiving site, Block 506. In this way the transmitting source address can be hidden from attackers. Preferably there is a plurality of tunnels implemented leading to a plurality of tunnel exit hosts thereby greatly increasing the complexity of any attacker traffic analysis and also providing greater reliability and anti denial of service capability. This plurality of exit hosts could be scattered throughout an Autonomous region or across several Autonomous Systems, thus ensuring multiple widely separated paths for the data packet flow.

Referring to Figure 6, there is shown a system incorporating multiple tunnels scattered across an Autonomous Region. There is an MAHT transmitting site, Block 600, that encapsulates the original multicast MAHT packets with a spoofed IP Source address, Block 602, 604, and 606 in unicast tunnel packets addressed to the range of tunnel exit hosts, Blocks 608, 610, and 612. Any encapsulated multicast packet arriving at a tunnel host will be de-encapsulated and delivered using the standard underlying multicast routing algorithm to the MAHT receiving sites, Blocks 614, 616, and 618. Note that the multicast packets exiting from the IP in IP tunnel can be destined to a plurality of MAHT receivers. The capability of the tunneling technique could be further enhanced over the standard IP tunneling techniques such as IP in IP by adding custom software to the tunnel exit hosts and the MAHT transmitter such that the packets are encrypted thus providing even greater resistance to traffic analysis.

In another embodiment, the MAHT can provide anti denial of service capabilities to a VPN system. In this embodiment, the VPN sites across the public network are all configured to use the MAHT technique to communicate on a full time basis. The VPN is set up such that there is no return unicast route from the public network back into the MAHT configured VPN sites. Such a requirement may be met by the non-advertisement of a unicast route to the VPN sites, by filtering unicast packets destined for the sites or decoying unicast traffic to another

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device. The MAHT technique allows the data traffic to flow between the various communicating sites but denies an attacker an effective unicast IP address against which to direct a denial of service attack. Preferably this embodiment would also include varying the indicia of packet source, such as the use of the IP spoofing techniques previously described, in order to provide anti traffic analysis capabilities as well.

In another embodiment, the MAHT system could be set up to provide an emergency backup mode for individual VPN sites that come under active denial of service attacks. In this embodiment, the individual VPN sites would normally communicate with default unicast point to point protocols. However if one site came under active denial of service attack then it could switch either manually or, preferably, automatically, to MAHT back up mode. In this mode the router connecting the VPN into the public network would be instructed, preferably by the VPN device using an automatic control channel, to cease advertising a unicast route into the site, thus shutting down the denial of service attack. The VPN site would then commence using the MAHT technique to communicate to the other VPN sites. The site under attack instructs the other VPN sites to transmit to it using MAHT. As the site under attack is still capable of unicast transmission even though unicast reception is suppressed, the site could still use normal unicast to send packets to the other VPN sites. Otherwise, the site under attack may indicate to the other VPN sites a desire to transmit to them using MAHT. Once the attack has ceased or been isolated then the VPN site under attack could revert back to normal operation.

In another embodiment, the MAHT system could be used to deliver data streams to multiple authorized receivers while providing an efficient method to prevent unauthorized users from viewing the data. It is computationally costly to perform real time high bandwidth decryption and administratively difficult to distribute decryption keys to multiple subscribers. Rather than encrypting the data stream it would be more efficient to use the MAHT technique to transmit the data stream on different and changing multicast ports. The receiving subscribers would have to know the correct hopping sequence and timing but would not be required

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to run any real time decryption software or hardware. It is computationally trivial to subscribe and de-subscribe to multicast addresses. The receiving subscribers could receive the hopping sequence through various means. For example, a subscriber could establish a secure connection to a web site using a standard protocol like Secure Sockets Level, (SSL). This web site would provide a pay for use service by passing through this connection the hopping sequence and timing to the end user on a continuing basis and the user could be charged on the basis of the time connected to the hopping and timing server and which data stream was used. Alternately, a user could receive the appropriate sequence and timing information for a fixed period for a periodic fee. This service would preferably offer multiple different data streams, for example, video (movies), audio (radio broadcasts), or real time data (stock quote feeds). This would increase the difficulty for an unauthorized user to effectively intercept the correct data stream.

Referring now to Figure 7, there is shown a MAHT system transmitting multiple data streams to a plurality of MAHT receivers such that only authorized subscribers correctly receive a given data stream. The MAHT transmitter, Block 700, receives a plurality of data streams, for example video streams, Blocks 702, 704, and 706, from connected sources, 708, 710, and 712. The MAHT transmitter, Block 700, uses the MAHT technique to transmit these data streams in MAHT multicast packets to multiple and changing multicast addresses in the Internet, Block 714. Authorized users, Blocks 716, 718, and 720, who have the correct addressing hopping and timing sequence for a given data stream can subscribe to the appropriate address at the appropriate times and receive the data stream. In this case Authorized Subscriber 1, Block 716, has subscribed to Data Stream 2, Block 704, and similarly Authorized Subscriber 2, Block 718, to Data Stream N, Block 706, and Authorized Subscriber N, Block 720, to Data Stream 1, Block 702. If a subscriber does not have the correct information they will not receive the packets correctly and may even receive a mixed up conglomeration of packets originating from different data streams.

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In another embodiment, the system may be further enhanced by formatting a data portion of the multicast packet with data intended for different end stations according to a data coding scheme for combining and separating the data. The scheme may use a code division multiplexing technique. In a preferred embodiment of this system, a MAHT Transmitting site communicates with a plurality of MAHT Receiving sites using the MAHT technique. However each Receiving site subscribes to the same full set of multicast addresses and therefore receives all packets communicated. However, the MAHT transmitting software uses a code division multiplexing algorithm to embed data for every site on every packet, including null data if there were no data for a particular receiving site. An IP packet typically consists of an IP packet header, header options (if needed) and a data or payload portion. The data portion itself can be divided into a header and data depending on what protocol is being used for that packet. It is intended that the code division multiplexing process be used on the portions of the IP packet not including the actual IP packet header.

Code division multiplexing or direct sequence spreading is a well-understood and implemented technology. In this embodiment, a different orthogonal code sequence having a fixed length is generated for each receiving end station. After a given number of bits the orthogonal code repeats itself exactly. In classic direct spreading the speed of the code sequence is called the chipping rate, measured in chips per second (cps). In this invention, it is called a chip ratio, since the underlying physical network, that may change during transit, determines the speed at which the bits or chips are transmitted on each segment of the physical communications link. For direct sequence, the amount of spreading is dependent upon the ratio of chips per bit of information. Each bit of the original message is multiplied by the code sequence thus the original message is spread by the factor of the orthogonal code length. For example a 50 bit message that is spread with a 5 bit code will result in a 250 bit coded sequence. At the receiver, the information is recovered by binary multiplying the signal with a locally generated replica of the code sequence for each sequence of bits corresponding to the code length and counting the number of "one" bits in the result. The

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resultant count is put through a threshold device to decide whether the original bit was a binary "one" or "zero". This process is sequentially used on each set of bits corresponding to the code length to recover the original sequence of bits in the message.

Referring now to Figure 8, there is shown a system using both MAHT and code division multiplexing. The MAHT transmitter, Block 800, sends different data to a plurality of MAHT receivers, Blocks 802, 804, and 806. A pseudorandom sequence generator, Block 808, generates a different orthogonal code sequence for each MAHT receiver, e.g. Block 810. The MAHT transmitter then takes the data destined for each receiving site, e.g. Block 812 destined for Receiver 1, and multiplies each bit in the message destined for that receiver by its corresponding code sequence, e.g. Block 810, to result in a combination data and code sequence for each receiver, e.g. Block 814 for Receiver 1, which is the length of the data length times the code sequence length. These individual data and code sequences are then arithmetically added together to result in a combined result, Block 816, containing data destined for all the receivers. Note that any carry over bits from this binary addition process are discarded. This data is then packaged in a data portion of an MAHT multicast packet and transmitted to all the MAHT receivers, Blocks 802, 804, and 806, that have all subscribed to the applicable multicast address to receive this packet.

Once the multicast packet is received at a given MAHT receiver the data destined for that particular receiver is recovered by passing the received combined result from the data portion of the packet, Block 818, through a code division de-multiplexer that uses the identical pseudorandom sequence, Block 822, that the MAHT transmitter used to encode the data for that receiver. The received combined data, Block 818, is identical to the Combined data at Block 816. The code division de-multiplexer consists of a pseudorandom sequence generator, Block 820, which generates the same sequence, Block 822, as the code sequence, Block 810, generated by the MAHT Transmitter pseudorandom generator, Block 808, for traffic destined for Receiver 1. The output of the de-multiplexer is the original data destined for Receiver 1. Such a system may be

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further extended by having the spreading sequence be much longer than a physical packet length thus enabling more reliable delivery of data when packets are lost in transit since information could be recovered even if some packets are lost. It is also possible to implement this system in a full duplex arrangement between a plurality of participating sites by having each site run both the MAHT transmitting and receiving systems with the appropriate parameters. A Transmitting site may incorporate null data in the coding scheme for sites for which there is no current data to be sent.

As may be understood, a data coding scheme such as code division multiple access may be used in a multicasting network protocol that does not incorporate MAHT or that does incorporate MAHT with schemes to hide the source of the multicast packets, such as TTL jittering or IP Source Address.

The MAHT of the subject invention has been partially prototyped and tested using a three router laboratory test bed. Referring now to Figure 9, there is shown the set up for the existing prototype test bed. The test bed comprised two Cisco™ 3620 model routers, Router 1, Block 908, and Router 2, Block 910, directly connected together using DCE and DTE V.35 cables. These directly connected cables simulated a long distance high- speed serial communications link. Each of these Cisco Routers was connected in turn through one of their Ethernet ports to a Local Area Network (LAN), LAN 1, Block 906, for Router 1, and LAN 2, Block 912, for Router 2. There was an Intel™ based Linux ™ computer, Block 904, running custom software developed for the MRS functionality located on LAN 1. This MRS computer had a second Ethernet card that connected to LAN 3, Block 902, and was configured to route IP packets between the LAN 1, and LAN 3. There was a Linux computer used as a Protected Server Site Host, Block 900, which was also connected into LAN 3, Block 902. This PSSH Linux workstation was configured to run an ftp server, an http server, a telnet server, and an email server. On LAN 2, Block 912, there were two computers connected, a Linux based workstation, Block 914, and a Windows™ 95 based workstation, Block 916. The Linux based workstation, Block 914, was running custom software to provide DFS functionality. The Windows computer, Block 916, was running a Netscape™ and

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Microsoft Internet Explorer™ web browser software as well as standard Windows ftp, ping, and telnet client software.

Router 1, Block 908 was configured to block all packets destined for the PSSH, Block 900, that arrived on the serial interface from Router 2, Block 910. However, the Routers were configured using the Protocol Independent Multicast – Dense Mode (PIM-DM) routing protocol to allow multicast packets to travel from the rest of the network to LAN 1, block 906 and LAN2, Block 912. Thus there was a multicast route available between LAN 1 and LAN 2 but no unicast traffic was allowed to flow from the Client Host, block 916 to the PSSH, Block 900.

The system was tested using ftp, ping, web browsing, and ping between the PSSH and Client Host. When the DFS software, Block 914, and MRS software, Block 904 were turned off there was no connectivity between the Client Host and the MRS. When the DFS and MRS were turned on thereby initiating the MAHT protocol, then normal communications occurred between the Client Host and the PSSH using ftp, telnet, ping, and web browsing. The DFS, Block 914, picked up packets destined for the PSSH, Block 900, using packet sniffing software, encapsulated them in multicast packets, and sent them back to Router 2, block 910. This router forwarded the packets out its serial interface 0/1 to Router 1, Block 908, since Router 1 had been receiving IGMP subscribe messages for each of the 20 multicast addresses. These packets were delivered to the MRS, Block 904, where the original unicast packets were de-encapsulated and passed to the PSSH, Block 900, through the second Ethernet interface onto LAN 3, Block 902. Normal unicast packets from the PSSH, Block 900, destined for the Client Host, Block 916, could still pass normally from the PSSH through the network to the Client Host. This allowed a full bi-directional flow of data between the PSSH, Block 900 running various services and the Client Host, Block 916, in a completely transparent manner. The system achieved a rate of over 80 kilo bits per second even while using 446 bit encryption on each packet.

The multicast address hopping software was implemented primarily in the Java™ programming language with several low level Ethernet packet interface routines implemented in the C language. The software was configured

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to hop within a set of 20 multicast addresses in a fixed pattern and did not drop or add new addresses.

Although the present invention has been described with respect to certain preferred embodiments thereof, various changes and modifications may be suggested to one skilled in the art and it is intended that the present invention encompass such changes and modifications as fall within the scope of the appended claims

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WHAT IS CLAIMED IS:

1. In a multicast capable Internet Protocol (IP) network, a method for transmitting multicast packets between a transmitting end station and one or more receiving end stations on a chosen multicast (IP) address from a plurality of multicast IP addresses for multicast communication, the packets comprising one or more indicia normally capable of identifying an end station as the source of the packets, the method comprising the steps of:

selectively varying the chosen multicast IP address from the plurality of multicast IP addresses according to a predetermined scheme known to the transmitting and receiving end stations;

selectively varying one or more of the indicia within the packets so as to conceal the source of the packets; and

transmitting the packets on the chosen multicast IP address.

2. The method of claim 1 wherein the step of selectively varying the chosen multicast IP address comprises:
randomly hopping from one multicast IP address to another.

3. The method of claim 1 wherein the indicia are chosen from the group comprising a Time To Life (TTL) field and a IP Source Address field of the multicast packets.

4. The method of claim 1 further including the step of tunneling the multicast packets according to a network protocol to one or more tunnel exit hosts each capable of receiving and re-transmitting the multicast packets.

5. The method of claim 1 further comprising the steps of:
combining according to a data coding scheme data intended for each receiving end station, at least some of the data being different for different receiving end stations, to make combined data capable of separation by each receiving end

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stations to obtain the data intended for the receiving end station; and coding a portion of said packets for transmission to all receiving stations with said combined data.

6. The method of claim 5 wherein said data coding scheme is a code division multiple access (CDMA) scheme.

7. The method of claim 1 wherein the multicast packets comprise at least one stream of data and wherein the step or transmitting comprises, for each stream, transmitting the multicast packets comprising the stream to one or more receiving end stations.

8. In a multicast capable Internet Protocol (IP) network, a method for receiving multicast packets at one or more receiving end stations from a transmitting end station on a chosen multicast (IP) address from a plurality of multicast IP addresses for multicast communication, the packets comprising one or more indicia normally capable of identifying an end station as the source of the packets, the method comprising the step of:

selectively varying the chosen multicast IP address from the plurality of multicast IP addresses according to a predetermined scheme known to the transmitting and receiving end stations;

subscribing to the chosen multicast IP address; and

receiving the packets on the chosen multicast IP address;

wherein the one or more of the indicia within the packets are selectively varied so as to conceal the source of the packets.

9. The method of claim 8 further including the step of subscribing to a set of multicast IP addresses comprising at least one multicast IP address from the plurality of multicast IP addresses for multicast communication and including the chosen multicast IP address for transmitting the packets.

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10. The method of claim 9 further comprising the steps of selectively varying the set of multicast IP addresses to which at least one of the receiving end stations is subscribed according to a predetermined scheme known to the at least one receiving end station and transmitting end station and subscribing to the varied set.

11. The method of claim 10 wherein the predetermined scheme for selectively varying the set of multicast IP addresses comprises randomly adding to and dropping from the set of multicast IP addresses.

12. The method of claim 8 wherein the step of selectively varying the chosen multicast IP address comprises:
randomly hopping from one multicast IP address to another chosen from the set of multicast IP addresses.

13. The method of claim 8 wherein at least one of the receiving end stations is isolated from the network so as to prevent the reception of unicast packets.

14. The method of claim 8 further comprising the step of:
separating according to a data coding scheme combined data from data intended for each receiving end station, at least some of the data being different for different receiving end stations and coded in a portion of said packets for transmission to all receiving stations to obtain the data intended for the receiving end station.

15. The method of claim 14 wherein said data coding scheme is code division multiple access (CDMA) scheme.

16. In a multicast capable Internet Protocol (IP) network, a system for transmitting multicast packets between a transmitting end station and one or more receiving end stations on a chosen multicast (IP) address from a plurality of

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multicast IP addresses for multicast communication, the packets comprising one or more indicia normally capable of identifying an end station as the source of the packets, the system comprising;

means for selectively varying the chosen multicast IP address from the plurality of multicast IP addresses according to a predetermined scheme known to the transmitting and receiving end stations;

means for selectively varying one or more of the indicia within the packets so as to conceal the source of the packets; and

means for transmitting the packets on the chosen multicast IP address.

17. The system of claim 16 wherein the means for selectively varying the chosen multicast IP address comprises:

means for randomly hopping from one multicast IP address to another.

18. The system of claim 16 wherein the indicia are chosen from the group comprising a Time To Life (TTL) field and a IP Source Address field of the multicast packets.

19. The system of claim 16 further including means for tunneling the multicast packets according to a network protocol to one or more tunnel exit hosts each capable of receiving and re-transmitting the multicast packets.

20. The system of claim 16 further comprising:

means for combining, according to a data coding scheme data intended for each receiving end station, at least some of the data being different for different receiving end stations, to make combined data capable of separation by each receiving end stations to obtain the data intended for the receiving end station; and coding a portion of said packets for transmission to all receiving stations with said combined data.

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21. The system of claim 16 wherein the multicast packets comprise at least one stream of data and wherein the step or transmitting comprises, for each stream, transmitting the multicast packets comprising each stream to one or more receiving end stations.

22. In a multicast capable Internet Protocol (IP) network, a system for receiving multicast packets at one or more receiving end stations from a transmitting end station on a chosen multicast (IP) address from a plurality of multicast IP addresses for multicast communication, the packets comprising one or more indicia normally capable of identifying an end station as the source of the packets, the system comprising:

means for selectively varying the chosen multicast IP address from the plurality of multicast IP addresses according to a predetermined scheme known to the transmitting and receiving end stations;

means for subscribing to the chosen multicast IP address; and

means for receiving the packets on the chosen multicast IP address;

wherein the one or more of the indicia within the packets are selectively varied so as to conceal the source of the packets.

23. The system of claim 22 further comprising means for subscribing to a set of multicast IP addresses comprising at least one multicast IP address from the plurality of multicast IP addresses for multicast communication and including the chosen multicast IP address for transmitting the packets.

24. The system of claim 23 further comprising means for selectively varying the set of multicast IP addresses to which at least one of the receiving end stations is subscribed according to a predetermined scheme known to the at least one receiving end station and transmitting end station and means for subscribing to the varied set.

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25. The system of claim 24 wherein means for selectively varying the set of multicast IP addresses comprises means for randomly adding to and dropping from the set of multicast IP addresses.

26. The system of claim 22 wherein the means for selectively varying the chosen multicast IP address comprises:
means for randomly hopping from one multicast IP address to another chosen from the set of multicast IP addresses.

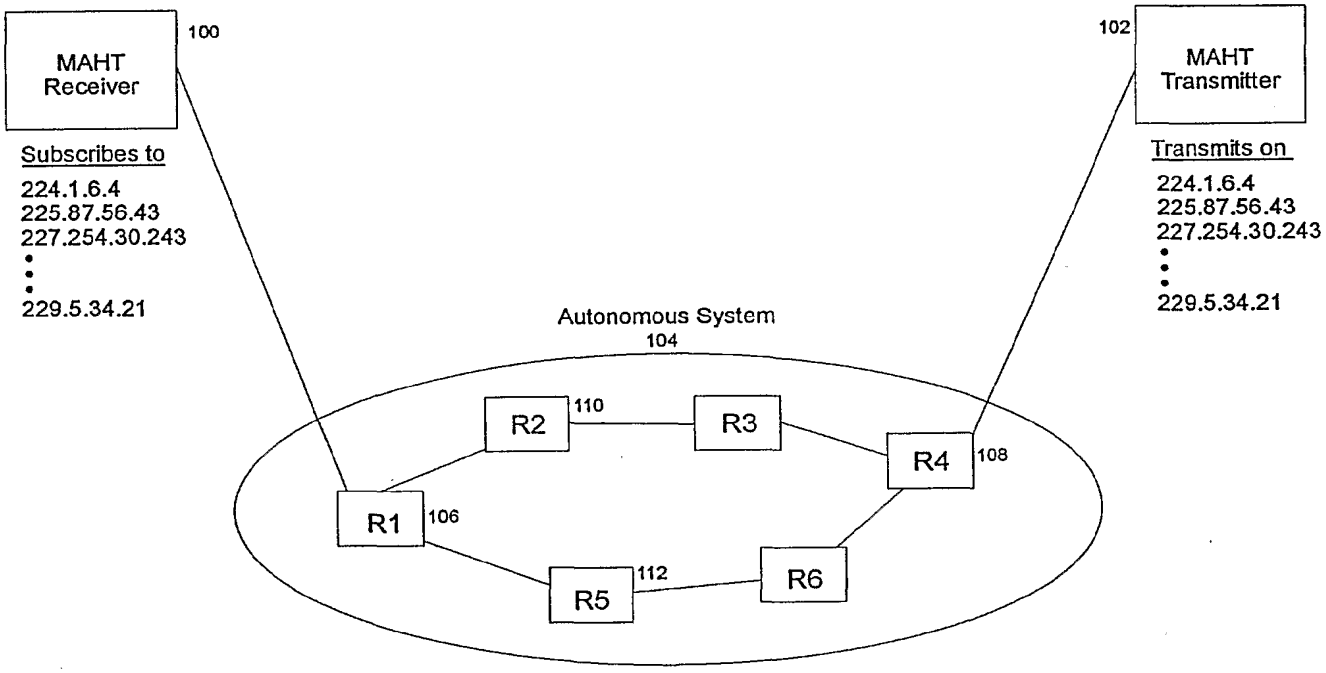
27. The system of claim 22 wherein at least one of the receiving end stations comprises means for isolating the receiving end station from the network for preventing the reception of unicast packets.

28. The system of claim 22 further comprising the step of:
separating according to a data coding scheme combined data from data intended for each receiving end station, at least some of the data being different for different receiving end stations and coded in a portion of said packets for transmission to all receiving stations to obtain the data intended for the receiving end station.

29. The system of claim 28 wherein said data coding scheme is code division multiple access (CDMA) scheme.

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Figure 1



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Figure 2

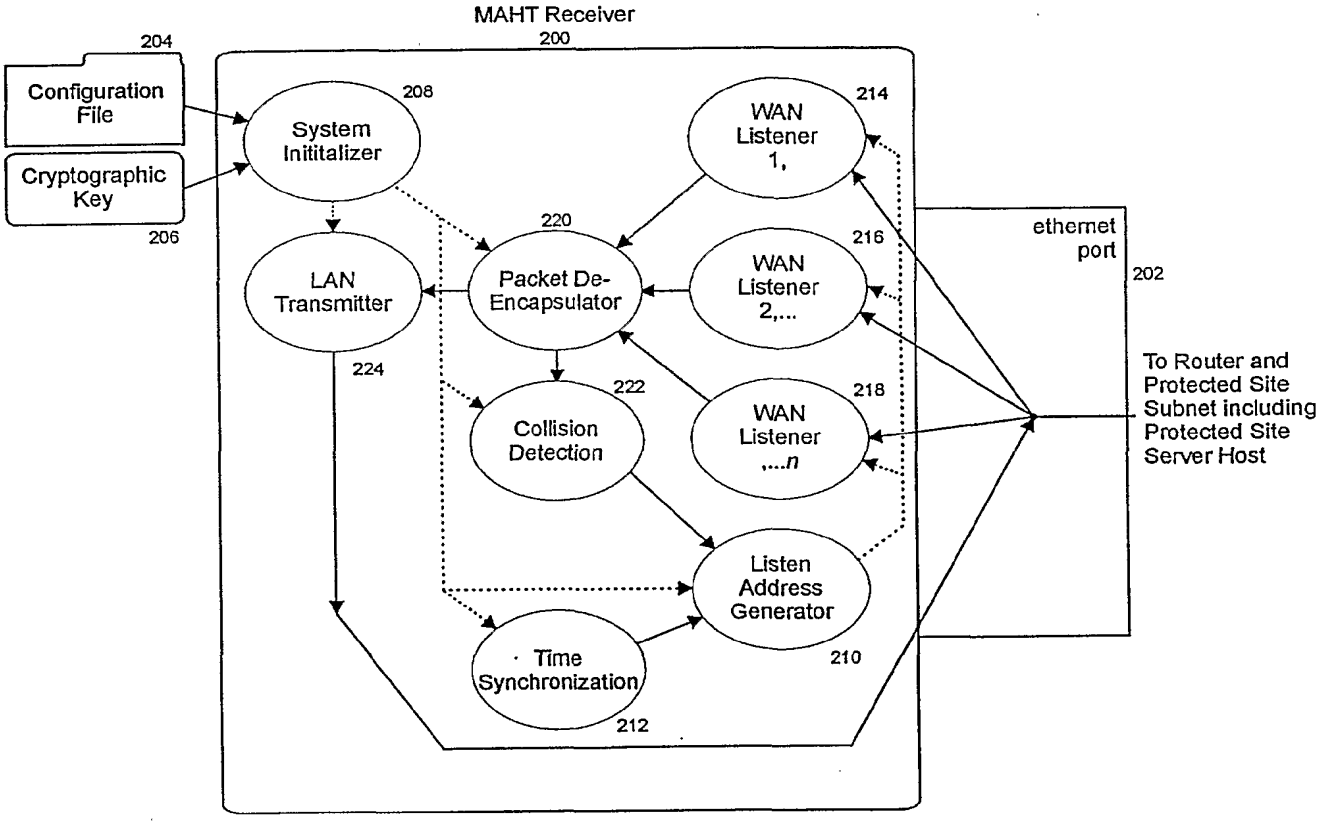

MAHT Receiver
200
204
Configuration File
Cryptographic Key
206
System Inititalizer
208
WAN Listener 1,
214
ethernet port
202
LAN Transmitter
224
Packet De-Encapsulator
220
WAN Listener 2,...
216
To Router and Protected Site Subnet including Protected Site Server Host
Collision Detection
222
WAN Listener ,...n
218
Listen Address Generator
210
Time Synchronization
212

Figure 3

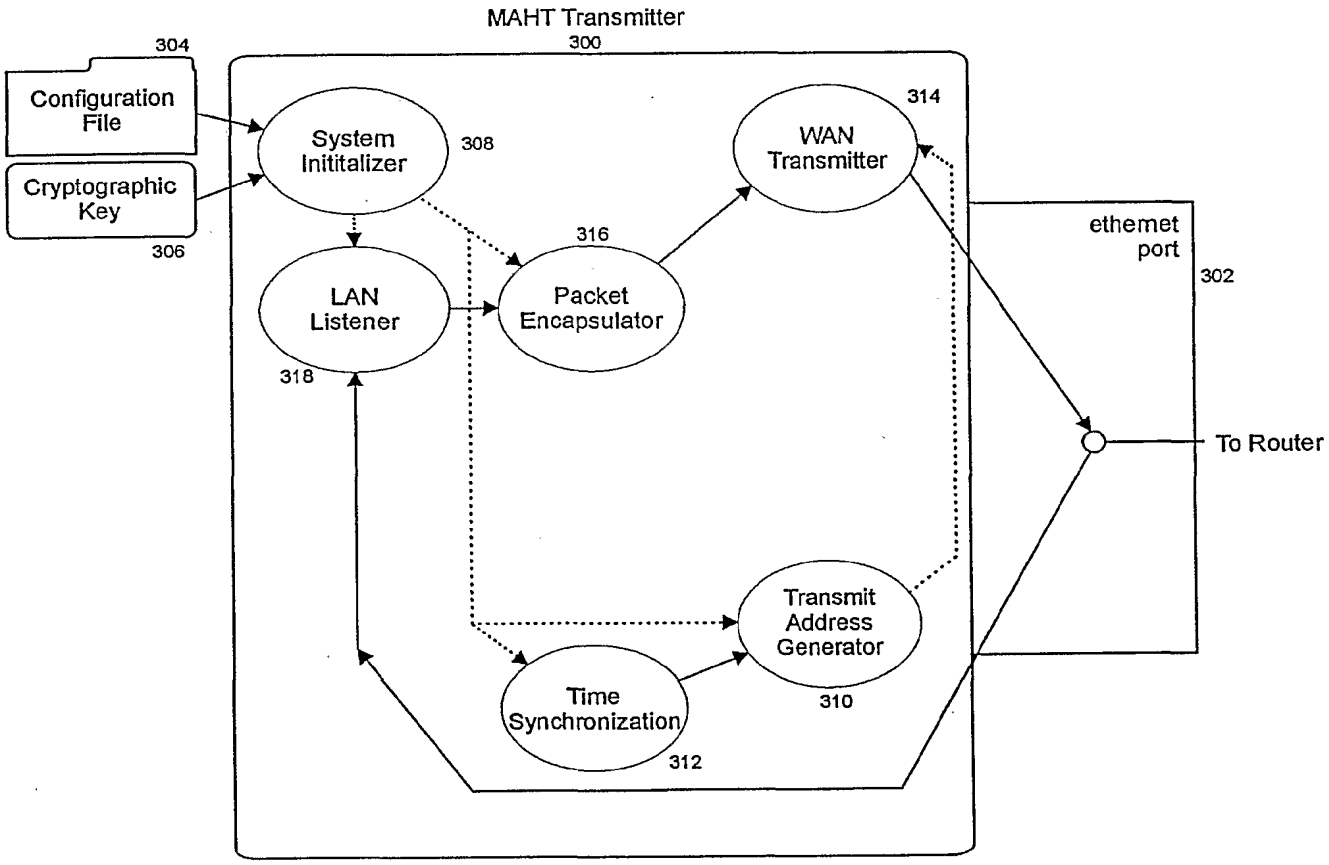

MAHT Transmitter
300
304
Configuration File
Cryptographic Key
306
System Inititalizer
308
WAN Transmitter
314
ethernet port
302
316
LAN Listener
318
Packet Encapsulator
To Router
Transmit Address Generator
310
Time Synchronization
312

Figure 4

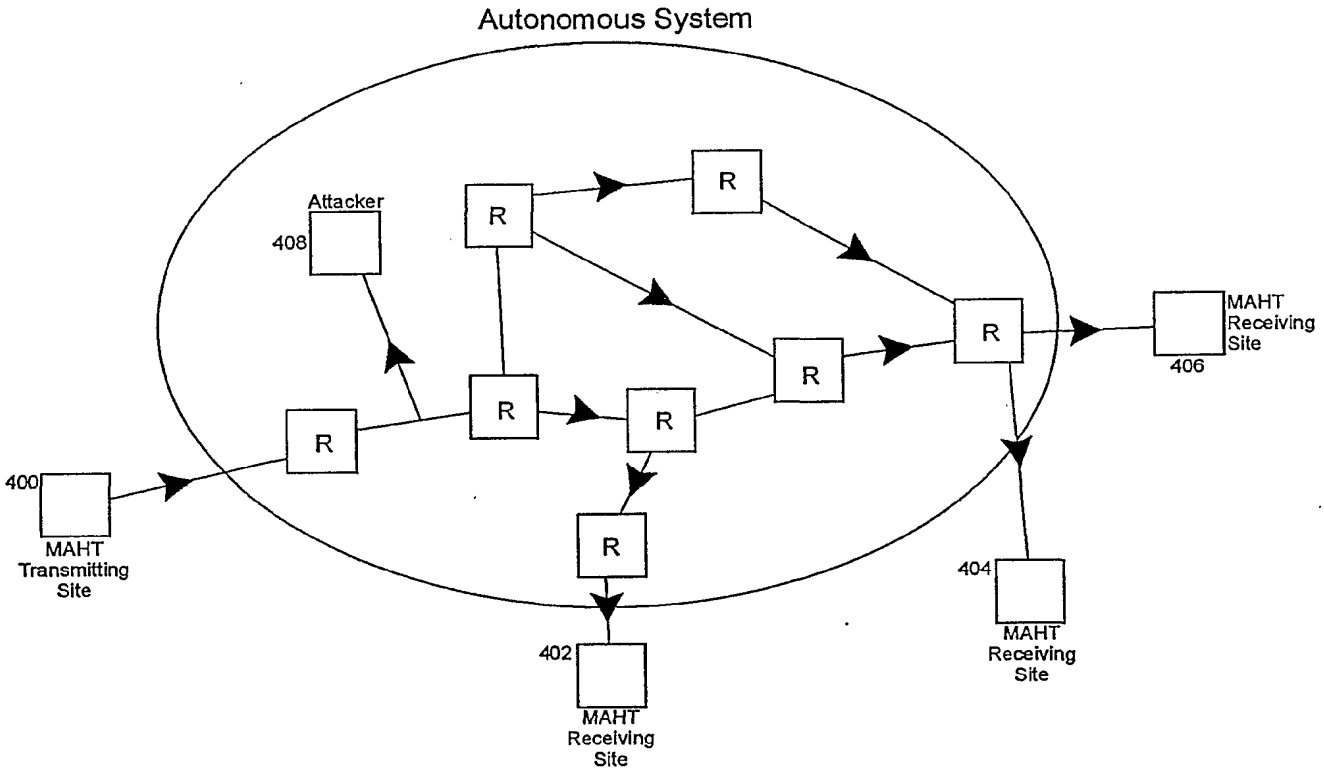

Autonomous System
Attacker
408
R
R
R
R
R
R
R
R
400
MAHT
Transmitting
Site
402
MAHT
Receiving
Site
404
MAHT
Receiving
Site
406
MAHT
Receiving
Site

Figure 5

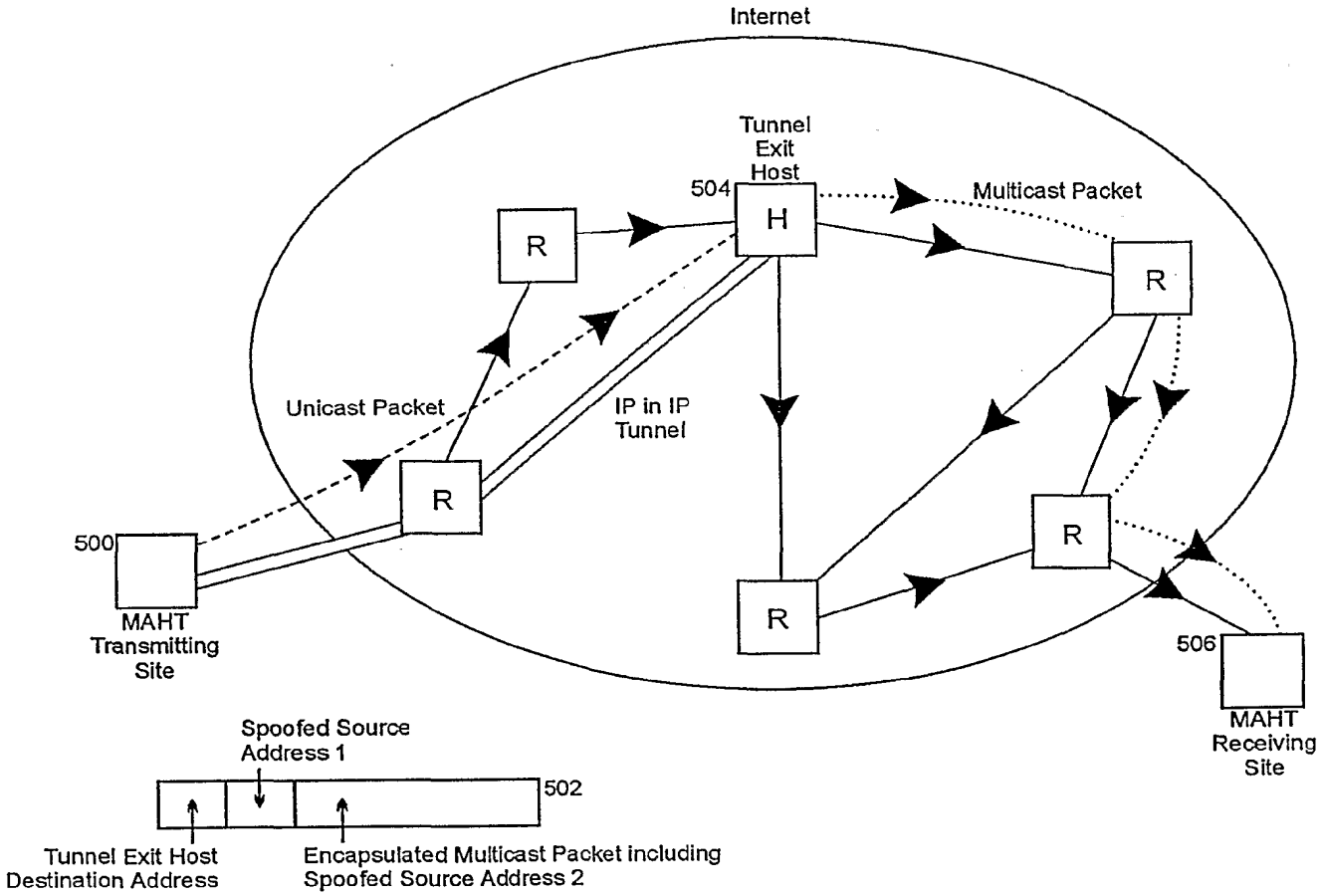

Internet
Tunnel Exit Host
504
H
Multicast Packet
R
R
Unicast Packet
IP in IP Tunnel
R
R
R
500
MAHT Transmitting Site
506
MAHT Receiving Site
Spoofed Source Address 1
502
Tunnel Exit Host Destination Address
Encapsulated Multicast Packet including Spoofed Source Address 2

Figure 6

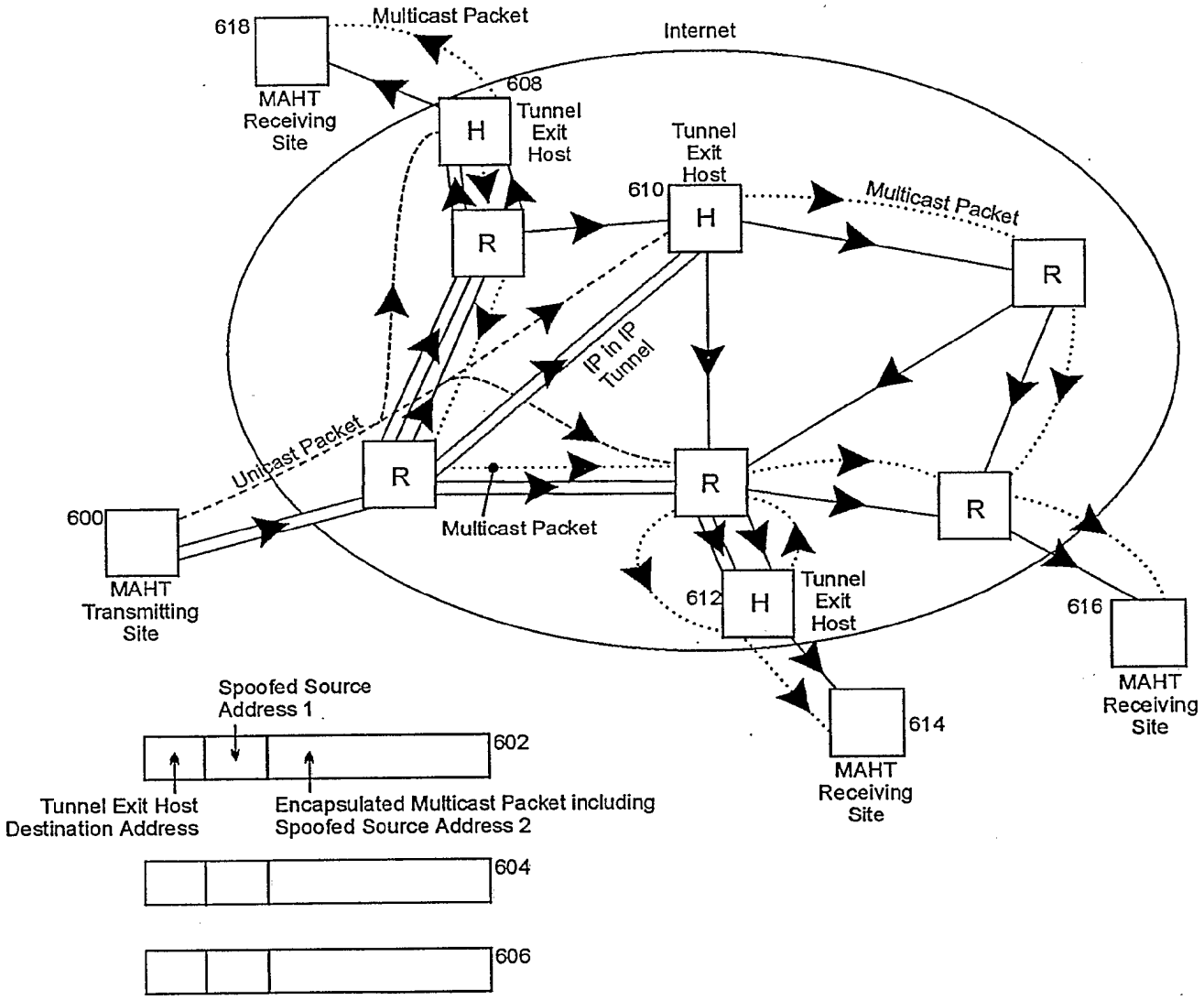

618
Multicast Packet
Internet
MAHT Receiving Site
608
H
Tunnel Exit Host
Tunnel Exit Host
610
H
Multicast Packet
R
R
IP in IP Tunnel
Unicast Packet
R
R
R
600
Multicast Packet
MAHT Transmitting Site
612
H
Tunnel Exit Host
616
MAHT Receiving Site
614
MAHT Receiving Site
Spoofed Source Address 1
602
Tunnel Exit Host Destination Address
Encapsulated Multicast Packet including Spoofed Source Address 2
604
606

Figure 7

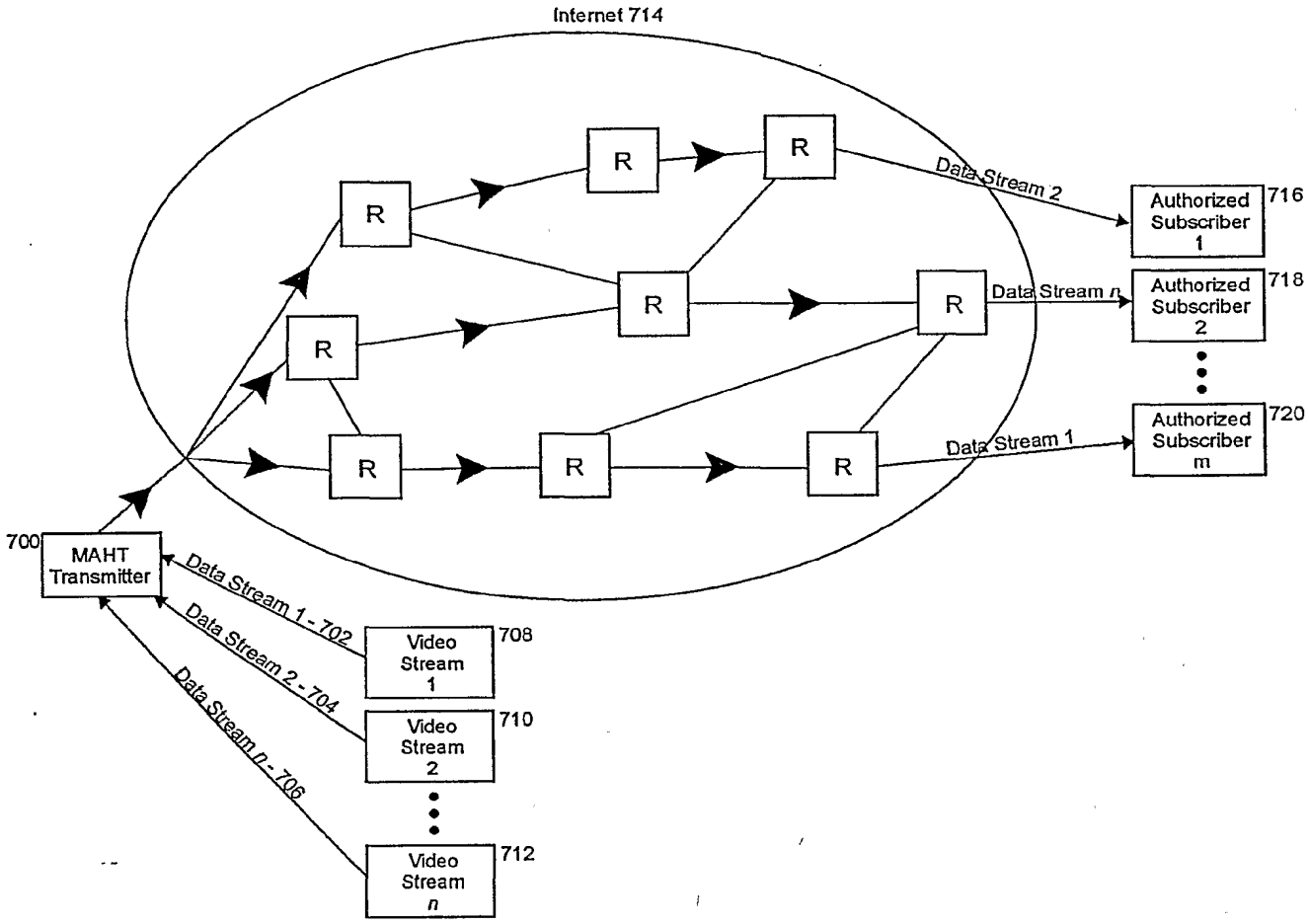

Internet 714
R
Data Stream 2
Authorized Subscriber 1
716
Data Stream n
Authorized Subscriber 2
718
Authorized Subscriber m
720
Data Stream 1
700
MAHT Transmitter
Data Stream 1 - 702
Data Stream 2 - 704
Data Stream n - 706
Video Stream 1
708
Video Stream 2
710
Video Stream n
712

Figure 8

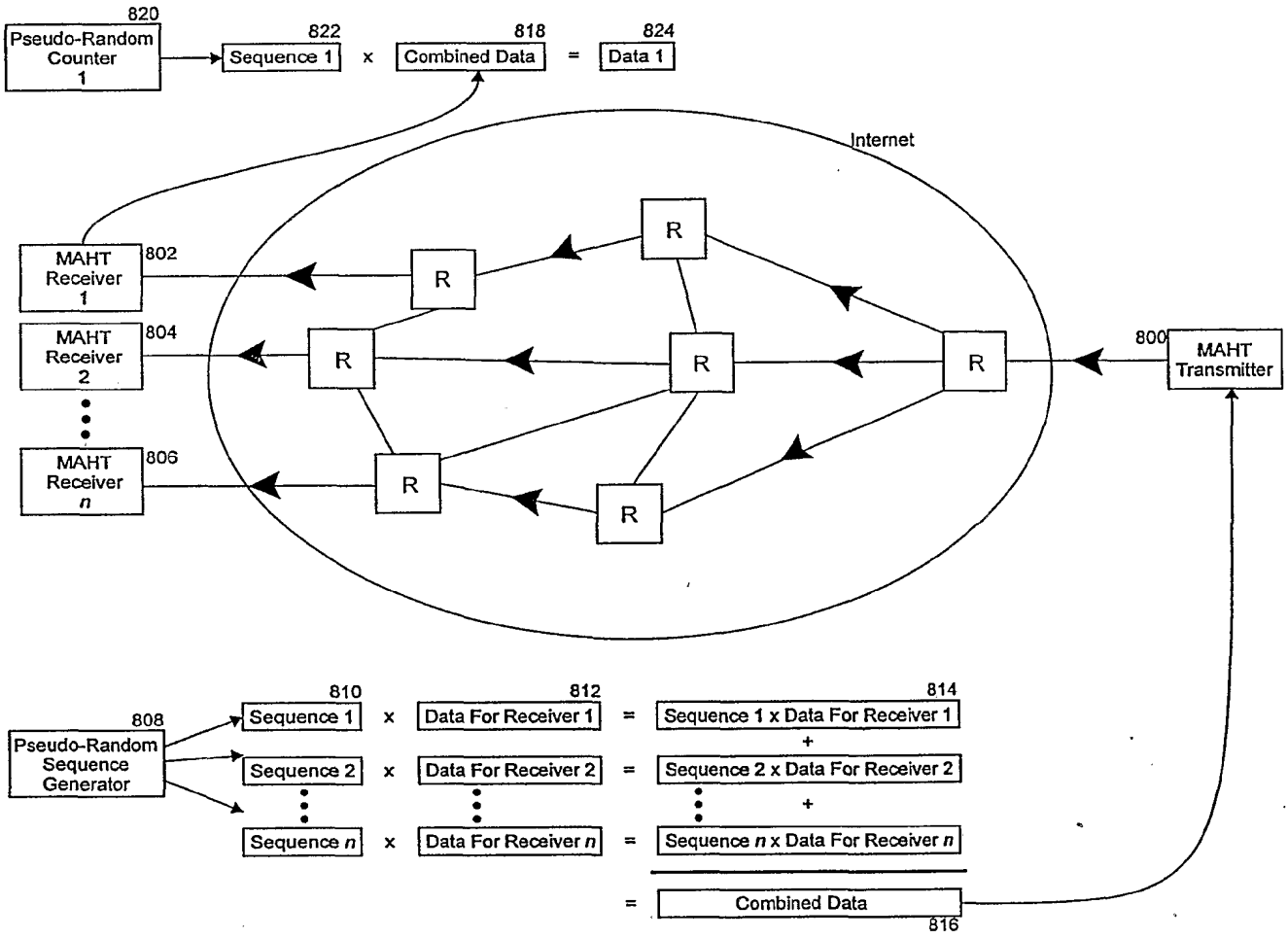
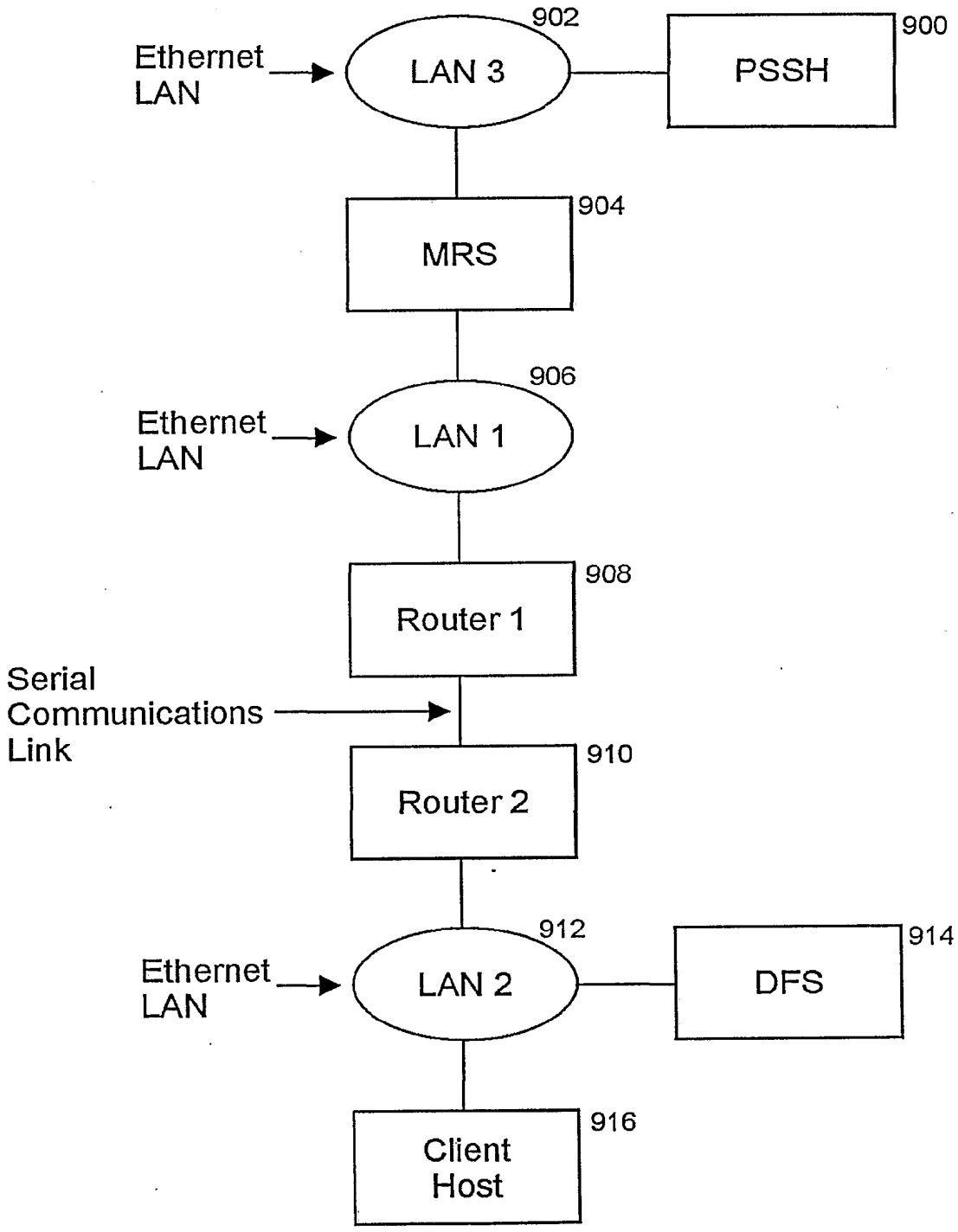

820
Pseudo-Random Counter 1
822
Sequence 1
x
818
Combined Data
=
824
Data 1
Internet
MAHT Receiver 1
802
MAHT Receiver 2
804
MAHT Receiver n
806
R
800
MAHT Transmitter
808
Pseudo-Random Sequence Generator
810
Sequence 1
Sequence 2
Sequence n
812
Data For Receiver 1
Data For Receiver 2
Data For Receiver n
814
Sequence 1 x Data For Receiver 1
Sequence 2 x Data For Receiver 2
Sequence n x Data For Receiver n
+
Combined Data
816

Figure 9


902
900
Ethernet LAN
LAN 3
PSSH
904
MRS
906
Ethernet LAN
LAN 1
908
Router 1
Serial Communications Link
910
Router 2
912
914
Ethernet LAN
LAN 2
DFS
916
Client Host

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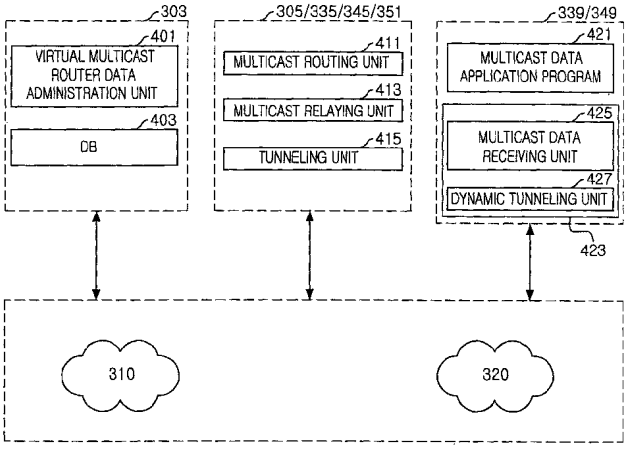
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(54) Title: METHOD AND SYSTEM FOR VIRTUAL MULTICAST NETWORKING



(57) Abstract: Method and system for virtual multicast networking, which can provide multicasting application service on non-multicast network that does not support multicast, are provided. A virtual multicast networking system for providing virtual multicast network on network environment where a multicast data source network to which multicast data source server is connected is linked through backbone network to non-multicast network that does not support multicast and to which a client is connected, the virtual multicast networking system includes: virtual multicast router system, included in the non-multicast network, for routing or relaying multicast data through tunnelling to multicast router or the nearest virtual multicast router system; multicast agent system, mounted on the client, for receiving the multicast data through tunnelling to the nearest virtual multicast router system, and transmitting the received multicast data to application program mounted on the client; and multicast management system, included in the multicast data source network, for managing the IP address of the virtual multicast router system and transmitting the IP address information of the virtual multicast router system to the virtual multicast router system or the multicast agent system.

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METHOD AND SYSTEM FOR VIRTUAL MULTICAST NETWORKING

Technical Field

The present invention relates to a multicasting technology in an Internet broadcasting system; and, more particularly, to a virtual multicast networking method for establishing a multicast network without changing existing routers or switches on the Internet, and a system thereof.

Background Art

Conventional data transmission method on the Internet is peer-to-peer transmission or unicast transmission, in which data are transmitted from one sending end to one receiving end. However, in case where multicast data transmission is performed in the unicasting method to transmit the same data to many receiving ends, there are problems that the server of the sending has a great deal of load, and the bandwidth of the network is occupied inefficiently.

Furthermore, the problems with performing multicast transmission in the unicasting method become more serious, because the next-generation Internet is based on multimedia data transmission, and the volume of multimedia data is very big.

If the problem with the unicasting method is solved, it is possible to broadcast multimedia data stream, such as video and audio data. In short, although a stream of multimedia data is outputted from a sending end, i.e., media server, once through the Internet, the data stream can be transmitted to all the clients (of a multicast group), which are final receiving ends that desire to receive the data stream, selectively, which is multicast technology. When data is transmitted from the sending end,

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each client of the multicast group that desires to receive the data can receive the same duplication of the data.

Multicast technology is a mixture of the advantages of unicasting and broadcasting technologies. It enhances the network efficiency and reduces the confusion of a network. Since it duplicates data and transmits the duplicated data to the receiving ends that desire to receive the data, i.e., ones that belong to the multicast group, it prevents unnecessary data reception. Accordingly, an Internet service provider can convert its network into a multicast network using multicast equipment adopting the multicasting technology.

On a multicast network, broadcast data can be transmitted as many as the bandwidth allows on the network, no matter how many clients are connected thereto. For instance, if the allowed bandwidth of a cable TV network is 30Mbps, 30 one-Mbps broadcast data or 60 500-Kbps broadcast data can be transmitted.

Despite the advantages of multicasting technology, there are many restrictions in converting the existing Internet into a multicast network. For instance, networking equipment that constitutes the Internet does not support the multicasting function, and it costs a lot of money to substitute the equipment with multicast-supporting equipment.

Fig. 1 is a diagram showing a conventional multicast network using a static tunneling technique. So far, to support the multicasting function, all the routers between the media server 101, i.e., sending end, and the clients 103, i.e., the final receiving ends should support the multicasting technology. So, if there are networks 105 and 107 that do not support the multicasting function in between, tunneling method should be used.

According to the conventional tunneling method, when a router 105 between the sending end and the receiving end

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does not support the multicast function, a virtual path is formed between multicast-supporting routers 109 to exchange multicast data, and the router 105 that does not support the multicasting function simply relay the multicast data. Between the multicast-supporting routers 109 connected through the tunneling method, the multicast data is encapsulated in the form of a unicast IP packet and transmitted to the encapsulated multicast data by adding a header containing a tunnel source address and a tunnel destination address. So, it has no problem to pass the router 105 that does not support the multicasting function.

The conventional tunneling method is a static technique, so the multicasting function should be set up in the router 109 manually. Accordingly, the router 109 on the part of the media server 101, the sending end, and the router 109 on the part of the client 103 that requires multicasting should be set up with the multicasting function, which acts as a big burden for the Internet service provider, because it should respond to every request for multicast setup from a plurality of clients 103 that desire to receive multicast data.

Furthermore, recent increasing demand for establishing a home network leads to increasing request for multicast service. However, since most clients 103 use flexible IP addresses, it is impossible to establish a multicast network using a static tunneling method. In short, a fixed IP address is needed in order to set up the multicasting function in a router and perform static tunneling, but if a client has a flexible IP address, the multicasting function cannot be set up in the router.

Fig. 2 is a diagram illustrating a conventional multicast network using a peer-to peer (P2P) transmission technique. Since it becomes hard to modify the scheme of a router, a multicast method is developed recently that makes other clients receive data by making a client, which has

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received the data from the sending end in the unicasting method, upload the received data on the Internet and relay the data to other clients.

According to the multicasting method, a client 213 receives data from the data transmission server 207 of a network 201 having a data source 205 in the unicasting method, and the client 213 uploads the received data on the network 203, to which it belongs, and then other clients 215 and 217 on the network receive the data from the client 213.

In short, when a client of a network receives data, the client performs as a repeater and thereby other client on the same network can receive the data.

As networks are mainly formed of routers and many routers and switches support the multicasting function recently, using the routers to the maximum extent makes it easy to administrate the network and reduces errors. However, this multicasting method also have a problem that the performance is deteriorated due to the limit in the upload speed on an asymmetric network, such as xDSL or cable network.

Disclosure of Invention

It is, therefore, an object of the present invention to provide a method and system for virtual multicast networking that can make clients receive multicast data even on a network that does not support multicasting function, without substituting or modifying networking equipment.

Those skilled in the art of this invention may understand the other objects and advantages of the present invention easily from the drawings, detailed description, and claims of this specification.

In accordance with one aspect of the present invention,

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there is provided a virtual multicast networking system including a client and a multicast source network having a multicast source server, for providing a virtual multicast network in a network environment wherein a non-multicast network that does not support a multicast function is connected through a backbone network, the virtual multicast networking system comprising: a virtual multicast router system included in the non-multicast network, for transmitting or relaying encapsulated multicast data through tunneling with a multicast router or the nearest virtual multicast router system; a multicast agent system loaded on the client, for receiving the encapsulated multicast data through dynamic tunneling with the nearest virtual multicast router system, extracting the multicast data transmitted by the multicast source server from the encapsulated multicast data, and transmitting the extracted multicast data to an application program loaded on the client; and a multicast administration system included in the multicast source network, for managing the IP addresses of the virtual multicast router system, and transmitting the address information of the virtual multicast router system to the virtual multicast router system or the multicast agent system.

In accordance with another aspect of the present invention, there is provided a method for performing virtual multicast networking in a virtual multicast networking system, the method comprising the steps of: a) at a virtual multicast router system included in the non-multicast network, transmitting or relaying encapsulated multicast data through tunneling with a multicast router or the nearest virtual multicast router system; b) at a multicast agent system loaded on the client, receiving the encapsulated multicast data through dynamic tunneling with the nearest virtual multicast router system, extracting the multicast data transmitted from the multicast source server

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from the received encapsulated multicast data, and transmitting the extracted multicast data to an application program loaded on the client; and c) at a multicast administration system included in the multicast source network, managing the IP addresses of the virtual multicast router system, and transmitting the address information of the virtual multicast router system to the virtual multicast router system or the multicast agent system.

In accordance with further anther aspect of the present invention, there is provided a virtual multicast networking system including a client and a multicast source network having a multicast source server, for providing a virtual multicast network in a network environment wherein a non-multicast network that does not support a multicast function is connected through a backbone network, the virtual multicast networking system comprising: a virtual multicast router system included in the non-multicast network, for transmitting or relaying encapsulated multicast data through tunneling with a multicast router or the nearest virtual multicast router system; and a multicast agent system loaded on the client, for receiving the encapsulated multicast data through dynamic tunneling with the nearest virtual multicast router system, extracting the multicast data transmitted from the multicast source server from the encapsulated multicast data, and transmitting the extracted multicast data to an application program loaded on the client.

According to this invention, it is possible to provide multicast service on a network that does not support multicasting function. A networking system in accordance with the embodiment of the present invention includes a multicast administration server, a virtual multicast router and a multicast agent.

The multicast administration server administrates IP addresses of the respective multicast routers, and the

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addresses are used for the multicast administration server to search for an arbitrary virtual multicast router or a virtual multicast router closest to the multicast agent. The IP address of a virtual multicast router searched out later is cached in the multicast administration server for quick search.

The virtual multicast router performs multicast routing, and transmits multicast data to users on a network that does not support multicasting.

The virtual multicast router can be connected to another virtual multicast router through dynamic tunneling. Accordingly, a virtual multicast network can be established on a network that does not support multicasting, without any separate setup in the network scheme.

According to the embodiment of the present invention, a multicast agent is set up in the client to transmit and receive multicast data through the virtual multicast router.

Brief Description of Drawings

The above and other objects and features of the present invention will become apparent from the following description of the preferred embodiments given in conjunction with the accompanying drawings, in which:

Fig. 1 is a diagram illustrating a multicast network to which a conventional static tunneling is applied;

Fig. 2 is a diagram showing a multicast network to which a conventional peer-to-peer transmission technique is applied;

Fig. 3 is a diagram describing a virtual multicast network in accordance with a first embodiment of the present invention;

Fig. 4 is a block diagram showing the system of the virtual multicast network of Fig. 3 in accordance with the first embodiment of the present invention;

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Fig. 5 is a transaction flow chart describing the dynamic tunneling between the multicast routers in accordance with the first embodiment of the present invention;

Fig. 6 is a transaction flow chart describing a multicast agent receiving the multicast data in accordance with the first embodiment of the present invention; and

Fig. 7 is a diagram showing the process of a multicast agent or a virtual multicast router searching for the nearest virtual multicast router in accordance with a second embodiment of the present invention.

Best Mode for Carrying Out the Invention

Other objects and aspects of the invention will become apparent from the following description of the embodiments with reference to the accompanying drawings, which is set forth hereinafter. The same reference numerals in different drawings represent the same elements, and thus their descriptions will be omitted. While describing this invention, if more concrete description of the related arts is considered to blur the point of this invention, the description will be omitted.

An asymmetric digital subscriber line (ADSL) network illustrated in the drawings to describe an embodiment of the present invention is a network that does not support multicasting. It is obvious to those skilled in the art of this invention that the ADSL network as shown in the drawings can be variously changed into another form of a network that does not support multicasting, either, such as integrated services digital network (ISDN), cable network, and radio network. Therefore, this invention should be construed not limited to the ADSL network illustrated in the drawings.

Fig. 3 is a diagram describing a virtual multicast

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network in accordance with a first embodiment of the present invention. As illustrated in the drawing, the application environment of the virtual multicast networking method and system of the present invention includes a multicast source network 300 connected to a backbone network 310 in support of the multicasting function or a backbone network 320 that does not support the multicasting function.

The multicast source network 300 includes a multicast source, which is a media server 301, a multicast administration server 303, a virtual multicast router 305, and a multicast router 307. In case where a backbone network supports the multicasting function, the multicast router 307 operates to connect the multicast source network 300 to the backbone network 310 in support of the multicasting function. On the other hand, the virtual multicast router 305 operates to connect the multicast source network 300 to the backbone network 320 that does not support the multicasting function, in case where a backbone network supports the multicasting function. Accordingly, it is obvious to those skilled in the art that the virtual multicast router 305 and/or the multicast router 307 may be set up together or separately, according to the environment of a backbone network connected with the multicast source network 300.

The multicast administration server 303 administrates the IP addresses of virtual multicast routers. Later, the multicast administration server 303 searches the IP addresses of all virtual multicast routers to find out the nearest virtual multicast router.

In case of the backbone network 310 supporting the multicast function, the virtual multicast router can be set up on an xDSL network, or in a home gateway of a home network.

In case of the backbone network 320 not supporting the

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multicast function, the virtual multicast router can be set up on the multicast source network 300 and the xDSL network to form a multicast network through dynamic tunneling.

In short, the virtual multicast networking in accordance with the present invention can be formed in two different environments, and in an environment combining the two environments.

First, there is a case where the multicast-supporting backbone network 310 is connected to a non-multicast network—for example, an ADSL network 330—through a non-multicast router 331. Most ADSL networks do not support the multicasting function.

The ADSL network 330 includes a virtual multicast router 335 of the present invention, and a plurality of clients 339 are connected to an ADSL network 330 through an ADSL server (b-RAS) 333 and ADSL service device (DSLAM) 337. That is, in accordance with the embodiment of the present invention, the virtual multicast router 335 is set up on a sub network, such as b-RAS 333 that forms the ADSL network 330, to support multicasting.

The multicast router included in the multicast source network 300 and the virtual multicast router in the ADSL network 330 transmits and receives multicast data through static tunneling. For static tunneling, an IP tunneling technique may be used, and as multicast routing protocol, protocol independent multicast-sparse mode (PIM-SM), distance vector multicast routing protocol (DVMRP), or source specific multicast (SSM) can be used. To perform the static tunneling, tunneling setup data is set up in advance in the configuration file of the routers 307 and 335.

To receive multicast data transmitted from the multicast source network 300, the clients 339 searches for the nearest virtual multicast router 335 from the multicast administration server 303, and then registers the address

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of the nearest virtual multicast router 335 in the multicast group (Dynamic tunneling).

When the virtual multicast router 335 receives data heading for the addresses of the multicast group, it encapsulates the data and transmits the encapsulated data to the multicast agent of the registered clients 339 through the path set up by the tunneling method. The multicast agent removes the header containing the tunnel source address and the tunnel destination address from the encapsulated multicast data, and then transmits the multicast data to an application program set up in the clients 339.

The tunneling between the virtual multicast router 335 and the multicast agents of the clients registered in the multicast group, and the method of data transmission through a path set up by the tunneling are various based on the environment of networks, to which the virtual multicast router receiving the multicast data or the multicast agent belongs to. For example, a tunneling set up from the virtual multicast router 335 to a virtual multicast router of a non-multicast network or a multicast agent may be IP tunneling, UDP tunneling, or TCP tunneling. The method of data transmission through a path set up by this tunneling method may be IP multicast transmission or UDP/TCP unicast transmission. In case where the virtual multicast router or multicast agent is in a network address translator (NAT) or firewall environment, multicast data are transmitted by the TCP tunneling, and in other cases, they are transmitted by the UDP tunneling.

Second, there is a case where the non-multicast backbone network 320 is connected to a non-multicast network—for example, an ADSL network 340—through a non-multicast router 341. The ADSL network 340 includes a virtual multicast router 34 of the present invention, and a plurality of clients 349 are connected to the ADSL network

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340 through the ADSL server (b-RAS) 343 and ADSL service device (DSLAM) 347. That is, in accordance with the first embodiment of the present invention, the virtual multicast router 345 is set up on a sub network, such as b-RAS 343 that forms the ADSL network 340, to support the multicast.

A home network 350 includes a home network gateway 351 connected to the non-multicast router 341, a TV set 353, which is a home network client, a desktop computer 355, a video camera 357, and a laptop computer 359.

The virtual multicast router of the present invention can be used as an exclusive hardware system that performs the role of a multicast router in a non-multicast network, such as xDSL, or a server software in the home network gateway 351 needed to establish a home network.

The virtual multicast router 345 or 351 sets up a data path with the virtual multicast router 305 included in the multicast source network 300 by performing dynamic tunneling to form a virtual multicast network. Also, the dynamic tunneling is carried out between the virtual multicast routers 345 and 351, too, to provide multicast service to the home network environment 350.

When the virtual multicast router 345 or 351 receives multicast data from the multicast source network 300, it transmits the multicast data to the clients 349, 355, and 359 registered in the multicast group.

Third, there is a case where the non-multicast backbone network 320 is connected to a multicast-supporting network through the virtual multicast router of the present invention (not shown). In this case, the virtual multicast router sets up a data path with the virtual multicast router 305 in the multicast source network 300 by performing dynamic tunneling. The router and clients on a multicast-supporting network can receive data transmitted in a multicast method from the virtual multicast router that are connected with a backbone network and has a path

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that leads to the virtual multicast router 305, the path being set up in the dynamic tunneling method. For instance, the router and clients of a multicast-supporting network receives data transmitted in the IP multicasting method from the virtual multicast router that are connected with a backbone network and has a path that leads to the virtual multicast router 305, the path being set up in the dynamic tunneling method.

In short, the virtual multicast router of the present invention can set up a data transmission path by performing tunneling in various methods according to the environment of its sub-network, and on the other hand, it can also transmit encapsulated data to the virtual multicast router or multicast agent in various data transmission methods.

Fig. 4 is a block diagram showing the system of the virtual multicast network of Fig. 3. In accordance with the first embodiment of the present invention, the multicast networking system includes the multicast administration server 303, virtual multicast router 305, 335, 345, and 351, and multicast agent 423.

The multicast administration server 303 includes a virtual multicast router data administration unit 401 and a database 403. The virtual multicast router data administration unit 401 administrates the IP address of the virtual multicast router, and upon receipt of a request for searching IP addresses of the virtual multicast routers 305, 335, 345, and 351 transmitted from a multicast agent 423 or the virtual multicast routers 305, 335, 345, and 351, it refers to the IP addresses of the virtual multicast routers stored in the database 403, and searches for the nearest virtual multicast router 305, 335, 345, or 351 from the virtual multicast routers 305, 335, 345, and 351. The search result is transmitted to a corresponding multicast agent 423 or the virtual multicast routers 305, 335, 345, and 351.

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In general, since the multicast agent 423 of the clients and the virtual multicast routers 305, 335, 345, and 351 search for the nearest virtual multicast router 305, 335, 345, or 351 by calculating hop counters, the nearest virtual multicast router 305, 335, 345, or 351 is always the same. In this case, it takes very long time to set up a path and, the bandwidth of the network is wasted due to unnecessary data transmission, because IP addresses of all the virtual multicast routers should be transmitted from the multicast administration server 303 and then the nearest virtual multicast router should be searched for to set up a path every time.

To perform searching and set up a path quickly, the multicast administration server 303 forms a caching table of the IP addresses and network addresses of the multicast agent 423 which has requested searching or virtual multicast routers 305, 335, 345, and 351, and the IP address of a virtual multicast router that is searched out to be the nearest one from the multicast agent 423 or virtual multicast routers 305, 335, 345, and 351, and store the caching table in the database 403. The caching table reduces time for setting up a path of the multicast agent 423 or virtual multicast routers 305, 335, 345, and 351 through dynamic tunneling by performing quick searching, and prevents unnecessary data transmission.

The virtual multicast routers 305, 335, 345, and 351 includes a tunneling unit 415 for performing static and/or dynamic tunneling between general multicast routers or virtual multicast routers, a multicast routing unit 411, and a multicast relaying unit 413.

The virtual multicast routers 305, 335, 345 can be formed as an exclusive hardware virtual multicast router that can embody multicast networking with respect to a non-multicast network 330, 340, or 350, or in the home networking environment, it can be embodied as a software

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that enables multicast networking and installed in a home network gateway and a router of a non-multicast network.

The virtual multicast router of the present invention sets up a data transmission path by performing tunneling in various methods, such as IP tunneling, UDP tunneling, and TCP tunneling according to the environment of its sub-network, and it also transmits encapsulated data to the virtual multicast router of the sub-network or multicast agent in diverse data transmission methods, such as IP multicast transmission, and UDP/TCP unicast transmission.

For example, tunneling from the virtual multicast router 335 to the virtual multicast router of a non-multicast network or the multicast agent can be IP tunneling, UDP tunneling, or TCP tunneling, and the data transmission method through a path set up by this tunneling can be the IP multicast transmission, or UDP/TCP unicast transmission.

Meanwhile, in case where a multicast-supporting network is connected to the non-multicast backbone network 320 through the virtual multicast router of the present invention, the virtual multicast router sets up a data path with the virtual multicast router 305 on the multicast source network 300 by performing the dynamic tunneling to form a virtual multicast network, and the router and clients on the multicast-supporting network can receive data in the IP multicast data transmission method from the virtual multicast router, which is connected with the backbone network, and has a path set up with the virtual multicast router 305 by performing dynamic tunneling.

Static tunneling performed by the tunneling unit 415 is a method used between the multicast router 307 and the virtual multicast routers 305, 335, 345, or 351. As described above, the multicast router 307 on the multicast source network 300 and the virtual multicast router 335 on the ADSL network 330 transmits and receives multicast data

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through the static tunneling. As a static tunneling, the IP tunneling method can be used. For performing the static tunneling, tunneling setup data are stored in the configuration file of the routers 307 and 335 in advance.

Also, dynamic tunneling performed by the tunneling unit 415 is a method used between a virtual multicast router and a virtual multicast router—for example, between the virtual multicast routers 305 and 345, or between the virtual multicast routers 345 and 351. In the dynamic tunneling, the IP tunneling method can be used, too, just as the static tunneling, and UDP tunneling and TCP tunneling methods can be used as well. Different from static tunneling, the dynamic tunneling is performed dynamically on the request of the virtual multicast router, and the removal of the tunneling is carried out dynamically, too.

Meanwhile, the virtual multicast routers 305, 335, 345, or 351 perform different functions depending on the presence of a multicast router on the sub-network it belongs to. That is, the virtual multicast routers 305, 335, 345, and 351 examine if there is a multicast router on the sub-network it belongs to, and if there is a multicast router, it does not perform the role of a multicast router, but simply performs the role of a multicast repeater. If there is no multicast router after searching, it performs the roles of a multicast router and multicast repeater simultaneously. Therefore, in accordance with the first embodiment of the present embodiment, the virtual multicast routers 305, 335, 345, and 351 are activated to operate as the multicast routing unit 411 and/or multicast repeater 413, which will be described later, selectively depending on the environment of the sub-network it belongs to.

The multicast routing unit 411 that performs as a multicast router routes multicast data, using standard multicast routing protocol, which is Protocol Independent

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Multicast-Sparse Mode (PIM-SM), Distance Vector Multicast Routing Protocol (DVMRP), or Source Specific Multicast (SSM).

The multicast repeater 413 receives multicast data and transmits them to the clients 339, 349, 353, and 359 with a network in the non-multicast network environments 330, 340, and 350. The multicast repeater 413 administrates the joining and secession to and from a particular multicast group.

Membership information is registered, when the clients 339, 349, 353 and 359 transmit the multicast address and port number of a multicast group they want to join, after the virtual multicast router or multicast agent sets up a path with another virtual multicast router through dynamic tunneling. The membership information includes the addresses of the clients in the multicast group, port number of the multicast group, and address of a multicast agent or virtual multicast router registered in the multicast group.

When the clients 339, 349, 353, and 359 are registered in a particular multicast group, and then the virtual multicast routers 305, 335, 345, and 351 receive multicast data to be transmitted to the clients 339, 349, 353, and 359 of the multicast group, the received data are encapsulated and transmitted to the multicast agent mounted on the clients 339, 349, 353, and 359 of the multicast group, or another virtual multicast router.

In case where the network including the virtual multicast routers 305, 335, 345, and 351 supports broadcasting or unicasting only, the Internet group management protocol (IGMP) snooping of the L2 switch can be emulated.

IGMP Snooping is a well-known technology that makes a switch transmit multicast traffics intelligently. Based on the IGMP query and report message, a switch transmits

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traffics only to the ports that have requested multicast. This method prevents the switch from broadcast traffics and affecting the performance of the network. IGMP needs a router that can figure out if a multicast group exists on the sub-network, and administrates the membership of the group.

The multicast agent 423 is a system mounted on the client to receive multicast data. It includes a dynamic tunneling unit 427 for performing dynamic tunneling to set up a path with the multicast data receiving unit 425 and thus receive multicast data on a non-multicast network 330, 340, or 350.

The dynamic tunneling unit 427 requires the IP address of a virtual multicast router nearest to the multicast administration server 303. If the IP address of the nearest virtual multicast router is informed by the multicast administration server 303, the dynamic tunneling unit 427 sets up a path by performing dynamic tunneling. Otherwise, it brings the IP addresses of all virtual multicast routers, and then searches for the nearest virtual multicast router based on the IP addresses. The dynamic tunneling unit 427 calculates the hop counters of the IP addresses, and searches for the nearest virtual multicast router. That is, a virtual multicast router with an IP address having the smallest hop counter is considered to be in the nearest location.

After finding the nearest virtual multicast router, the multicast agent 423 requests it to join the multicast group. If the request is accepted, the multicast agent 423 can receive multicast data from the moment. When the multicast agent 423 receives multicast data through the multicast data receiving unit 425, it resets Time to Live (TTL) at 0, using the IP multicast inside the client, and performs multicast again, and then the multicast application program receives multicast data.

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Fig. 5 is a transaction flow chart describing the dynamic tunneling between the multicast routers in accordance with the first embodiment of the present invention. The process of dynamic tunneling of each virtual multicast router 305, 335, 345, or 351 is as follows.

At step S501, a first virtual multicast router 501 requests data of the nearest virtual multicast router, i.e., its IP address, to the multicast administration server 303, the IP address of the first virtual multicast router 501 already registered in the multicast administration server 303. At step S503, the multicast administration server 303 searches the virtual multicast router caching data stored in the database 403, and then at step S505, if there are data on the nearest multicast router, it transmits the data, otherwise, transmits data on all virtual multicast routers.

At step S507, the first virtual multicast router 501 that has received the router data from the multicast administration server 303 determines whether the received data is on the nearest virtual multicast router, that is, whether the data is about one single virtual multicast router, and at step S515, if the router data proves to be the nearest virtual multicast router, it requests dynamic tunneling to the nearest virtual multicast router, i.e., a second virtual multicast router 503. In case where the received data at the step S507 are not data on one virtual multicast router, but on all virtual multicast routers, at step S509, it acquires data on the nearest virtual multicast router from the received data on all virtual multicast routers by calculating hop counter, as described above.

The data on the nearest virtual multicast router is obtained from the above received data on all virtual multicast routers by calculating hop counter, because the first virtual multicast router 501 has never transmitted

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the data on the nearest virtual multicast router to the multicast administration server 303 before. Therefore, once the first multicast router 501 calculates hop counters and obtains data on the nearest virtual multicast router 503, at step S511, it transmits the data on the nearest virtual multicast router to the multicast administration server 303, and at step S513, the multicast administration server 303 updates the caching table of virtual multicast router IP addresses stored in the database 403. Later on, if the data on the nearest virtual multicast router is requested again from the first virtual multicast router 501, the multicast administration server 303 transmits the data on the nearest virtual multicast router based on the updated caching table.

Meanwhile, at step S515, the first virtual multicast router 501 that has obtained data on the nearest virtual multicast router 503 at the step S509 requests dynamic tunneling to the second virtual multicast router 503. The request for dynamic tunneling includes the IP address of the first virtual multicast router 501 as a destination address of the multicast data, which is used to encapsulate the multicast data.

At step S517, the second virtual multicast router 503 performs setting for dynamic tunneling, taking its IP address as a transmission source (tunnel source) address of encapsulated multicast data, and the IP address of the first virtual multicast router 501 as the destination (tunnel destination) address of the encapsulated multicast data. Then, at step S519, if the acknowledgement for the dynamic tunneling request is transmitted to the first virtual multicast router 501, at step S521, a path is set up between the first virtual multicast router 501 and the second virtual multicast router 503 by performing dynamic tunneling. That is, going through the flow illustrated in Fig. 5, the virtual multicast router performs dynamic

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tunneling with the nearest virtual multicast router among other virtual multicast routers, and a multicast tree is formed by the multicast tree forming algorithm of the PIM-SM, DVMRP, or SSM.

Fig. 6 is a transaction flow chart describing the multicast data reception of a multicast agent in accordance with the first embodiment of the present invention. It is assumed that a path is already set up between the virtual multicast router 501 of the network 330, 340, or 350, to which the multicast agent 423 belongs and the multicast source server 301, and this assumption can be expected from the logic flow illustrated in Fig. 5 sufficiently.

At step S601, when the IP address of the multicast agent 423 is registered in the multicast administration server 303, the multicast agent 423 requests the multicast administration server 303 for data on the nearest virtual multicast router, that is, IP address. At step S603, the multicast administration server 303 searches virtual multicast router caching data stored in the database 403, and if there is registered data on the nearest multicast router, transmits the data, and otherwise, if there is no registered data on it, at step S605, the multicast administration server 303 transmits data on all virtual multicast routers.

At step S607, the multicast agent 423 which has received data on a router from the multicast administration server 303 determines whether the received data are data on the nearest virtual multicast router, that is, the data is about one virtual multicast router, if the data is about the nearest virtual multicast router, at step S615, it requests the nearest virtual multicast router, for example a virtual multicast router 501, to join the multicast group.

Otherwise, if the data received at the step S607 are about all virtual multicast routers, at step S609, it obtains data on the nearest virtual multicast router from

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the received data on all virtual multicast router addresses. By calculating hop counters of all the virtual multicast routers, the data on the nearest virtual multicast router can be obtained.

Since the multicast agent 423 has not transmitted any data on the nearest virtual multicast router to the multicast administration server 303 before, it is possible for the multicast agent 423 to obtain data on the nearest virtual multicast router by calculating the hop counters. Accordingly, at step S611, once the multicast agent obtains the data on the nearest virtual multicast router 501, it transmits the data to the multicast administration server 303. Then, at step S613, the multicast administration server 303 updates the virtual multicast router IP address caching table, which is stored in the database 403. Later on, when the IP address of the nearest virtual multicast router is requested again by the multicast agent 423, the multicast administration server 303 transmits the data on the nearest virtual multicast router 501 based on the updated caching table.

Meanwhile, at step S615, the multicast agent 423 that obtained the data on the nearest virtual multicast router 501 requests the multicast agent 423 to join the multicast group through the nearest virtual multicast router 501. The request for joining a multicast group is a request asking for dynamic tunneling, and it includes the IP address of the multicast agent 423 as the address of the destination of multicast data, which is used to encapsulate the multicast data.

At step S617, in response to the request for joining the multicast group, the virtual multicast router 501 updates the group data with its IP address as a transmission source (dynamic tunnel source) address of the encapsulated multicast data and the IP address of the multicast agent 423 as the destination address of the

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encapsulated multicast data, and, at step S619, it transmits acknowledgement of the multicast group request. Then, at step S621, a path between the multicast agent 423 and the multicast router is set up.

In short, when the multicast agent is registered in the multicast group, and when data are transmitted from the multicast source server 301, the virtual multicast router 501 checks out the address of the multicast data and transmits the multicast data to the multicast agent 423 registered on the multicast group. The multicast agent 423 that has received the multicast data from the virtual multicast router 501 removes the header, which contains the tunnel source address and the tunnel destination address, from the IP encapsulated multicast data, and perform re-multicasting to a multicast data application program loaded on a client.

Fig. 7 is a diagram showing the process of a multicast agent or a virtual multicast router searching for the nearest virtual multicast router in accordance with a second embodiment of the present invention.

In Figs. 5 and 6, the multicast agent 423 or the first virtual multicast router 501 determines if the router data transmitted from the multicast administration server 303 is on the nearest virtual multicast router at step S507 or S607. If the received data prove to be data on all virtual multicast routers, at step S509 or S609, their hop counters are calculated from the received data on all virtual multicast router addresses and the data on the nearest virtual multicast router are obtained.

Fig. 7 shows another embodiment for obtaining data on the nearest virtual multicast router data not by calculating hop counters as described in Figs. 5 and 6, but by calculating round trip time (RTT).

First, the multicast source server 301 calculates the RTT values between the multicast source server 301 and the

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virtual multicast routers 501 and 701a to 701n by transmitting a message to each of the virtual multicast routers 501 and 701a to 701n periodically, and then it transmits the maximum RTT value and the average RTT value of the calculated RTT values to the virtual multicast routers 501 and 701a to 701n. Accordingly, the multicast source server 301 and the respective virtual multicast routers 501 and 701a to 701n are always aware of the maximum RTT value and the average RTT value of the virtual multicast routers.

In this circumstance, at step S701, if the multicast agent 423 or the first virtual multicast router 501 requests the multicast source server 301 for the data on the nearest high-ranked virtual multicast router, at step S703, the multicast source server 301 transmits to the other virtual multicast routers 701a to 701n a command to send the data to the multicast agent 423 or the first virtual multicast router 501 in a particular time period.

At step S705, each of the virtual multicast routers 701a to 701n, which has received the data transmission command, waits for a time subtracting the average RTT value from the maximum RTT value based on the time point when the data transmission command is received, and transmits the data to the multicast agent 423 or the first multicast router 501.

At step S707, the multicast agent 423 or the first multicast router 501 recognizes the virtual multicast router that has sent the data arriving first among the data transmitted from each of the virtual multicast routers 701a to 701n as the nearest virtual multicast router and thus obtains the data on the nearest virtual multicast router.

At step S709, the subsequent process is the same as the steps S513 through S521 or the steps S613 through S621 of Fig. 5 or 6.

The method of the present invention described can be

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embodied as a program and recorded in a computer-readable recording medium, such as CD-ROMs, RAMs, ROMs, floppy disks, hard disks, and optical magnetic disks.

This invention, which is a method and system for virtual multicast networking, can provide multicast application service such as Internet broadcasting effectively even in a network environment that does not support the multicasting function. The dynamic tunneling technology between the virtual multicast routers solves the problem of a conventional static tunneling that a user should set up the tunneling by himself and the problem in multicast networking when a user uses a dynamic IP.

The application of multicast service will be enhanced due to this dynamic tunneling technology, because a multicast network can be established without performing any set up process to the existing network environment.

Later on, when home networking is generalized, it is also possible to use the multicast technology at an end terminal, too, and provide various services by applying the multicast technology to the home gateway.

While the present invention has been described with respect to certain preferred embodiments, it will be apparent to those skilled in the art that various changes and modifications may be made without departing from the scope of the invention as defined in the following claims.

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CLAIMS

1. A virtual multicast networking system including a client and a multicast source network having a multicast source server, for providing a virtual multicast network in a network environment wherein a non-multicast network that does not support a multicast function is connected through a backbone network, the virtual multicast networking system comprising:

a virtual multicast router system included in the non-multicast network, for transmitting or relaying encapsulated multicast data through tunneling with a multicast router or the nearest virtual multicast router system;

a multicast agent system loaded on the client, for receiving the encapsulated multicast data through dynamic tunneling with the nearest virtual multicast router system, extracting the multicast data transmitted by the multicast source server from the encapsulated multicast data, and transmitting the extracted multicast data to an application program loaded on the client; and

a multicast administration system included in the multicast source network, for managing the IP addresses of the virtual multicast router system, and transmitting the address information of the virtual multicast router system to the virtual multicast router system or the multicast agent system.

2. The system as recited in claim 1, wherein the virtual multicast router system includes:

a tunneling unit for transmitting a dynamic tunneling request including its IP address to the nearest virtual multicast router system, and setting up a tunnel source address and a tunnel destination address for dynamic tunneling based on the dynamic tunneling request from the

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nearest virtual multicast router system or the multicast agent system; and

a multicast relaying unit for managing the membership information of the multicast group, and transmitting the encapsulated multicast data, which are transmitted from the nearest virtual multicast router system through dynamic tunneling, to the client or virtual multicast router system included in the membership information of the multicast group through a multicast router included in a sub-network of the non-multicast network, to which the virtual multicast router system belongs.

3. The system as recited in claim 2, wherein the virtual multicast router system further includes a multicast routing unit for routing the encapsulated multicast data, if there is no multicast router or virtual multicast router system on the non-multicast network.

4. The system as recited in claim 3, wherein the multicast agent system includes:

a dynamic tunneling unit for transmitting a multicast group joining request including the IP address of the multicast agent system to the virtual multicast router system; and

a multicast data receiving unit for receiving encapsulated multicast data from the virtual multicast router system, removing the header that includes the tunnel source address and the tunnel destination address from the received data, and transmitting the multicast data, which is transmitted from the multicast source server, to an application program of the client.

5. The system as recited in claim 4, wherein the multicast data receiving unit transmits the multicast data transmitted from the multicast source server to the

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application program of the client by setting time to live (TTL) at zero using IP multicast.

6. The system as recited in claim 5, wherein the multicast administration system includes:

a database for caching and storing in a table the IP address information of all virtual multicast router systems in the network environment; and

a virtual multicast router data administration unit for searching the database and transmitting the data on the nearest virtual multicast router to the tunneling unit or the dynamic tunneling unit, upon a request for the address information of the nearest virtual multicast router system from the tunneling unit or the dynamic tunneling unit.

7. The system as recited in claim 6, wherein the virtual multicast router data administration unit searches the database, upon the request for the nearest virtual multicast router system data, and if there is no data on the nearest virtual multicast router, transmitting the address information of all virtual multicast router systems stored in the table to the tunneling unit or the dynamic tunneling unit.

8. The system as recited in claim 7, wherein the tunneling unit or the dynamic tunneling unit obtains the address information of the nearest virtual multicast router system by calculating hop counters based on the address information of all virtual multicast router systems transmitted from the virtual multicast router data administration unit, and transmits the obtained address information of the nearest virtual multicast router system to the virtual multicast router data administration unit.

9. The system as recited in claim 6, wherein the

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virtual multicast router data administration unit searches the database upon the request for data on the nearest virtual multicast router system, and if there is no information on the nearest virtual multicast router, transmits to all the virtual multicast router systems in the network environment a command to send data for checking out distance to the tunneling unit or the dynamic tunneling unit at a predetermined time point.

10. The system as recited in claim 9, wherein the virtual multicast router data administration unit periodically obtains each average round trip time (RTT) and the maximum RTT of all the virtual multicast router systems in the network environment, and transmits the average RTT and the maximum RTT to all the virtual multicast router systems in the network environment; and

wherein the predetermined time point is a time subtracting the average RTT value from the maximum RTT value based on the time point when the command is received is passed.

11. The system as recited in claim 10, wherein the tunneling unit or the dynamic tunneling unit obtains the address information of the nearest virtual multicast router system based on the data that has arrived first among other data sent from all the virtual multicast router systems in the network environment to check out the distance, and transmits the obtained address information of the nearest virtual multicast router system to the virtual multicast router data administration unit.

12. The system as recited in claim 8 or 10, wherein the virtual multicast router data administration unit further performs the function of updating the IP address information of the virtual multicast router systems, which

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are stored in the database in the form of a table, based on the address information of the nearest virtual multicast router system transmitted from the tunneling unit or the dynamic tunneling unit.

13. The system as recited in claim 12, wherein the virtual multicast router system performs tunneling and transmits the encapsulated multicast data based on the network environment, to which the multicast agent system or the nearest virtual multicast router system that receives the encapsulated multicast data transmitted from the virtual multicast router system belongs.

14. The system as recited in claim 13, wherein the virtual multicast router system emulates the Internet group management protocol (IGMP) snooping function of L2 switch, in case where the non-multicast network supports a broadcast or unicast function only.

15. The system as recited in claim 2, wherein the backbone network does not support the multicast function, and the multicast source network includes the virtual multicast router system.

16. The system as recited in claim 2, wherein the backbone network supports the multicasting function,

wherein the multicast source network includes a multicast router,

wherein the tunneling unit has the tunnel source address and the tunnel destination address set up between the virtual multicast router system and the multicast router through static tunneling, and

wherein the multicast relaying unit transmits the encapsulated multicast data, which are transmitted from the multicast router system through static tunneling, to the

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client or virtual multicast router system in the membership information of the multicast group through a multicast router on a sub-network of the non-multicast network, to which the virtual multicast router system belongs.

17. A method for performing virtual multicast networking in a virtual multicast networking system, the method comprising the steps of:

a) at a virtual multicast router system included in the non-multicast network, transmitting or relaying encapsulated multicast data through tunneling with a multicast router or the nearest virtual multicast router system;

b) at a multicast agent system loaded on the client, receiving the encapsulated multicast data through dynamic tunneling with the nearest virtual multicast router system, extracting the multicast data transmitted from the multicast source server from the received encapsulated multicast data, and transmitting the extracted multicast data to an application program loaded on the client; and

c) at a multicast administration system included in the multicast source network, managing the IP addresses of the virtual multicast router system, and transmitting the address information of the virtual multicast router system to the virtual multicast router system or the multicast agent system.

18. The method as recited in claim 17, wherein the step a) includes the steps of:

a1) at a tunneling unit included in the virtual multicast router system, transmitting a dynamic tunneling request including the IP address of the virtual multicast router system to the nearest virtual multicast router system;

a2) at the tunneling unit, setting up the tunnel

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source address and the tunnel destination address for dynamic tunneling based on the dynamic tunneling request transmitted from the nearest virtual multicast router system or the multicast agent system; and

a3) at a multicast relaying unit included in the virtual multicast router system, managing the membership information of the multicast group, and transmitting the encapsulated multicast data, which are transmitted from the nearest virtual multicast router system through dynamic tunneling, to the client or virtual multicast router system in the membership information of the multicast group through a multicast router on a sub-network of the non-multicast network, to which the virtual multicast router system belongs.

19. The method as recited in claim 18, wherein the step a) further comprises the step of:

a4) the multicast routing unit included in the virtual multicast router system, routing the encapsulated multicast data, if there is no multicast router or virtual multicast router system on the non-multicast network.

20. The method as recited in claim 19, wherein the step b) comprises the steps of:

b1) at a dynamic tunneling unit included in the multicast agent system, transmitting a multicast group joining request including the IP address of the multicast agent system to the virtual multicast router system; and

b2) at a multicast data receiving unit included in the multicast agent system, receiving the encapsulated multicast data from the virtual multicast router system, removing the header that includes the tunnel source address and the tunnel destination address from the received data, and transmitting the multicast data, which is transmitted from the multicast source server, to an application program

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of the client.

21. The method as recited in claim 20, wherein in the step b2), the multicast data transmitted from the multicast source server are transmitted to the application program of the client by setting time to live (TTL) at zero using IP multicast.

22. The method as recited in claim 21, wherein the step c) includes the steps of:

c1) caching the IP address information of all virtual multicast router systems in the network environment and storing the cached data in the database in the form of a table; and

c2) at the virtual multicast router data administration unit, searching the database and transmitting the data on the nearest virtual multicast router to the tunneling unit or the dynamic tunneling unit, upon a request for data on the nearest virtual multicast router system from the tunneling unit or the dynamic tunneling unit.

23. The method as recited in claim 22, wherein the step c) further includes the step of:

c3) at the virtual multicast router data administration unit, searching the database upon the request for data on the nearest virtual multicast router system, and if there is no information on the nearest virtual multicast router, transmitting the address information of all virtual multicast router systems stored in the table to the tunneling unit or the dynamic tunneling unit.

24. The method as recited in claim 23, wherein the step a2) further includes the steps of:

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a2-1) at the tunneling unit, obtaining the address information of the nearest virtual multicast router system by calculating hop counters based on the address information of all virtual multicast router systems received by the process of the step c3); and

a2-2) at the tunneling unit, transmitting the obtained address information of the nearest virtual multicast router system to the virtual multicast router data administration unit, and

wherein the step b1) further includes the steps of:

b1-1) at the dynamic tunneling unit, obtaining the address information of the nearest virtual multicast router system by calculating hop counters based on the address information of all virtual multicast router systems received by the process of the step c3); and

b1-2) at the dynamic tunneling unit, transmitting the obtained address information of the nearest virtual multicast router system to the virtual multicast router data administration unit.

25. The method as recited in claim 22, wherein the step c) further includes the step of:

c4) the virtual multicast router data administration unit, searching the database upon the request for information on the nearest virtual multicast router system, and if there is no information on the nearest virtual multicast router, transmitting to all the virtual multicast router systems in the network environment a command to send data for checking out distance to the tunneling unit or the dynamic tunneling unit at a predetermined time point.

26. The method as recited in claim 25, wherein the step c) further includes the step of:

c5) at the virtual multicast router data administration unit, periodically obtaining the average

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round trip time (RTT) and the maximum RTT of all the virtual multicast router systems in the network environment, and transmitting the average RTT and the maximum RTT to all the virtual multicast router systems included in the network environment, and

wherein the predetermined time point is a time subtracting the average RTT value from the maximum RTT value based on the time point when the command is received is passed.

27. The method as recited in claim 26, wherein the step a2) further includes the steps of:

a2-1) at the tunneling unit, obtaining the address information of the nearest virtual multicast router system based on the data that has arrived first among other data transmitted from all the virtual multicast router systems included in the network environment to check out the distance; and

a2-2) at the tunneling unit, transmitting the obtained address information of the nearest virtual multicast router system to the virtual multicast router data administration unit, and

wherein the step b1) further includes the steps of:

b1-1) at the dynamic tunneling unit, obtaining the address information of the nearest virtual multicast router system based on the data that has arrived first among other data transmitted from all the virtual multicast router systems included in the network environment to check out the distance; and

b1-2) at the dynamic tunneling unit, transmitting the obtained address information of the nearest virtual multicast router system to the virtual multicast router data administration unit.

28. The method as recited in claim 24 or 26, wherein

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the step c) further comprises the step of:

c6) at the virtual multicast router data administration unit, updating the IP address information of the virtual multicast router systems, which are stored in the database in the form of a table, based on the address information of the nearest virtual multicast router system transmitted from the tunneling unit or the dynamic tunneling unit.

29. The method as recited in claim 28, wherein in the step a), the tunneling is performed based on the network environment, to which the multicast agent system or the nearest virtual multicast router system that receives the encapsulated multicast data transmitted from the virtual multicast router system belongs, and the encapsulated multicast data are transmitted.

30. The method as recited in claim 29, wherein in the step a), the virtual multicast router system emulates the Internet group management protocol (IGMP) snooping function of L2 switch, in case where the non-multicast network supports a broadcast or unicast function.

31. The method as recited in claim 18, wherein the backbone network does not support the multicasting function, and the multicast source network includes the virtual multicast router system.

32. The method as recited in claim 18, wherein the backbone network supports the multicasting function,

wherein the multicast source network includes a multicast router,

wherein the tunneling unit has tunnel source address and tunnel destination address set up between the virtual multicast router system and the multicast router through

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static tunneling, and

wherein the step a3) includes the step of:

a3-1) at the multicast relaying unit, transmitting the encapsulated multicast data, which are transmitted from the multicast router system through static tunneling, to the client or virtual multicast router system in the membership information of the multicast group through a multicast router included in a sub-network of the non-multicast network, to which the virtual multicast router system belongs.

33. A virtual multicast networking system including a client and a multicast source network having a multicast source server, for providing a virtual multicast network in a network environment wherein a non-multicast network that does not support a multicast function is connected through a backbone network, the virtual multicast networking system comprising:

a virtual multicast router system included in the non-multicast network, for transmitting or relaying encapsulated multicast data through tunneling with a multicast router or the nearest virtual multicast router system; and

a multicast agent system loaded on the client, for receiving the encapsulated multicast data through dynamic tunneling with the nearest virtual multicast router system, extracting the multicast data transmitted from the multicast source server from the encapsulated multicast data, and transmitting the extracted multicast data to an application program loaded on the client.

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FIG. 1

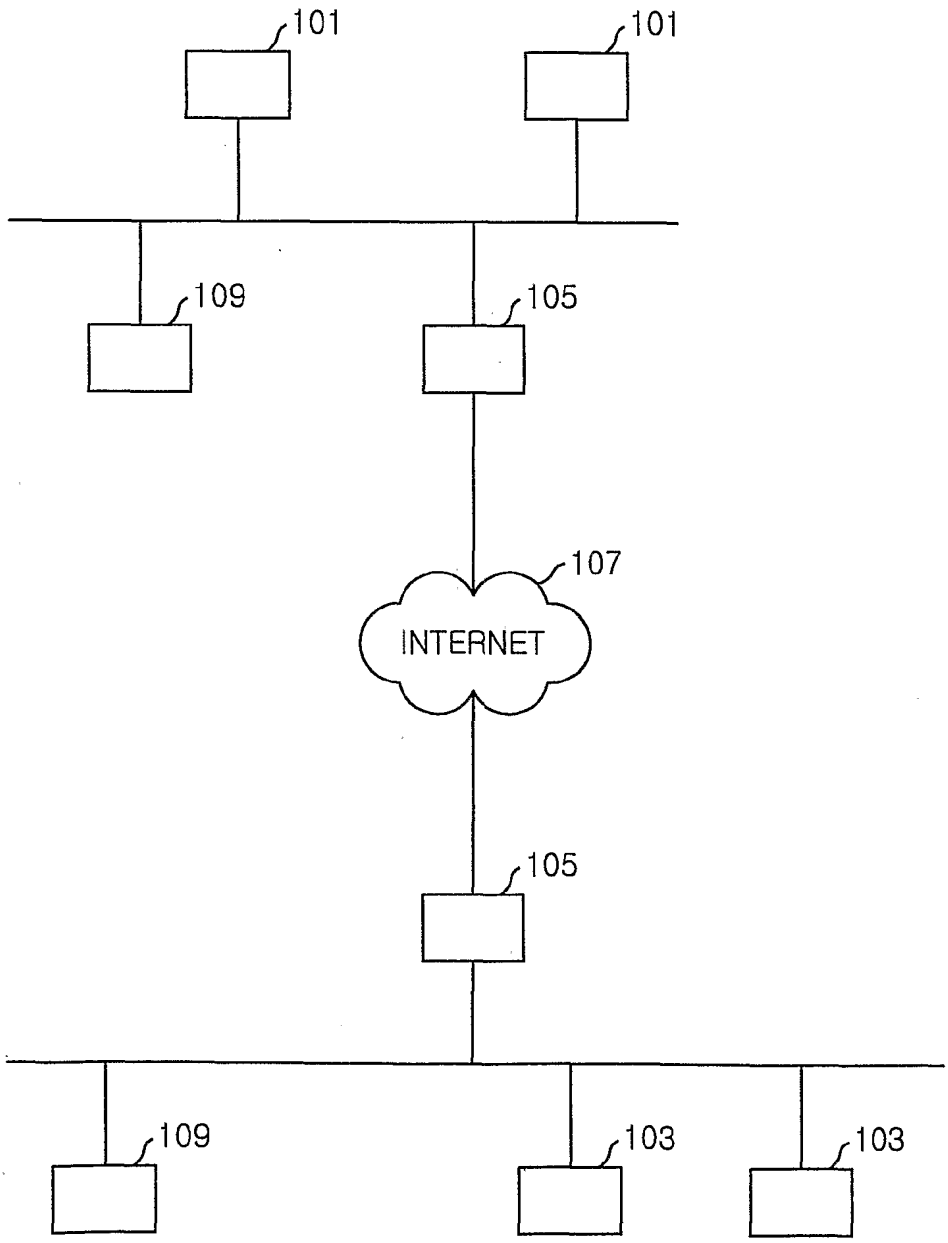


FIG. 2

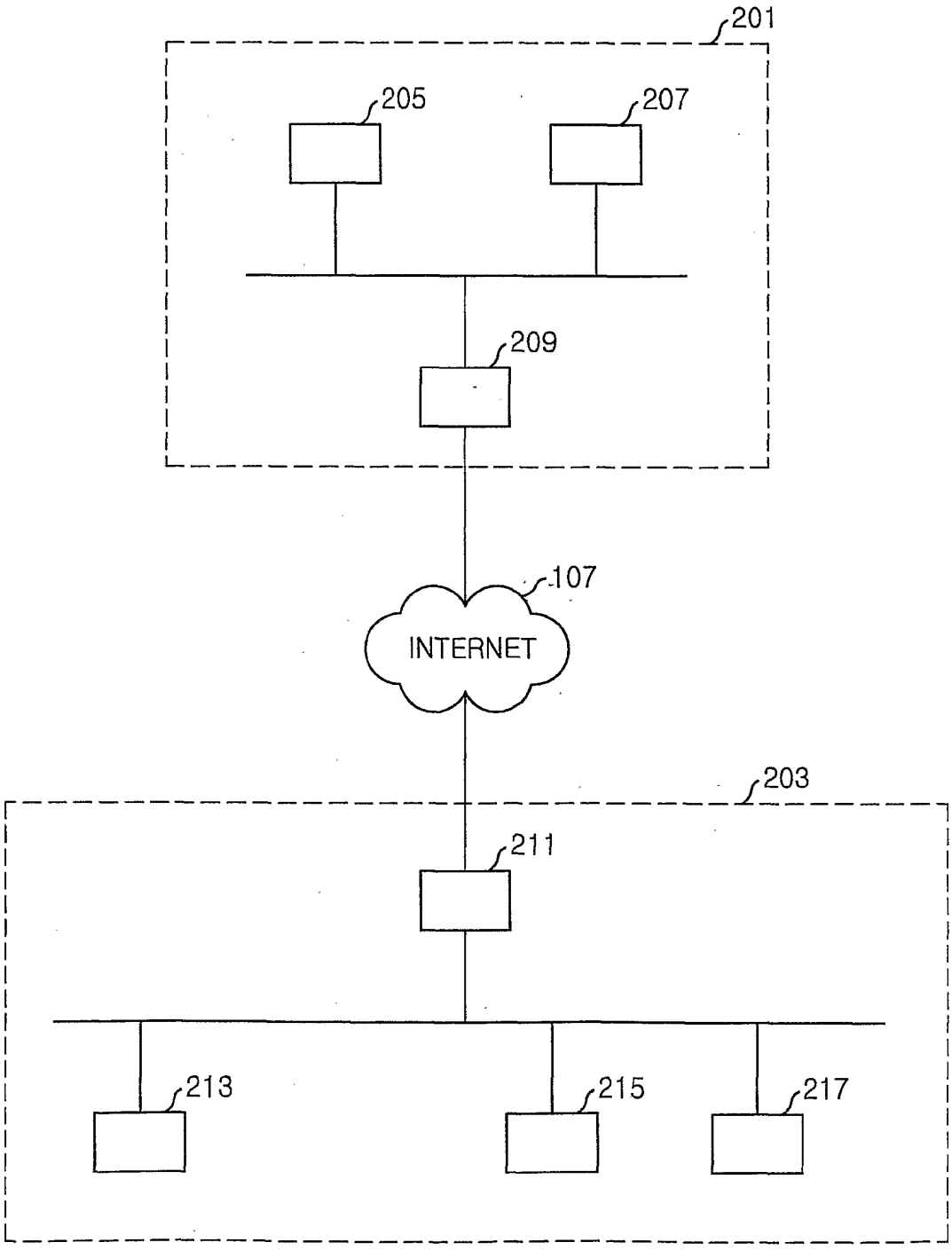
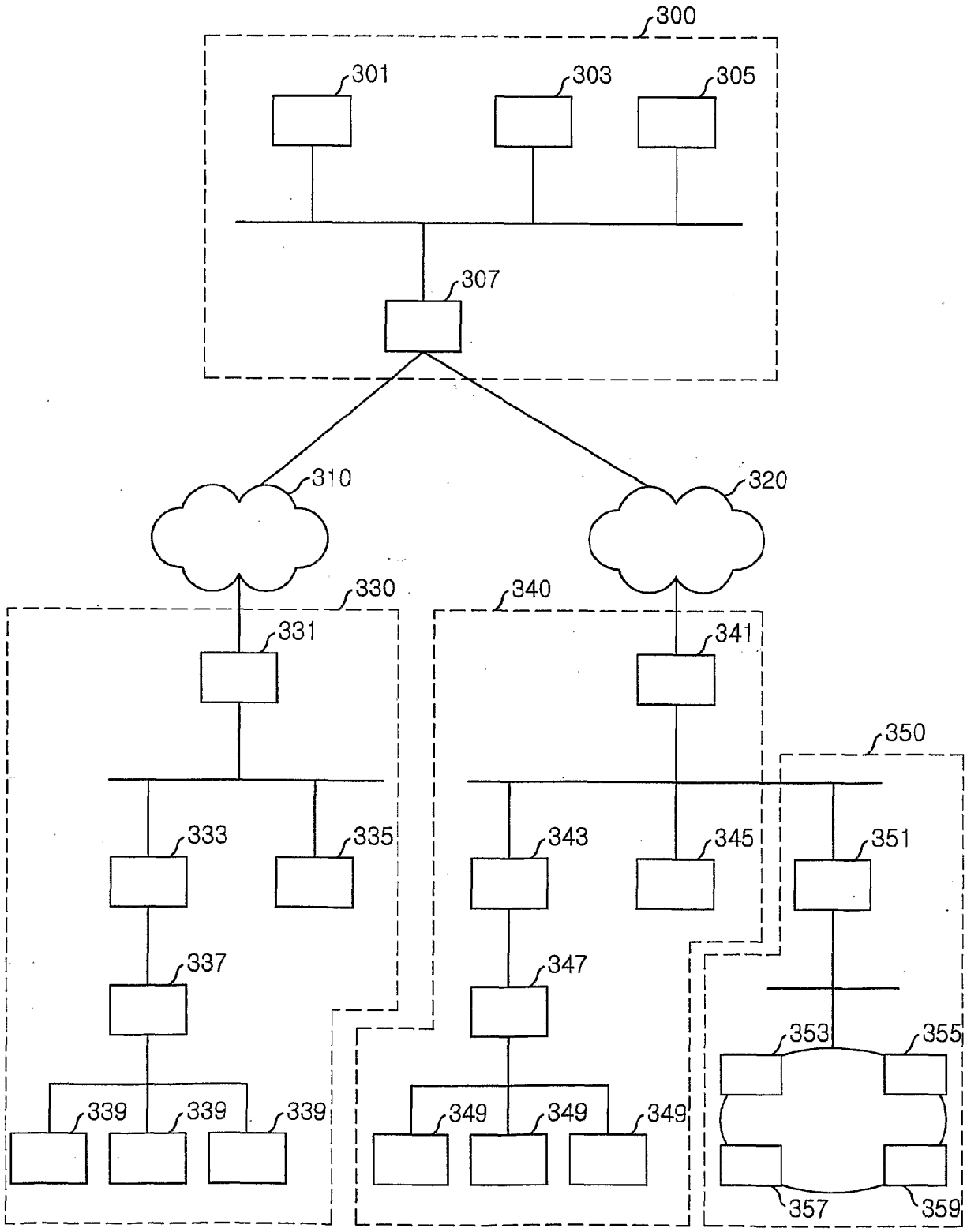


FIG. 3



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FIG. 4

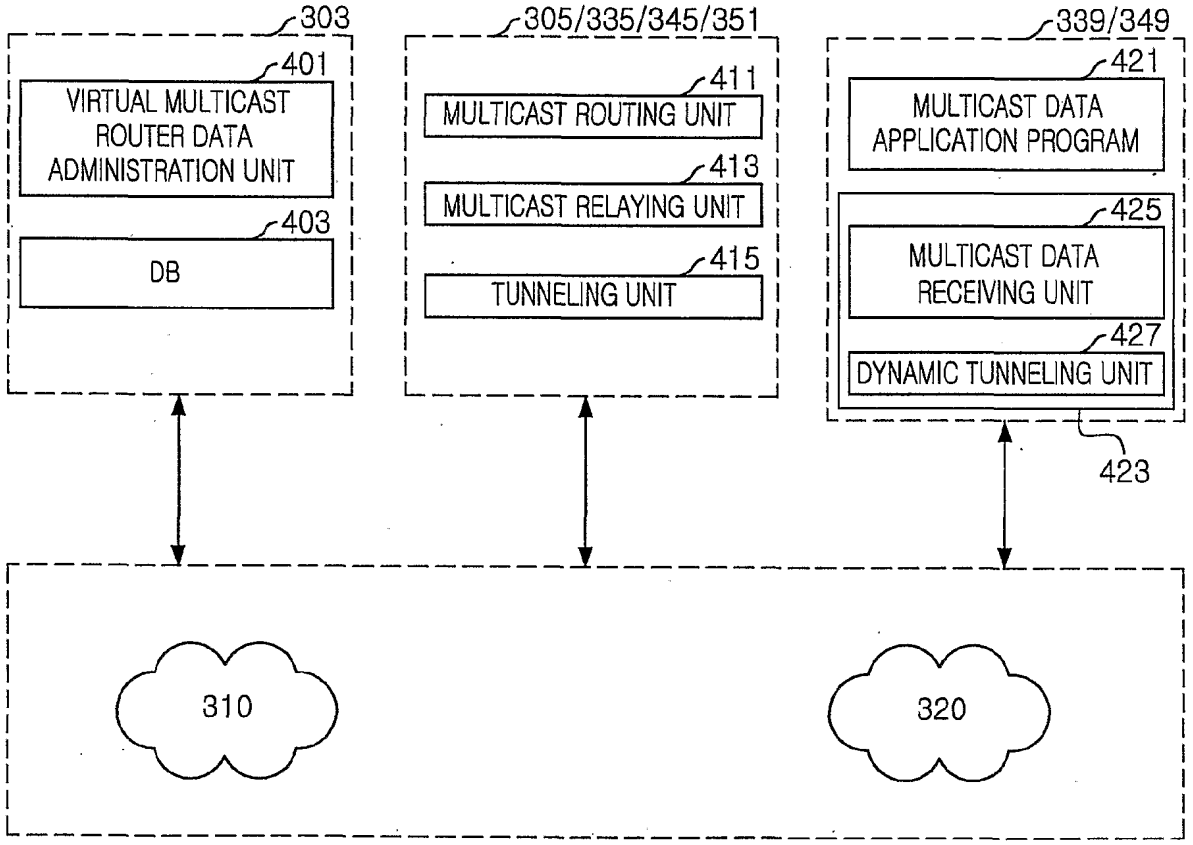
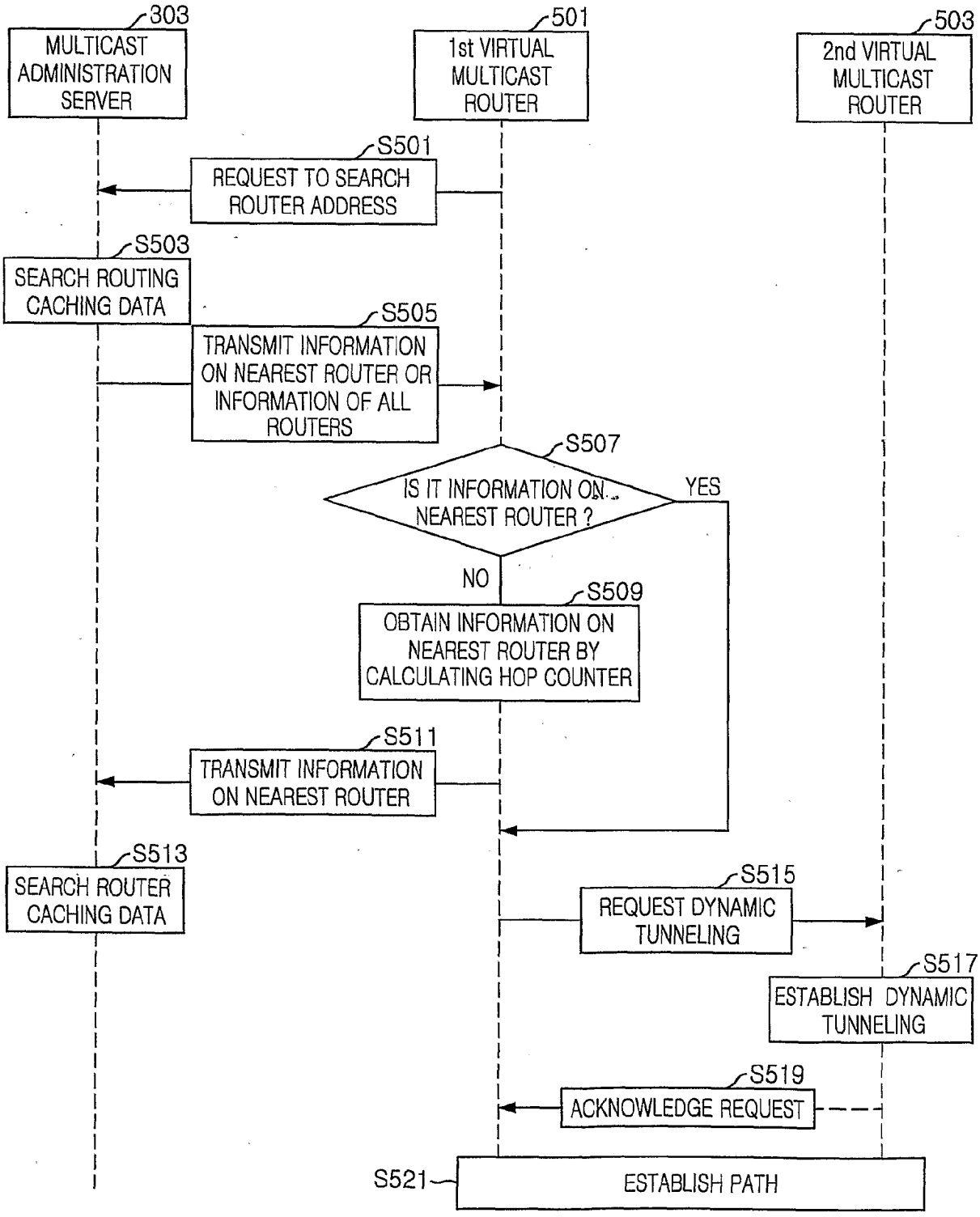
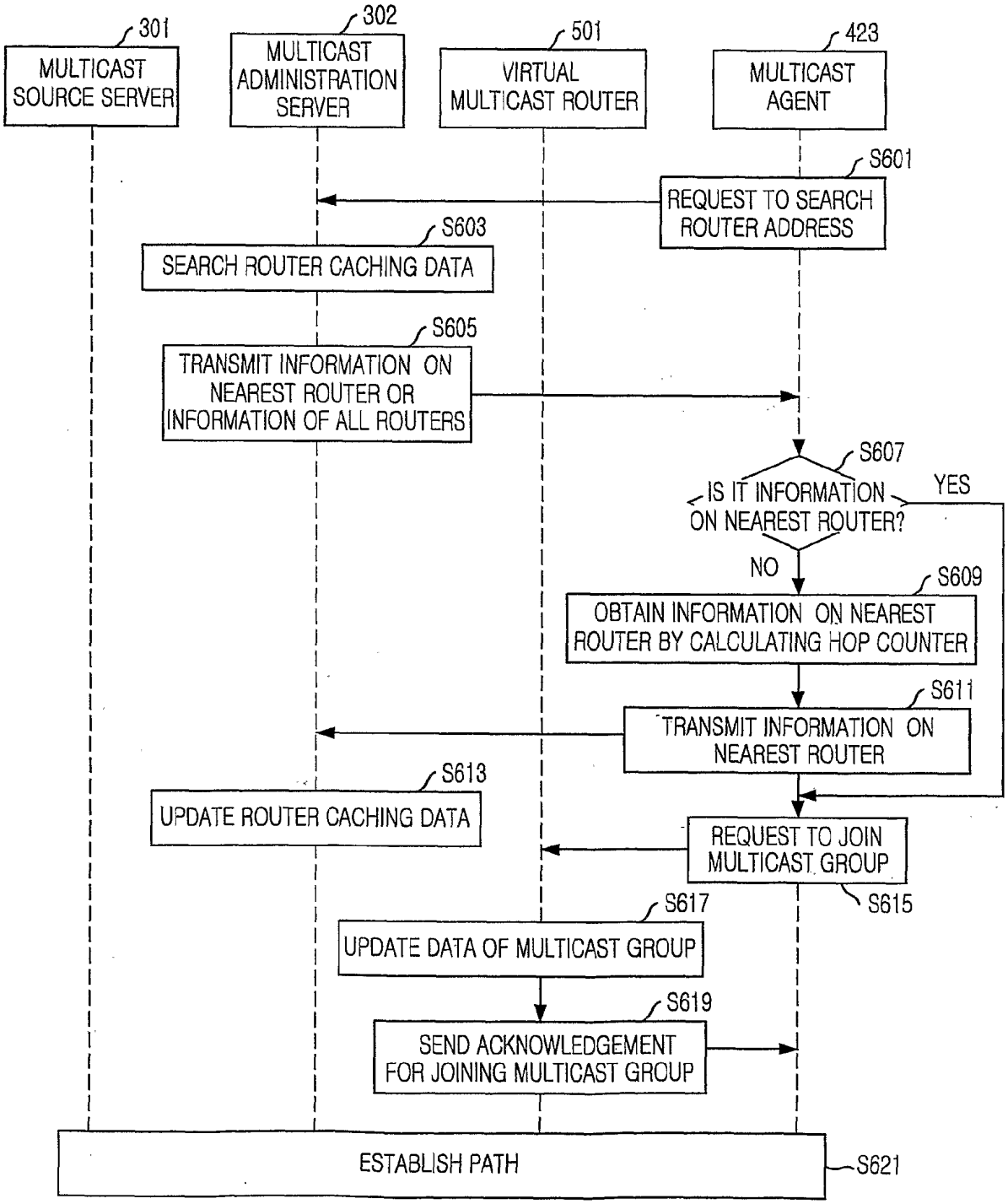

303
401
VIRTUAL MULTICAST ROUTER DATA ADMINISTRATION UNIT
403
DB
305/335/345/351
411
MULTICAST ROUTING UNIT
413
MULTICAST RELAYING UNIT
415
TUNNELING UNIT
339/349
421
MULTICAST DATA APPLICATION PROGRAM
425
MULTICAST DATA RECEIVING UNIT
427
DYNAMIC TUNNELING UNIT
423
310
320

FIG. 5



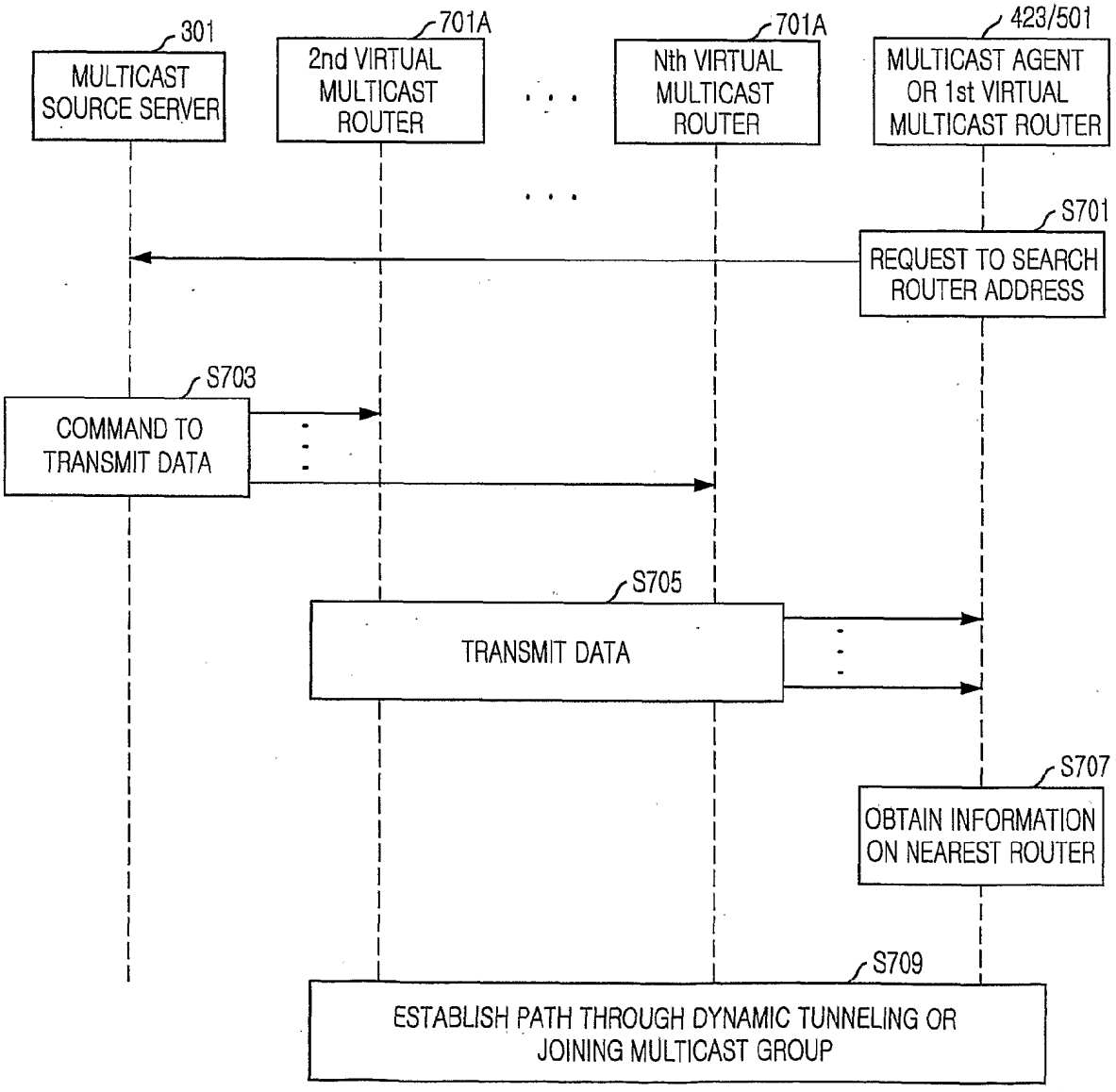
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FIG. 6



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FIG. 7



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INTERNATIONAL SEARCH REPORT

nternational application No.
PCT/KR02/01003

A. CLASSIFICATION OF SUBJECT MATTER

IPC7 H04L 12/28

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC7: H04L, H04M, G06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Korean Patents and Applications for Inventions since 1975
Korean Utility Models and Applications for Utility Models since 1975

Electronic data base consulted during the intertnational search (name of data base and, where practicable, search terms used)
IEL(IEEE/IEE Electronic Library)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 6,047,330 (Netscape Communication Corp.) 4. April 2000: abstract, column 1-2(summary of the invention) claim	1-32
A	JP2000-83030 (Nippon Electric Corp. Ltd.) 21. March 2000: abstract, claims, figures	1-14
A	WO 97/18657 (Cabletron Systems Inc.) 22. May 1997: abstract, summary of the invention	1-33
A	US 5,305,311(Xerox Corp..) 19. April 1994 : abstract detail description	1-33

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevence
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevence; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevence; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents,such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
24 SEPTEMBER 2002 (24.09.2002)	25 SEPTEMBER 2002 (25.09.2002)

Name and mailing address of the ISA/KR	Authorized officer
Korean Intellectual Property Office 920 Dunsan-dong, Seo-gu, Daejeon 302-701, Republic of Korea Facsimile No. 82-42-472-7140	LEE, Saang Woong Telephone No. 82-42-481-5714

Form PCT/ISA/210 (second sheet) (July 1998)

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Exhibit 1005 – 258

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/KR02/01003

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 6,047,330A	4. 4. 2000	None	
JP2000-83030A	21. 3. 2000	None	
WO 97/18657	22. 5. 1997	None	
US 5,305,311A	19. 4. 1994	None	

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Exhibit 1005 – 259

Electronic Patent Application Fee Transmittal

Application Number:	13674233
Filing Date:	12-Nov-2012
Title of Invention:	AUDIO-VIDEO MULTI-PARTICIPANT CONFERENCE SYSTEMS USING PSTN AND INTERNET NETWORKS
First Named Inventor/Applicant Name:	Thomas Dye
Filer:	Brent David Martin/Chloe Hong
Attorney Docket Number:	207.0002-03000

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:	22510345
Application Number:	13674233
International Application Number:	
Confirmation Number:	5197
Title of Invention:	AUDIO-VIDEO MULTI-PARTICIPANT CONFERENCE SYSTEMS USING PSTN AND INTERNET NETWORKS
First Named Inventor/Applicant Name:	Thomas Dye
Customer Number:	22882
Filer:	Brent David Martin/Chloe Hong
Filer Authorized By:	Brent David Martin
Attorney Docket Number:	207.0002-03000
Receipt Date:	02-JUN-2015
Filing Date:	12-NOV-2012
Time Stamp:	14:31:32
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		Amendment.pdf	78815 f3983764800dcc616cae8958e285020cd627baad	yes	7

	Multipart Description/PDF files in .zip description				
	Document Description	**Start**	**End**		
	Amendment after Notice of Allowance (Rule 312)	1	1		
	Claims	2	6		
	Applicant Arguments/Remarks Made in an Amendment	7	7		
Warnings:					
Information:					
2	Transmittal Letter	IDS.pdf	72120 c5c98c5737302526033f5d6fb8c0d0094712ffc1	no	3
Warnings:					
Information:					
3	Information Disclosure Statement (IDS) Form (SB08)	SB08.pdf	102108 3a0df881e418ed1463b90ad04d5da2a8d138dab1	no	2
Warnings:					
Information:					
This is not an USPTO supplied IDS fillable form					
4	Foreign Reference	WO0191397A2.pdf	2175887 56c963859071b9effbacadfd9d5b92409261ac3e	no	48
Warnings:					
Information:					
5	Foreign Reference	WO02098063A1.pdf	2081209 52828b5f479e1aa6153ca9af6fd3cbcfd642d5da	no	48
Warnings:					
Information:					
6	Non Patent Literature	VPN_v_ATT_Plainttifs_Response_to_First_Set_214-cv-01013-01014_Apr_14_2015_28pgs.pdf	955983 4cfd253c44c10d1b404167691b4c28cf7b701d78	no	28
Warnings:					
Information:					
7	Non Patent Literature	ATT_Invalidity_Contentions_w_Claim_Charts_214-cv-1013-1014_Apr_16_2015_2274pgs.pdf	15130189 0917dad80a455187798ef07b1904b3d324a8de34	no	2274
Warnings:					
Information:					
8	Non Patent Literature	ATT_Objections_and_Responses_to_VPNs_First_Set_214-cv-1013-1014_Apr_23_2015_20pgs.pdf	149675 e5678af5f0ca0190a48e64ee6049a317f8[illegible]	no	20

Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1005 – 263

Warnings:					
Information:					
9	Non Patent Literature	Alchaal_Offering_a_Multicast_Delivery_Service_in_a_Programmable_2002_6pgs.PDF	433017 c88739523d4b6e1848b63da997ae62962b6bedd4	no	6
Warnings:					
Information:					
10	Non Patent Literature	Bokun_The_MECCANO_Internet_Multimedia_Conferencing_Architecture_Dec_1999_67pgs.PDF	7860161 d26009fbc1e751cd5a9cb02a4034931cca801922	no	67
Warnings:					
Information:					
11	Non Patent Literature	Cisco_Systems_Inc_Multicast_VPN_Design_Guide_Aug_2003_25pgs.PDF	3484072 da8f026d0329b72956ebae26d963e13ac6310cf0	no	25
Warnings:					
Information:					
12	Non Patent Literature	Cisco_Systems_Inc_Multicast_VPN_IP_Multicast_Support_for_MPLS_VPNs_2002_86pgs.PDF	4770178 d2c79bc1fd9e7de40de35779ca1ad13a21766066	no	86
Warnings:					
Information:					
13	Non Patent Literature	Cisco_Systems_Inc_Networkers_Multicast_for_MPLS-BGP_VPNs_2001_89pgs.pdf	4428809 9174256d92ce995db2f2e79f77bd1f32b4d3729e	no	89
Warnings:					
Information:					
14	Non Patent Literature	Comer_Internetworking_with_TCP-IP_Vol_I_3ed_Mar_1995_628pgs.pdf	22720707 a22d80643b9ed9bdab1d50eeebd2c6b35e390341	no	628
Warnings:					
Information:					
15	Non Patent Literature	Costa_An_Introduction_to_Virtual_Private_Networks_June_2000_20pgs.PDF	1362069 18f1ca99d3057b3012aadb8edf4e76377811a7c2	no	20
Warnings:					
Information:					
16	Non Patent Literature	Eriksson_MBONE_The_Multicast_Backbone_Aug_1994_11pgs.PDF	2135102 bd5a87be2e6ddb59eb3faf69956bec95329751a6	no	11
Warnings:					
Information:					
17	Non Patent Literature	Finlayson_The_UDP_Multicast_Tunneling_Protocol_Nov_19_6pgs.PDF	245592 8cb9e9f154195a75346b09d81bdfea6f70e...	no	6

Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1005 – 264

Warnings:					
Information:					
18	Non Patent Literature	Kent_Security_Architecture_for_the_Internet_Protocol_Nov_1998_61pgs.PDF	2595543 aca16f555c24c9dcc647267d2e9f512559e4121e	no	61
Warnings:					
Information:					
19	Non Patent Literature	Kirstein_The_RadioActive_Networking_Architecture_May_2000_16pgs.PDF	2267333 a2bd2c50d0083f8f571a7342cf0f33d4befd3627	no	16
Warnings:					
Information:					
20	Non Patent Literature	Kumar_Mbone_Interactive_Multimedia_on_the_Internet_1996_242pgs.pdf	8509280 bef19882afee5313f948b4af98f55cc94d173a9a	no	242
Warnings:					
Information:					
21	Non Patent Literature	Labonte_Group_Management_Strategies_for_Secure_Multicasting_IEEE_Nov_2000_10pgs.PDF	1469141 435e32417475b5686fca848ef50b723001a47aee	no	10
Warnings:					
Information:					
22	Non Patent Literature	Lamaster_Internet_technologies_and_requirements_for_telemedicine_1997_8pgs.PDF	756846 2a1ab4da56077cb9af6684b96696337b25d19712	no	8
Warnings:					
Information:					
23	Non Patent Literature	Macedonia_Mbone_Provides_Audio_and_Video_Across_the_Internet_Apr_1994_8pgs.PDF	2799146 1989dbfc2c952f76ba256fe634520336464b0a1a	no	8
Warnings:					
Information:					
24	Non Patent Literature	Rosen_Multicast_in_MPLS-BGP_VPNs_Nov_2000_17pgs.PDF	713232 38dd021dc665c6d5ffd2611f9f6440f68efe8a2e	no	17
Warnings:					
Information:					
25	Non Patent Literature	Savetz_MBONE_Multicasting_Tomorrows_Internet_1996_259pgs.pdf	12177654 b1def7860e099d698af494b574fa7174898899b9	no	259
Warnings:					
Information:					
26	Non Patent Literature	Waitzman_Distance_Vector_Multicast_Routing_Protocol_RFC_1075_Nov_1988_24pgs.PDF	905863 8958b20a7b0351de9885e05915d6d8[illegible]	no	24

Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1005 – 265

Warnings:					
Information:					
27	Non Patent Literature	Wittmann_Multicast_Communication_Protocols_and_Applications.pdf	13065214 0056822ae7ba1b1c7ebd3aa5f6d29c93cb59dafd	no	362
Warnings:					
Information:					
28	Fee Worksheet (SB06)	fee-info.pdf	30792 1c017fbd42942494e5cfb5914136e730771cdd81	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	113475737		

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

In re Application of:	)	Confirmation No.: 5197
Thomas Dye et al.	)	
Serial No.: 13/674,233	)	Group Art Unit: 2656
Filed: February 12, 2012	)	Examiner: Suhan Ni
For: AUDIO-VIDEO MULTI-PARTICIPANT CONFERENCE SYSTEMS USING PSTN AND INTERNET NETWORKS	)	

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

Sir:

STATEMENT OF SUBSTANCE OF INTERVIEW

An in person interview between the undersigned, Amedeo F. Ferraro, and Examiner Suhan Ni was conducted on February 4, 2015. A possible Amendment was discussed and the Examiner agreed to fully consider the claims if filed. It is requested that this document be made of record in the above-identified application.

To the extent any extension of time under 37 C.F.R. § 1.136 is required to obtain entry of this reply, such extension is hereby respectfully requested. If there are any fees due under 37 C.F.R. §§ 1.16 or 1.17 which are not enclosed herewith, including any fees required for an extension of time under 37 C.F.R. § 1.136, please charge such fees to our Deposit Account No. 50-1068.

Respectfully submitted,

MARTIN & FERRARO, LLP

Dated: March 10, 2015

By: /Brent D. Martin/
Brent D. Martin
Registration No. 62,717

5151 Headquarters Drive, Suite 170
Plano, Texas 75024
Telephone: (972) 668-3050
Facsimile: (972) 668-3056

Electronic Acknowledgement Receipt

EFS ID:	21731260
Application Number:	13674233
International Application Number:	
Confirmation Number:	5197
Title of Invention:	AUDIO-VIDEO MULTI-PARTICIPANT CONFERENCE SYSTEMS USING PSTN AND INTERNET NETWORKS
First Named Inventor/Applicant Name:	Thomas Dye
Customer Number:	22882
Filer:	Brent David Martin
Filer Authorized By:	
Attorney Docket Number:	207.0002-03000
Receipt Date:	10-MAR-2015
Filing Date:	12-NOV-2012
Time Stamp:	18:34:54
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 summary of interview with examiner	Interview_Summary.pdf	65937 e1b5e0cd2583c5bd508a45a07c3ef06391a08bfc	no	1

Warnings:	
Information:	

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Exhibit 1005 – 268

Total Files Size (in bytes):	65937

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
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www.uspto.gov

NOTICE OF ALLOWANCE AND FEE(S) DUE

22882 7590 03/02/2015

MARTIN & FERRARO, LLP
1557 LAKE O'PINES STREET, NE
HARTVILLE, OH 44632

EXAMINER
NI, SUHAN

ART UNIT	PAPER NUMBER
2656	

DATE MAILED: 03/02/2015

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/674,233	11/12/2012	Thomas Dye	207.0002-03000	5197

TITLE OF INVENTION: AUDIO-VIDEO MULTI-PARTICIPANT CONFERENCE SYSTEMS USING PSTN AND INTERNET NETWORKS

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	$480	$0	$480	$480	06/02/2015

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.

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Exhibit 1005 – 270

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)

22882 7590 03/02/2015
MARTIN & FERRARO, LLP
1557 LAKE O'PINES STREET, NE
HARTVILLE, OH 44632

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.
13/674,233	11/12/2012	Thomas Dye	207.0002-03000	5197

TITLE OF INVENTION: AUDIO-VIDEO MULTI-PARTICIPANT CONFERENCE SYSTEMS USING PSTN AND INTERNET NETWORKS

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	$480	$0	$480	$480	06/02/2015

EXAMINER	ART UNIT	CLASS-SUBCLASS
NI, SUHAN	2656	370-260000

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. _____

Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1005 - 271

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
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www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/674,233	11/12/2012	Thomas Dye	207.0002-03000	5197

22882 7590 03/02/2015

MARTIN & FERRARO, LLP
1557 LAKE O'PINES STREET, NE
HARTVILLE, OH 44632

EXAMINER	
NI, SUHAN	

ART UNIT	PAPER NUMBER
2656	

DATE MAILED: 03/02/2015

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.

Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1005 – 272

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.

Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1005 – 273

Notice of Allowability	Application No. 13/674,233	Applicant(s) DYE ET AL.	
	Examiner SUHAN NI	Art Unit 2656	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 *the amendment filed 2/16/2015*.
   ☐ 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 *20-27 and 36-47*. 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 _____
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
4. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____ .
5. ☐ Examiner's Amendment/Comment
6. ☐ Examiner's Statement of Reasons for Allowance
7. ☐ Other _____.

/SUHAN NI/
Primary Examiner, Art Unit 2656

Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1005 – 274

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13674233	DYE ET AL.
	Examiner	Art Unit
	SUHAN NI	2656

✓	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	06/16/2014	09/30/2014	02/21/2015						
	1	-								
	2	-								
	3	-								
	4	-								
	5	-								
	6	-								
	7	-								
	8	-								
	9	-								
	10	-								
	11	-								
	12	✓	=	-						
	13	✓	=	-						
	14	✓	=	-						
	15	✓	=	-						
	16	✓	=	-						
	17	✓	=	-						
	18	✓	=	-						
	19	✓	=	-						
1	20	✓	=	=						
2	21	✓	=	=						
3	22	✓	=	=						
4	23	✓	=	=						
5	24	✓	=	=						
7	25	✓	=	=						
8	26	✓	=	=						
6	27	✓	=	=						
	28	✓	=	-						
	29	✓	=	-						
	30	✓	=	-						
	31	✓	=	-						
	32	✓	=	-						
	33	✓	=	-						
	34	✓	=	-						
	35	✓	=	-						
9	36			=						

Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1005 – 275

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13674233	DYE ET AL.
	Examiner	**Art Unit**
	SUHAN NI	2656

✓	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	06/16/2014	09/30/2014	02/21/2015						
10	37			=						
11	38			=						
12	39			=						
13	40			=						
14	41			=						
15	42			=						
16	43			=						
17	44			=						
18	45			=						
19	46			=						
20	47			=						

Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1005 – 276

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13674233	DYE ET AL.
	Examiner	**Art Unit**
	SUHAN NI	2656

CPC						
Symbol					**Type**	**Version**
H04M		3	/	568	F	2013-01-01
H04N		7	/	15	I	2013-01-01
H04L		12	/	1818	I	2013-01-01
H04L		12	/	4641	I	2013-01-01
H04L		29	/	06027	I	2013-01-01
H04M		3	/	567	I	2013-01-01
H04M		7	/	009	A	2013-01-01
H04M		7	/	1225	I	2013-01-01
H04M		2207	/	35	A	2013-01-01
H04L		65	/	1009	I	2013-01-01
H04L		65	/	4038	I	2013-01-01
			/			
			/			
			/			
			/			

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

NONE (Assistant Examiner)	(Date)	**Total Claims Allowed:** 20	
/SUHAN NI/ Primary Examiner.Art Unit 2656 (Primary Examiner)	02/21/2015 (Date)	O.G. Print Claim(s) 1	O.G. Print Figure 4

Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1005 – 277

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13674233	DYE ET AL.
	Examiner	**Art Unit**
	SUHAN NI	2656

US ORIGINAL CLASSIFICATION		INTERNATIONAL CLASSIFICATION										
CLASS	SUBCLASS	CLAIMED					NON-CLAIMED					
370	260	H	0	4	L	12 / 66 (2006.01.01)						

CROSS REFERENCE(S)					
CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)				
370	352	354			

NONE	Total Claims Allowed:	
(Assistant Examiner) (Date)	20	
/SUHAN NI/ Primary Examiner.Art Unit 2656 02/21/2015	O.G. Print Claim(s)	O.G. Print Figure
(Primary Examiner) (Date)	1	4

Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1005 – 278

Issue Classification	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13674233	DYE ET AL.
	Examiner	**Art Unit**
	SUHAN NI	2656

☐ 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		33										
	2		18		34										
	3		19		35										
	4	1	20	9	36										
	5	2	21	10	37										
	6	3	22	11	38										
	7	4	23	12	39										
	8	5	24	13	40										
	9	7	25	14	41										
	10	8	26	15	42										
	11	6	27	16	43										
	12		28	17	44										
	13		29	18	45										
	14		30	19	46										
	15		31	20	47										
	16		32												

NONE (Assistant Examiner)	(Date)	**Total Claims Allowed:** 20	
/SUHAN NI/ Primary Examiner.Art Unit 2656 (Primary Examiner)	02/21/2015 (Date)	O.G. Print Claim(s) 1	O.G. Print Figure 4

Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1005 – 279

OMB 0651-0031

Substitute for FORM PTO-1449	Attorney Docket Number 207.0002-03000	Customer No. 22882	
INFORMATION DISCLOSURE STATEMENT IN AN APPLICATION	Applicant Thomas Dye et al.	Application Number 13/674,233	
(Use several sheets if necessary) Sheet 1 of 1	Filing Date November 12, 2012	Group Art Unit 2656	Examiner Suhan Ni

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
	5,805,805	8/1998	Civanlar, S. et al.			
	6,041,166	3/2000	Hart, J.H. et al.			
	6,047,325	4/2000	Jain et al.			
	6,728,358	4/2004	Kwan			
	6,751,477	6/2004	Alperovich et al.			
	7,444,425	10/2008	Lehmann et al.			
	7,664,056	2/2010	Dye			
	8,339,997	12/2012	Dye			
	8,477,778	7/2013	Lehmann et al.			
	2003/0137976	7/2003	Zhu et al.			
	2003/0235338	12/2003	Dye			
	2004/0022322	2/2004	Dye			
	2011/0043601	2/2011	Dye			
	2013/0163480	6/2013	Dye			
	14/590,791	1/2015	Dye			

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION (YES/NO)

OTHER DOCUMENTS *(Including Author, Title, Date, Pertinent Pages, Etc.)*	
Lit. 1	VPN Multicast Technologies LLC v. AT&T Inc. and AT&T Corporation; Complaint; Case No. 2:14-cv-1013; October 31, 2014; 8 pages.
Lit. 2	VPN Multicast Technologies LLC v. Dimension Data North America, Inc., Dimension Data Holdings PLC, and Dimension Data, LLC; Complaint; Case No. 2:14-cv-1014; October 31, 2014; 8 pages.
Lit. 1; Lit. 2	VPN Multicast Technologies LLC v. AT&T Inc. and AT&T Corporation; VPN Multicast Technologies LLC v. Dimension Data North America, Inc., Dimension Data Holdings PLC, and Dimension Data, LLC; Dimension Data North America, Inc.'s Answer and Affirmative Defenses to Plaintiff's First Amended Complaint; Case Nos. 2:14-cv-1013 and 2:14-cv-1014; January 29, 2015; 15 pages.
	International Telecommunications Union Recommendation H.323, Titled "Packet Based Multimedia Communication System," November 2000, 258 pages.
	International Telecommunications Union Recommendation H.261, Titled "Video Codec for Audio Visual Services at Px64 kbps," March 1993, 29 pages.
	International Telecommunications Untion Recommendation H.263, Titled "Video Coding for Low Bit-Rate Communications," February 1998, 167 pages.

EXAMINER	/Suhan Ni/	DATE CONSIDERED	02/21/2015

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

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Exhibit 1005 – 280

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

BIB DATA SHEET

CONFIRMATION NO. 5197

SERIAL NUMBER	FILING or 371(c) DATE RULE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
13/674,233	11/12/2012	370	2656	207.0002-03000

APPLICANTS
MEETRIX COMMUNICATION, INC., Santa Monica, CA

INVENTORS
Thomas Dye, Austin, TX;
Thomas Dundon, San Marcos, TX;

**** CONTINUING DATA ***************************
This application is a CON of 12/646,892 12/23/2009 PAT 8339997
which is a CON of 10/796,560 03/09/2004 PAT 7664056
which claims benefit of 60/453,307 03/10/2003

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

**** IF REQUIRED, FOREIGN FILING LICENSE GRANTED **** ** SMALL ENTITY **
12/03/2012

Foreign Priority claimed ☐ Yes ☑ No 35 USC 119(a-d) conditions met ☐ Yes ☐ No Verified and Acknowledged /SUHAN NI/ Examiner's Signature	☐ Met after Allowance Initials	STATE OR COUNTRY	SHEETS DRAWINGS	TOTAL CLAIMS	INDEPENDENT CLAIMS
		TX	6	24	3

ADDRESS
MARTIN & FERRARO, LLP
1557 LAKE O'PINES STREET, NE
HARTVILLE, OH 44632
UNITED STATES

TITLE
AUDIO-VIDEO MULTI-PARTICIPANT CONFERENCE SYSTEMS USING PSTN AND INTERNET NETWORKS

FILING FEE RECEIVED		
722	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

Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1005 – 281

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13674233	DYE ET AL.
	Examiner	Art Unit
	SUHAN NI	2656

CPC- SEARCHED		
Symbol	Date	Examiner
H04M 3/56, 7/006, 3/561, 3/569.	2/21/2015	SN
H04L 29/06027, 29/06326, 49/25, 49/30, 12/64, 12/6418.		
H04Q 2213/13204.		

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner
370	260-263, 265, 352-356.	6/16/2014	SN
		9/30/2014	SN
		2/21/2015	SN

SEARCH NOTES		
Search Notes	Date	Examiner
EAST	6/16/2014	SN
	9/30/2014	SN
	2/21/2015	SN

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner
	ALL ABOVE	9/30/2014	SN
		2/21/2015	SN

	/SUHAN NI/ Primary Examiner.Art Unit 2656

U.S. DEPARTMENT OF COMMERCE
PATENT AND TRADEMARK OFFICE

PATENT WITHDRAWAL NOTICE

DATE WITHDRAWN	WITHDRAWAL NUMBER
2/17/2015	28130

The following application has been **WITHDRAWN** from the

2/17/2015 issue.

SERIAL NO.	PATENT NUMBER
13674233	8958347

TITLE

AUDIO-VIDEO MULTI-PARTICIPANT CONFERENCE SYSTEMS USING PSTN AND INTERNET NETWORKS

NAME AND ADDRESS

THOMAS DYE
Austin, TX

REASON FOR WITHDRAWAL

Auto-petition to withdraw - Granted
-

APPROVED

/Kimberly Terrell/, Manager

Patent Publication Branch
Office of Data Management

FORM PTO-302 -- (REV. 05-2009)

PTO/SB/30EFS (07-09)
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.

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

Application Number	13674233	Filing Date	2012-11-12	Docket Number (if applicable)	207.0002-03000	Art Unit	2656
First Named Inventor	Thomas Dye			Examiner Name	Suhan Ni		

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, or to any design application. The Instruction Sheet for this form is located at WWW.USPTO.GOV

SUBMISSION REQUIRED UNDER 37 CFR 1.114

Note: If the RCE is proper, any previously filed unentered amendments and amendments enclosed with the RCE will be entered in the order in which they were filed unless applicant instructs otherwise. If applicant does not wish to have any previously filed unentered amendment(s) entered, applicant must request non-entry of such amendment(s).

☐ 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 _____

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 501068

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED

☒ Patent Practitioner Signature

☐ Applicant Signature

Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1005 – 284

PTO/SB/30EFS (07-09)
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.

Signature of Registered U.S. Patent Practitioner			
Signature	/Brent D. Martin/	Date (YYYY-MM-DD)	2015-02-16
Name	Brent D. Martin	Registration Number	62717

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.

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

Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1005 – 285

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 records.

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.

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Exhibit 1005 – 286

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	)	Confirmation No.: 5197
Thomas Dye et al.	)	
Serial No.: 13/674,233	)	Group Art Unit: 2656
Filed: February 12, 2012	)	Examiner: Suhan Ni
For: AUDIO-VIDEO MULTI-PARTICIPANT CONFERENCE SYSTEMS USING PSTN AND INTERNET NETWORKS	)	

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

Sir:

AMENDMENT

Prior to the further examination of the above-identified application and in reply to the Notice of Allowance of Final Office Action of October 7, 2014, please amend the application as follows:

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

Remarks begin on page 7 of this paper.

Amendments to the Claims:

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

Listing of Claims:

Claims 1-19. (Cancelled)

20. (Previously Presented) A system for supporting a multi-participant conference call comprising:

a first mixer that mixes a Public Switched Telephone Network (PSTN) client audio data stream with a moderator audio-video data stream into a first mixed data stream;

a first transport output that transmits the first mixed data stream to at least one remote client that receives the first mixed data stream, the at least one remote client communicatively coupled to the Internet, which generates a remote client audio-video data stream;

a second mixer that mixes the moderator audio-video data stream with the remote client audio-video data stream into a second mixed data stream; and

a second transport output that transmits a mixed audio data stream, corresponding to the second mixed data stream, to the PSTN client.

21. (Previously Presented) The system of claim 20 further comprising a third mixer that mixes the audio data from the PSTN client with the audio-video data stream from the remote client into a third mixed data stream and communicates the third mixed data stream to the moderator.

22. (Previously Presented) The system of claim 20 further comprising a VoIP decoder that receives IP packets including the audio data stream generated by

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the PSTN client, the VoIP decodes decodes the IP packets including the audio data from the PSTN client.

23. (Previously Presented) The system of claim 20 further comprising at least one audio decompressor that decodes IP packets including the audio-video data stream generated by the remote client.

24. (Previously Presented) The system of claim 20 wherein the PSTN client audio data stream and the moderator audio-video data stream are transported across a virtual private network tunnel.

25. (Previously Presented) The system of claim 20 wherein the moderator audio-video data stream and the remote client audio-video data stream are transported across a virtual private network tunnel.

26. (Previously Presented) The system of claim 25 further comprising an encoder that receives the first mixed data stream and encodes the first mixed voice data before transmitting the first mixed data stream to the remote client.

27. (Previously Presented) The system of claim 24 further comprising a VoIP encoder that encodes the second mixed data stream and encode the second mixed voice data before transmitting the second mixed data stream to the PSTN client.

Claims 28-35 (Cancelled).

36. (New) A non-transitory computer-readable medium including instructions for a multi-participant conference process to be executed by a local moderator computer, the process comprising:

receiving audio data from a telephone through a public switched telephone network (PTSN);

receiving audio data and video data from a first remote computer through

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an Internet;

receiving audio data and video data from a second remote computer through the Internet;

receiving audio data from a local audio input device communicatively connected to the local moderator computer;

receiving video data from a local video input device communicatively connected to the local moderator computer;

mixing the audio data received from the telephone with the audio data received from the local audio input device and the video data received from the local video input device into mixed audio-video data;

transmitting the mixed audio-video data to the first remote computer and the second remote computer;

mixing the audio data received from the first remote computer and the audio data received from the second remote computer with the audio data received from the local audio input device into mixed audio data;

compressing the mixed audio data;

transmitting the compressed mixed audio data to the telephone; and

transmitting collaboration data to the first remote computer and the second remote computer.

37. (New) The process of claim 36, further comprising mixing the audio data received from the telephone with the audio data received from the first and second remote computers into a second mixed audio data.

38. (New) The process of claim 36, wherein the receiving audio data from the telephone includes receiving internet protocol (IP) packets, the process further comprising decoding the IP packets.

39. (New) The process of claim 36, wherein the receiving audio data and video data from the first remote computer includes receiving internet protocol (IP) packets,

the process further including decoding the IP packets.

40. (New) The process of claim 36, wherein the transmitting the mixed audio-video data includes transmitting the mixed audio-video data through a Virtual Private Network (VPN).

41. (New) The process of claim 36, wherein the transmitting the mixed audio data includes transmitting the mixed audio data through a Virtual Private Network (VPN).

42. (New) The process of claim 36, further comprising encoding the mixed audio-video data before the transmitting of the mixed audio-video data to the first and second remote computers.

43. (New) The process of claim 36, further comprising encoding the compressed mixed audio data before the transmitting of the mixed audio data to the telephone.

44. (New) A computer-implemented multi-participant conference system utilizing a local moderator computer, the system comprising:

a voice over IP decoder configured to decode audio data received by the local moderator computer from a telephone through a public switched telephone network (PSTN);

a voice over IP encoder configured to compress audio data transported from the local moderator computer to the telephone through the PTSN;

a first mixer configured to mix decoded audio data received by the local moderator computer from the telephone through the PTSN with audio data received by the local moderator computer from a local audio input device and video data received by the local moderator computer from a local video input device into an audio-video stream for transmission through an Internet to a first remote computer and a second remote computer;

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a second mixer configured to mix audio data received by the local moderator computer from the first remote computer and the second remote computer through the Internet with audio data received by the local moderator computer from the local audio input device into an audio stream for transmission to the telephone through the PSTN; and

a data collaboration unit configured to transmit collaboration data from the local moderator through the internet to the first remote computer and the second remote computer.

45. (New) The system of claim 44, further comprising a third mixer configured to mix the decoded audio data received from the telephone with the audio data received from the first and second remote computers.

46. (New) The system of claim 44, wherein the audio data received by the local moderator computer from the telephone through the PTSN is transported through a virtual private network (VPN) tunnel.

47. (New) The system of claim 44, wherein audio data transported from the local moderator computer to the telephone is transported through a virtual private network (VPN) tunnel.

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REMARKS

Applicant cancelled claims 12-19 and 28-35 without prejudice or disclaimer of their subject matter and added new claims 36-47 to further define Applicant's invention.

Entry and consideration of this Amendment prior to the further examination of the above-identified application is respectfully requested.

If there are any fees due in connection with the filing of this Amendment, please charge the fee to our Deposit Account No. 50-1068.

Respectfully submitted,

MARTIN & FERRARO, LLP

Dated: February 16, 2015

By: /Brent D. Martin/
Brent D. Martin
Registration No. 62,717

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Plano, Texas 75024
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Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1005 – 293

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	)	Confirmation No.: 5197
Thomas Dye et al.	)	
Serial No.: 13/674,233	)	Group Art Unit: 2656
Filed: November 12, 2012	)	Examiner: Suhan Ni
For: AUDIO-VIDEO MULTI-PARTICIPANT CONFERENCE SYSTEMS USING PSTN AND INTERNET NETWORKS	)	

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

Sir:

INFORMATION DISCLOSURE STATEMENT UNDER 37 C.F.R. § 1.97(b)

Pursuant to 37 C.F.R. §§ 1.56 and 1.97(b), Applicant brings to the attention of the Examiner the documents listed on the attached Form PTO/SB/08. This Information Disclosure Statement is being filed concurrently with a Request for Continued Examination for the above-referenced application.

The present Application is a continuation of Application No. 12/646,892, filed December 23, 2009, now U.S. Patent No. 8,339,997; which is a continuation of Application No. 10/796,560, filed March 9, 2004, now U.S. Patent No. 7,664,056.

Applicant brings to the Examiner's attention Application Nos. 10/772,012, filed February 4, 2004, now U.S. Patent No. 7,444,425; 12/237,286, filed September 24, 2008, now U.S. Patent No. 8,477,778 ("'778 patent"); 13/674,227, filed November 12,

2012 (Publication No. 2013/0163480), which is pending; and 14/590,791, filed January 6, 2015, which is pending.

Applicant also brings to the attention of the Examiner the file history (the Office Actions and responses) of each of the above-referenced patents and applications. While the individual Office Actions and responses are not attached hereto, they are available in each of the file wrappers in the Patent Office, through PAIR, or will be provided by the Applicant at the Examiner's request.

Copies of the listed non-U.S. patent documents are attached. Applicant respectfully requests that the Examiner consider the listed documents and indicate that they were considered by making appropriate notations on the attached form.

Applicant brings to the Examiner's attention that the '778 patent is the subject of litigation in the United States District Court for the Eastern District of Texas, Marshall Division, Civil Action No. 2:14-cv-1013 hereinafter referred to as Litigation 1. The documents associated with Litigation 1 are identified by the designation "Lit. 1" in the Examiner Initial column of the attached Form PTO/SB/08.

The '778 patent is also the subject of litigation in the United States District Court for the Eastern District of Texas, Marshall Division, Civil Action No. 2:14-cv-1014 hereinafter referred to as Litigation 2. The documents associated with Litigation 2 are identified by the designation "Lit. 2" in the Examiner Initial column of the attached Form PTO/SB/08.

Applicant hereby respectfully requests the Examiner to advise Applicant of any additional types of litigation documents beyond those already provided that the Examiner may desire in association with the present application.

This submission does not represent that a search has been made or that no better art exists and does not constitute an admission that each or all of the listed documents are material or constitute "prior art." If the Examiner applies any of the documents as prior art against any claims in the application and Applicant determines that the cited documents do not constitute "prior art" under United States law, Applicant reserves the right to present to the office the relevant facts and law regarding the appropriate status of such documents.

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Applicant further reserves the right to take appropriate action to establish the patentability of the disclosed invention over the listed documents, should one or more of the documents be applied against the claims of the present application.

If there is any fee due in connection with the filing of this Statement, please charge the fee to our Deposit Account No. 50-1068.

Respectfully submitted,

MARTIN & FERRARO, LLP

Dated: February 16, 2015

By: /Daniel J. Fraley/
Daniel J. Fraley
Registration No. 70,165

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OMB 0651-0031

Substitute for FORM PTO-1449	Attorney Docket Number 207.0002-03000	Customer No. 22882	
INFORMATION DISCLOSURE STATEMENT IN AN APPLICATION	Applicant Thomas Dye et al.	Application Number 13/674,233	
(Use several sheets if necessary) Sheet 1 of 1	Filing Date November 12, 2012	Group Art Unit 2656	Examiner Suhan Ni

U.S. PATENT DOCUMENTS

EXAMINER INITIAL	DOCUMENT NUMBER	DATE	NAME	CLASS	SUBCLASS	FILING DATE IF APPROPRIATE
	5,805,805	8/1998	Civanlar, S. et al.			
	6,041,166	3/2000	Hart, J.H. et al.			
	6,047,325	4/2000	Jain et al.			
	6,728,358	4/2004	Kwan			
	6,751,477	6/2004	Alperovich et al.			
	7,444,425	10/2008	Lehmann et al.			
	7,664,056	2/2010	Dye			
	8,339,997	12/2012	Dye			
	8,477,778	7/2013	Lehmann et al.			
	2003/0137976	7/2003	Zhu et al.			
	2003/0235338	12/2003	Dye			
	2004/0022322	2/2004	Dye			
	2011/0043601	2/2011	Dye			
	2013/0163480	6/2013	Dye			
	14/590,791	1/2015	Dye			

FOREIGN PATENT DOCUMENTS

	DOCUMENT NUMBER	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION (YES/NO)

OTHER DOCUMENTS *(Including Author, Title, Date, Pertinent Pages, Etc.)*	
Lit. 1	VPN Multicast Technologies LLC v. AT&T Inc. and AT&T Corporation; Complaint; Case No. 2:14-cv-1013; October 31, 2014; 8 pages.
Lit. 2	VPN Multicast Technologies LLC v. Dimension Data North America, Inc., Dimension Data Holdings PLC, and Dimension Data, LLC; Complaint; Case No. 2:14-cv-1014; October 31, 2014; 8 pages.
Lit. 1; Lit. 2	VPN Multicast Technologies LLC v. AT&T Inc. and AT&T Corporation; VPN Multicast Technologies LLC v. Dimension Data North America, Inc., Dimension Data Holdings PLC, and Dimension Data, LLC; Dimension Data North America, Inc.'s Answer and Affirmative Defenses to Plaintiff's First Amended Complaint; Case Nos. 2:14-cv-1013 and 2:14-cv-1014; January 29, 2015; 15 pages.
	International Telecommunications Union Recommendation H.323, Titled "Packet Based Multimedia Communication System," November 2000, 258 pages.
	International Telecommunications Union Recommendation H.261, Titled "Video Codec for Audio Visual Services at Px64 kbps," March 1993, 29 pages.
	International Telecommunications Untion Recommendation H.263, Titled "Video Coding for Low Bit-Rate Communications," February 1998, 167 pages.

EXAMINER	DATE CONSIDERED

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

Electronic Patent Application Fee Transmittal

Application Number:	13674233
Filing Date:	12-Nov-2012
Title of Invention:	AUDIO-VIDEO MULTI-PARTICIPANT CONFERENCE SYSTEMS USING PSTN AND INTERNET NETWORKS
First Named Inventor/Applicant Name:	Thomas Dye
Filer:	Brent David Martin
Attorney Docket Number:	207.0002-03000

Filed as Small Entity

Filing Fees for Utility under 35 USC 111(a)

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Petition Fee-37CFR 1.17(h) (Group II)	2464	1	70	70
Request for Continued Examination	2801	1	600	600
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Miscellaneous:				
			Total in USD ($)	**670**

UNITED STATES PATENT AND TRADEMARK OFFICE

Commissioner for Patents
United States Patent and Trademark Office
P.O. Box 1450
Alexandria, VA 22313-1450
www.uspto.gov

Decision Date : February 16, 2015

In re Application of :

Thomas Dye

DECISION ON PETITION

UNDER CFR 1.313(c)(2)

Application No : 13674233

Filed : 12-Nov-2012

Attorney Docket No : 207.0002-03000

This is an electronic decision on the petition under 37 CFR 1.313(c)(2), filed February 16, 2015 , to withdraw the above-identified application from issue after payment of the issue fee.

The petition is **GRANTED.**

The above-identified application is withdrawn from issue for consideration of a submission under 37 CFR 1.114 (request for continued examination). See 37 CFR 1.313(c)(2).

Petitioner is advised that the issue fee paid in this application cannot be refunded. If, however, this application is again allowed, petitioner may request that it be applied towards the issue fee required by the new Notice of Allowance.

Telephone inquiries concerning this decision should be directed to the Patent Electronic Business Center (EBC) at 866-217-9197.

This application file is being referred to Technology Center AU 2656 for processing of the request for continuing examination under 37 CFR 1.114 .

Office of Petitions

Electronic Acknowledgement Receipt

EFS ID:	21507859
Application Number:	13674233
International Application Number:	
Confirmation Number:	5197
Title of Invention:	AUDIO-VIDEO MULTI-PARTICIPANT CONFERENCE SYSTEMS USING PSTN AND INTERNET NETWORKS
First Named Inventor/Applicant Name:	Thomas Dye
Customer Number:	22882
Filer:	Brent David Martin
Filer Authorized By:	
Attorney Docket Number:	207.0002-03000
Receipt Date:	16-FEB-2015
Filing Date:	12-NOV-2012
Time Stamp:	14:28:37
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$670
RAM confirmation Number	9862
Deposit Account	501068
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 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Petition automatically granted by EFS	petition-request.pdf	31330 eff889076c0db9e34e693a4e70303eafc836db04	no	2
Warnings:					
Information:					
2	Request for Continued Examination (RCE)	RCE.pdf	697588 71d26b97f34258ebc522987c709c678c13121fe5	no	3
Warnings:					
Information:					
3		Amendment.pdf	77265 72d14b618b1c7931b0116574b56facc8bc8d5ea1	yes	7

Multipart Description/PDF files in .zip description

Document Description	Start	End
Amendment Submitted/Entered with Filing of CPA/RCE	1	1
Claims	2	6
Applicant Arguments/Remarks Made in an Amendment	7	7

Warnings:					
Information:					
4	Transmittal Letter	IDS.pdf	71132 00d63b1b179794519e99091b35fe2464d50f1908	no	3
Warnings:					
Information:					
5	Information Disclosure Statement (IDS) Form (SB08)	SB08.pdf	95458 895f198abb01fff3d745ede3d5104ac3ef1df25c	no	1
Warnings:					
Information:					

This is not an USPTO supplied IDS fillable form

6	Non Patent Literature	ATT_Complaint_10-31-14_8pgs.pdf	179370 18049c2dd4fdf2ccbcb8101f79d25a82ea4ae3f7	no	8
Warnings:					
Information:					
7	Non Patent Literature	Dimension_Data_Answer_and_Affirmative_Defenses_1-29-2015_15pgs_pto.pdf	161348 e81235340ab9ecb1532c968afde8a8a5529195b4	no	15
Warnings:					
Information:					
8	Non Patent Literature	Dimension_Data_Complaint_10-31-14_8pgs.pdf	183163 24248d49d15d3e7767666388fa314726b9dde2fb	no	8
Warnings:					
Information:					
9	Non Patent Literature	H261_29pgs_pto.pdf	352114 e2ba20c06fe86d4a38680029c252bd0215795bcc	no	29
Warnings:					
Information:					
10	Non Patent Literature	H263_February_1998_167pgs_pto.pdf	965671 3c0bd888bb48685b3fa922efece9fc5eae275d89	no	167
Warnings:					
Information:					
11	Non Patent Literature	H323_November_2000_258pgs_pto.pdf	1371730 41564b964c0072300b3e731549654c1311d3848f	no	258
Warnings:					
Information:					
12	Fee Worksheet (SB06)	fee-info.pdf	32303 a93912576f9543e38f24f97df442fdd8e7e3cd16	no	2
Warnings:					
Information:					
			Total Files Size (in bytes):	4218472	

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.

Doc Code: PET.AUTO Document Description: Petition automatically granted by EFS-Web	PTO/SB/140 U.S. Patent and Trademark Office Department of Commerce

Electronic Petition Request	**PETITION TO WITHDRAW AN APPLICATION FROM ISSUE AFTER PAYMENT OF THE ISSUE FEE UNDER 37 CFR 1.313(c)**
Application Number	13674233
Filing Date	12-Nov-2012
First Named Inventor	Thomas Dye
Art Unit	2656
Examiner Name	SUHAN NI
Attorney Docket Number	207.0002-03000
Title	AUDIO-VIDEO MULTI-PARTICIPANT CONFERENCE SYSTEMS USING PSTN AND INTERNET NETWORKS

An application may be withdrawn from issue for further action upon petition by the applicant. To request that the Office withdraw an application from issue, applicant must file a petition under this section including the fee set forth in § 1.17(h) and a showing of good and sufficient reasons why withdrawal of the application from issue is necessary.

APPLICANT HEREBY PETITIONS TO WITHDRAW THIS APPLICATION FROM ISSUE UNDER 37 CFR 1.313(c).

A grantable petition requires the following items:
(1) Petition fee; and
(2) One of the following reasons:
(a) Unpatentability of one or more claims, which must be accompanied by an unequivocal statement that one or more claims are unpatentable, an amendment to such claim or claims, and an explanation as to how the amendment causes such claim or claims to be patentable;
(b) Consideration of a request for continued examination in compliance with § 1.114 (for a utility or plant application only); or
(c) Express abandonment of the application. Such express abandonment may be in favor of a continuing application, but not a CPA under 37 CFR 1.53(d).

Petition Fee

- (◉) Small Entity
- (◯) Micro Entity
- (◯) Regular Undiscounted

Reason for withdrawal from issue

◯ One or more claims are unpatentable ◉ Consideration of a request for continued examination (RCE) (List of Required Documents and Fees) ◯ Applicant hereby expressly abandons the instant application (any attorney/agent signing for this reason must have power of attorney pursuant to 37 CFR 1.32(b)).
RCE request,submission, and fee. ☐ I certify, in accordance with 37 CFR 1.4(d)(4) that : The RCE request ,submission, and fee have already been filed in the above-identified application on ☒ Are attached.
THIS PORTION MUST BE COMPLETED BY THE SIGNATORY OR SIGNATORIES I certify, in accordance with 37 CFR 1.4(d)(4) that I am: ◉ An attorney or agent registered to practice before the Patent and Trademark Office who has been given power of attorney in this application. ◯ An attorney or agent registered to practice before the Patent and Trademark Office, acting in a representative capacity. ◯ A sole inventor ◯ A joint inventor; I certify that I am authorized to sign this submission on behalf of all of the inventors as evidenced by the power of attorney in the application ◯ A joint inventor; all of whom are signing this e-petition

Signature	/Brent D. Martin/
Name	Brent D. Martin
Registration Number	62717

PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 13/674,233	Filing Date 11/12/2012	☐ To be Mailed

ENTITY: ☐ LARGE ☒ SMALL ☐ MICRO

APPLICATION AS FILED – PART I

FOR	(Column 1) NUMBER FILED	(Column 2) 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	02/16/2015	(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	** 24	= 0	X $40 =	0
	Independent (37 CFR 1.16(h))	* 3	Minus	***3	= 0	X $210 =	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
/KIMBERLY PANNELL/

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.

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
13/674,233	11/12/2012	Thomas Dye	MEET 12.003

CONFIRMATION NO. 5197

22882
MARTIN & FERRARO, LLP
1557 LAKE O'PINES STREET, NE
HARTVILLE, OH 44632

POA ACCEPTANCE LETTER

OC000000073412343

Date Mailed: 02/13/2015

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 02/10/2015.

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.

/dtvernon/

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1005 – 308

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
13/674,233	11/12/2012	Thomas Dye	MEET 12.003

CONFIRMATION NO. 5197

POWER OF ATTORNEY NOTICE

48008
KERR IP GROUP, LLC
MICHAEL A. KERR
P.O. Box 18600
RENO, NV 89511

OC000000073412307

Date Mailed: 02/13/2015

NOTICE REGARDING CHANGE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 02/10/2015.

- 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).

/dtvernon/

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1005 – 309

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.
13/674,233	11/12/2012	Thomas Dye	MEET 12.003	5197

48008 7590 02/10/2015

KERR IP GROUP, LLC
MICHAEL A. KERR
P.O. Box 18600
RENO, NV 89511

EXAMINER
NI, SUHAN

ART UNIT	PAPER NUMBER
2656	

NOTIFICATION DATE	DELIVERY MODE
02/10/2015	ELECTRONIC

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.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

MICK@KIPG.COM
mmk@kipg.com
admin@kipg.com

Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1005 – 310

Applicant-Initiated Interview Summary	Application No.	Applicant(s)	
	13/674,233	DYE ET AL.	
	Examiner	Art Unit	
	SUHAN NI	2656	

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

(1) *SUHAN NI*.

(2) *Brent D Martin*.

(3) *Amedeo F. Ferraro*.

(4) _____.

Date of Interview: *04 February 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: _____.

Identification of prior art discussed: _____.

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...)

The applicants will amend the claims, and the examiner will further consider the newly amended claims.

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

/SUHAN NI/ Primary Examiner, Art Unit 2656	

Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1005 – 311

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.

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

PTO/AIA/82B (07-13)
Approved for use through 11/30/2014. OMB 0651-0051
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number

POWER OF ATTORNEY BY APPLICANT

I hereby revoke all previous powers of attorney given in the application identified in either the attached transmittal letter or the boxes below.

Application Number	Filing Date

(Note: The boxes above may be left blank if information is provided on form PTO/AIA/82A.)

☑ I hereby appoint the Patent Practitioner(s) associated with the following Customer Number as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above: 22882

OR

☐ I hereby appoint Practitioner(s) named in the attached list (form PTO/AIA/82C) as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the patent application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above. (Note: Complete form PTO/AIA/82C.)

Please recognize or change the correspondence address for the application identified in the attached transmittal letter or the boxes above to:

☑ The address associated with the above-mentioned Customer Number

OR

☐ The address associated with Customer Number:

OR

Firm or Individual Name					
Address					
City		State		Zip	
Country					
Telephone		Email			

I am the Applicant (if the Applicant is a juristic entity, list the Applicant name in the box):

VPN MULTICAST TECHNOLOGIES LLC

☐ Inventor or Joint Inventor (title not required below)
☐ Legal Representative of a Deceased or Legally Incapacitated Inventor (title not required below)
☑ Assignee or Person to Whom the Inventor is Under an Obligation to Assign (provide signer's title if applicant is a juristic entity)
☐ Person Who Otherwise Shows Sufficient Proprietary Interest (e.g., a petition under 37 CFR 1.46(b)(2) was granted in the application or is concurrently being filed with this document) (provide signer's title if applicant is a juristic entity)

SIGNATURE of Applicant for Patent

The undersigned (whose title is supplied below) is authorized to act on behalf of the applicant (e.g., where the applicant is a juristic entity).

Signature		Date (Optional)	1/5/2015
Name	Tisha Stender		
Title	Chief Operating Officer and Legal Counsel		

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

☑ Total of 1 forms are submitted.

This collection of information is required by 37 CFR 1.131, 1.32, and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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

Electronic Acknowledgement Receipt

EFS ID:	21435795
Application Number:	13674233
International Application Number:	
Confirmation Number:	5197
Title of Invention:	AUDIO-VIDEO MULTI-PARTICIPANT CONFERENCE SYSTEMS USING PSTN AND INTERNET NETWORKS
First Named Inventor/Applicant Name:	Thomas Dye
Customer Number:	48008
Filer:	Brent David Martin
Filer Authorized By:	
Attorney Docket Number:	MEET 12.003
Receipt Date:	09-FEB-2015
Filing Date:	12-NOV-2012
Time Stamp:	18:04:23
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	Miscellaneous Incoming Letter	Request_POA.pdf	65500 0b834f89a67d4c1b6d1aa2b437451b1946d3a328	no	2

Warnings:	
Information:	

Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1005 – 314

2	Application Data Sheet	Corrected_ADS.pdf	224432 1851893926b50f415b7b474279066ab8f0324b53	no	6
Warnings:					
Information:					
This is not an USPTO supplied ADS fillable form					
3	Assignee showing of ownership per 37 CFR 3.73.	373c_statement.pdf	124343 bad85960a4af88bb1e8ee6bd047158d756f8628c	no	3
Warnings:					
Information:					
4	Transmittal Letter	POA_Transmittal.pdf	160777 2fdc19c7b046d2e7e65dbbcb40733aaa97bf8534	no	1
Warnings:					
Information:					
5	Power of Attorney	POA.pdf	269459 f8153ce9ef364cd792d18ed37d71bd51a901ec92	no	1
Warnings:					
Information:					
		Total Files Size (in bytes):	844511		

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

In re Application of:	)	Confirmation No.: 5197
Thomas Dye et al.	)	
Serial No.: 13/674,233	)	Group Art Unit: 2447
Filed: November 12, 2012	)	Examiner: Suhan Ni
For: AUDIO-VIDEO MULTI-PARTICIPANT CONFERENCE SYSTEMS USING PSTN AND INTERNET NETWORKS	)	

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

Sir:

REQUEST FOR ISSUANCE OF ACCEPTANCE OF POWER OF ATTORNEY

In response to the Denial of Request for Power of Attorney mailed by the United States Patent and Trademark Office on February 3, 2015, applicant hereby respectfully submits the following documentation:

1. Corrected Application Data Sheet;
2. Statement Under 37 CFR 3.73(c);
3. Transmittal for Power of Attorney; and
3. Power of Attorney

The issuance of a timely Acceptance of Power of Attorney is earnestly requested.

Applicant believes that there is no fee required with the submission of these

documents; however, if there are fees due, the Commissioner is hereby authorized to charge Deposit Account No. 50-1068.

Respectfully submitted,

MARTIN & FERRARO, LLP

Dated: February 9, 2015

By: /Brent D. Martin/
Brent D. Martin
Registration No. 62,717

5151 Headquarters Drive, Suite 170
Plano, Texas 75024
Telephone: (972) 668-3050
Facsimile: (972) 668-3056

Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1005 – 317

PTO/AIA/14 (08-12)
Approved for use through 01/31/2014. OMB 0651-0032
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.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	~~MEET 12.003~~ 207.0002-03000
	Application Number	13/674,233
Title of Invention	AUDIO-VIDEO MULTI-PARTICIPANT CONFERENCE SYSTEMS USING PSTN AND INTERNET NETWORKS	

The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76.
This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.

Secrecy Order 37 CFR 5.2

☐ Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)

Inventor Information:

Inventor 1 Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
Mr.	Thomas		Dye	

Residence Information (Select One) ◉ US Residency ○ Non US Residency ○ Active US Military Service

City	Austin	State/Province	TX	Country of Residence	US

Mailing Address of Inventor:

Address 1	6621 Candle Ridge Cove		
Address 2			
City	Austin	State/Province	TX
Postal Code	78731	Country	US

Inventor 2 Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
Mr.	Thomas		Dundon	

Residence Information (Select One) ◉ US Residency ○ Non US Residency ○ Active US Military Service

City	San Marcos	State/Province	TX	Country of Residence	US

Mailing Address of Inventor:

Address 1	2840 Paso Del Robles		
Address 2			
City	San Marcos	State/Province	TX
Postal Code	78666	Country	US

All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the **Add** button. Add

Correspondence Information:

Enter either Customer Number or complete the Correspondence Information section below.
For further information see 37 CFR 1.33(a).

Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1005 – 318

PTO/AIA/14 (08-12)
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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	~~MEET 12.003~~ 207.0002-03000
	Application Number	13/674,233
Title of Invention	AUDIO-VIDEO MULTI-PARTICIPANT CONFERENCE SYSTEMS USING PSTN AND INTERNET NETWORKS	

☐ **An Address is being provided for the correspondence Information of this application.**

Customer Number	~~48008~~ 22882		
Email Address	~~mick@kipg.com~~	Add Email	Remove Email

Application Information:

Title of the Invention	AUDIO-VIDEO MULTI-PARTICIPANT CONFERENCE SYSTEMS USING PSTN AND INTERNET NETWORKS		
Attorney Docket Number	~~MEET 12.003~~ 207.0002-03000	**Small Entity Status Claimed**	☒
Application Type	Nonprovisional		
Subject Matter	Utility		
Suggested Class (if any)		**Sub Class (if any)**	
Suggested Technology Center (if any)			
Total Number of Drawing Sheets (if any)	6	**Suggested Figure for Publication (if any)**	

Publication Information:

☐ Request Early Publication (Fee required at time of Request 37 CFR 1.219)

☐ **Request Not to Publish.** I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application **has not and will not** be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32).
Either enter Customer Number or complete the Representative Name section below. If both sections are completed the customer Number will be used for the Representative Information during processing.

Please Select One:	◉ Customer Number	○ US Patent Practitioner	○ Limited Recognition (37 CFR 11.9)
Customer Number	~~48008~~ 22882		

Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, or 365(c) or indicate National Stage entry from a PCT application. Providing this information in the application data sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78.

Prior Application Status	Pending		Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)
	Continuation of	12646892	2009-12-23

PTO/AIA/14 (08-12)
Approved for use through 01/31/2014. OMB 0651-0032
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.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	~~MEET 12.003~~ 207.0002-03000
	Application Number	13/674,233
Title of Invention	AUDIO-VIDEO MULTI-PARTICIPANT CONFERENCE SYSTEMS USING PSTN AND INTERNET NETWORKS	

Prior Application Status	Patented				Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
12646892	Continuation of	10796560	2004-03-09	7664056	2010-02-16

Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)
10796560	non provisional of	60453307	2003-03-10

Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the **Add** button. Add

Foreign Priority Information:

This section allows for the applicant to claim benefit of foreign priority and to identify any prior foreign application for which priority is not claimed. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55(a).

Remove

Application Number	Country i	Filing Date (YYYY-MM-DD)	Priority Claimed
			○ Yes ◉ No

Additional Foreign Priority Data may be generated within this form by selecting the **Add** button. Add

Authorization to Permit Access:

☐ Authorization to Permit Access to the Instant Application by the Participating Offices

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 instant patent application is filed access to the instant 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 instant patent application is filed to have access to the instant patent application.

In accordance with 37 CFR 1.14(h)(3), access will be provided to a copy of the instant patent application with respect to: 1) the instant patent application-as-filed; 2) any foreign application to which the instant 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 instant patent application; and 3) any U.S. application-as-filed from which benefit is sought in the instant patent application.

In accordance with 37 CFR 1.14(c), access may be provided to information concerning the date of filing this Authorization.

PTO/AIA/14 (08-12)
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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	~~MEET 12.003~~ 207.0002-03000
	Application Number	13/674,233
Title of Invention	AUDIO-VIDEO MULTI-PARTICIPANT CONFERENCE SYSTEMS USING PSTN AND INTERNET NETWORKS	

Applicant Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

Applicant 1

If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section.

Remove

○ Assignee	○ Legal Representative under 35 U.S.C. 117
◉ Person to whom the inventor is obligated to assign.	○ Person who shows sufficient proprietary interest

If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:

Name of the Deceased or Legally Incapacitated Inventor :

If the Assignee is an Organization check here. ☒

Organization Name	~~Meetrix Communication, Inc.~~ VPN Multicast Technologies LLC		
Mailing Address Information:			
Address 1	~~2261 23rd Street~~ 101 E. Park		
Address 2	6th Floor, Suite 33		
City	~~Santa Monica~~ Plano	**State/Province**	~~CA~~ TX
Country [i] US		Postal Code	~~90405~~ 75074
Phone Number	~~310-399-7471~~	Fax Number	
Email Address			

Additional Applicant Data may be generated within this form by selecting the Add button. Add

Signature:

Remove

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

Signature	~~/Michael A. Kerr/~~ /Brent D. Martin/			Date (YYYY-MM-DD)	2014-02-09 ~~2012-11-09~~
First Name	~~Michael~~ Brent D.	Last Name	~~Kerr~~ Martin	Registration Number	~~42722~~ 62717

Additional Signature may be generated within this form by selecting the Add button. Add

Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1005 – 321

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	~~MEET 12.003~~ 207.0002-03000
	Application Number	13/674,233
Title of Invention	AUDIO-VIDEO MULTI-PARTICIPANT CONFERENCE SYSTEMS USING PSTN AND INTERNET NETWORKS	

This collection of information is required by 37 CFR 1.76. 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 23 minutes to complete, including gathering, preparing, and submitting the completed application data sheet 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 records.

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.

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

Applicant/Patent Owner: Thomas Dye et al.

Application No./Patent No.: 13/674,233 Filed/Issue Date: November 12, 2012

Titled: AUDIO-VIDEO MULTI-PARTICIPANT CONFERENCE SYSTEMS USING PSTN AND INTERNET NETWORKS

VPN Multicast Technologies LLC, 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: Thomas Dye and Thomas Dundon To: Meetrix, Inc.

   The document was recorded in the United States Patent and Trademark Office at
   Reel 034715, Frame 0567, or for which a copy thereof is attached.

2. From: Trustee of Meetrix, Inc. To: Great West Capital, LLC

   The document was recorded in the United States Patent and Trademark Office at
   Reel 034765, Frame 0762, 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**

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

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

3. From: Great West Capital, LLC To: Meetrix Communications, Inc.

The document was recorded in the United States Patent and Trademark Office at
Reel 029932, Frame 0738, or for which a copy thereof is attached.

4. From: Meetrix Communications, Inc. To: Copytele Patent Acquisition Corporation

The document was recorded in the United States Patent and Trademark Office at
Reel 034005, Frame 0249, or for which a copy thereof is attached.

5. From: Copytele Patent Acquisition Corporation To: ITUS Patent Acquisition Corporation

The document was recorded in the United States Patent and Trademark Office at
Reel 034032, Frame 0082, or for which a copy thereof is attached.

6. From: ITUS Patent Acquisition Corporation To: VPN Multicast Technologies LLC

The document was recorded in the United States Patent and Trademark Office at
Reel 034005, Frame 0904, 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.

/Brent D. Martin/	February 9, 2015
Signature	Date
Brent D. Martin	62,717
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.

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

PTO/AIA/82A (07-13)
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TRANSMITTAL FOR POWER OF ATTORNEY TO ONE OR MORE REGISTERED PRACTITIONERS

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

Application Number	13/674,233
Filing Date	November 12, 2012
First Named Inventor	Thomas Dye
Title	AUDIO-VIDEO MULTI-PARTICIPANT CONFERENCE SYSTEMS USING PSTN AND INTERNET NETWORKS
Art Unit	2447
Examiner Name	Suhan Ni
Attorney Docket Number	207.0002-03000

SIGNATURE of Applicant or Patent Practitioner

Signature	/Brent D. Martin/	Date (Optional)	February 9, 2015
Name	Brent D. Martin	Registration Number	62,717
Title (if Applicant is a juristic entity)			
Applicant Name (if Applicant is a juristic entity)			

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

☑ *Total of 1 forms are submitted.

This collection of information is required by 37 CFR 1.131, 1.32, and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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

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

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
13/674,233	11/12/2012	Thomas Dye	MEET 12.003

CONFIRMATION NO. 5197

48008
KERR IP GROUP, LLC
MICHAEL A. KERR
P.O. Box 18600
RENO, NV 89511

MISCELLANEOUS NOTICE

OC000000073176936

Date Mailed: 02/04/2015

A communication which cannot be delivered in electronic form has been mailed to the applicant.

Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1005 – 328

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www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
13/674,233	11/12/2012	Thomas Dye	MEET 12.003

CONFIRMATION NO. 5197

48008
KERR IP GROUP, LLC
MICHAEL A. KERR
P.O. Box 18600
RENO, NV 89511

MISCELLANEOUS NOTICE

OC000000073176936

Date Mailed: 02/04/2015

A communication which cannot be delivered in electronic form has been mailed to the applicant.

Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1005 – 329

UNITED STATES PATENT AND TRADEMARK OFFICE

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APPLICATION NUMBER	FILING DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
13/674,233	11/12/2012	Thomas Dye	MEET 12.003

CONFIRMATION NO. 5197

OC000000073176936

48008
KERR IP GROUP, LLC
MICHAEL A. KERR
P.O. Box 18600
RENO, NV 89511

Cc: MARTIN & FERRARO, LLP
1557 LAKE O'PINES STREET, NE
HARTVILLE, OH 44632

Date Mailed: 02/03/2015

DENIAL OF REQUEST FOR POWER OF ATTORNEY

The request for Power of Attorney filed 01/14/2015 is acknowledged. However, the request cannot be granted at this time for the reason stated below.

- ☐ The Power of Attorney you provided did not comply with the new Power of Attorney rules that became effective on June 25, 2004. See 37 CFR 1.32.
- ☐ The revocation is not signed by the applicant, the assignee of the entire interest, or one particular principal attorney having the authority to revoke.
- ☐ The Power of Attorney is from an assignee and the Certificate required by 37 CFR 3.73(c) has not been received.
- ☐ The person signing for the assignee has omitted their empowerment to sign on behalf of the assignee.
- ☐ The inventor(s) is without authority to appoint attorneys since the assignee has intervened as provided by 37 CFR 3.71.
- ☐ The signature(s) of _____, a co-inventor in this application, has been omitted. The Power of Attorney will be entered upon receipt of confirmation signed by said co-inventor(s).
- ☐ The person(s) appointed in the Power of Attorney is not registered to practice before the U.S. Patent and Trademark Office.
- ☐ Only one Customer Number can be designated for the Power of Attorney in an application. The Customer Number that was captured is the first Customer Number provided on the Power of Attorney document.

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

- ☐ A request under 37 CFR 1.48 to add an inventor was granted in this application, however, no power of attorney consistent with the power of attorney granted by the originally named inventive entity has been received. Thus, the addition of the inventor has resulted in the loss of power of attorney in the application. See 37 CFR 1.32(e).
- ☐ The power of attorney has not been accepted because the party who is giving power of attorney has not been identified. Power of attorney may only be signed by the applicant for patent (37 CFR 1.42) or the patent owner. A patent owner who was not the applicant must appoint any power of attorney in compliance with 37 CFR 3.71 and 3.73. See 37 CFR 1.32(b)(4).
- ☐ The power of attorney from the inventors has not been accepted because it is a copy from a prior national application for which benefit is claimed and the continuing application names an inventor who was not named as an inventor in the prior application.
- ☐ The power of attorney from the inventors has not been accepted because the power of attorney must be signed by the applicant for patent. See 37 CFR 1.32(b)(4).
- ☑ Any request to correct or update the name of the applicant must include an application data sheet (ADS) in compliance with 37 CFR 1.76 specifying the correct or updated name of the applicant in the applicant information section. Any request to change the applicant after an original applicant has been specified under 37 CFR 1.46(b) must include a new ADS in compliance with 37 CFR 1.76 specifying the applicant in the applicant information section and comply with 37 CFR 3.71 and 3.73. See 37 CFR 1.46(c).

Any inquiries regarding this notice should be directed to the Application Assistance Unit at 571-272-4200.

Application Assistance Unit
571-272-4200

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United States Patent and Trademark Office
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APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/674,233	02/17/2015	8958347	207.0002-03000	5197

22882 7590 01/27/2015

MARTIN & FERRARO, LLP
1557 LAKE O'PINES STREET, NE
HARTVILLE, OH 44632

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 163 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):

Thomas Dye, Austin, TX;
Thomas Dundon, San Marcos, TX;
MEETRIX COMMUNICATION, INC., Santa Monica, 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.

Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1005 – 332

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Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
13/674,233	11/12/2012	Thomas Dye	207.0002-03000

CONFIRMATION NO. 5197

22882
MARTIN & FERRARO, LLP
1557 LAKE O'PINES STREET, NE
HARTVILLE, OH 44632

POA ACCEPTANCE LETTER

OC000000072894272

Date Mailed: 01/16/2015

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 01/14/2015.

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.

/nhorne/

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1005 – 333

UNITED STATES PATENT AND TRADEMARK OFFICE

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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
13/674,233	11/12/2012	Thomas Dye	MEET 12.003

CONFIRMATION NO. 5197

POWER OF ATTORNEY NOTICE

48008
KERR IP GROUP, LLC
MICHAEL A. KERR
P.O. Box 18600
RENO, NV 89511

OC00000072894271

Date Mailed: 01/16/2015

NOTICE REGARDING CHANGE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 01/14/2015.

- 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).

/nhorne/

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1005 – 334

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

PTO/AIA/82A (07-13)
Approved for use through 11/30/2014. OMB 0651-0051
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

TRANSMITTAL FOR POWER OF ATTORNEY TO ONE OR MORE REGISTERED PRACTITIONERS

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

Application Number	13/674,233
Filing Date	November 12, 2012
First Named Inventor	Thomas Dye
Title	AUDIO-VIDEO MULTI-PARTICIPANT CONFERENCE SYSTEMS USING PSTN AND INTERNET NETWORKS
Art Unit	2656
Examiner Name	Suhan Ni
Attorney Docket Number	207.0002-03000

SIGNATURE of Applicant or Patent Practitioner

Signature	/Amedeo F. Ferraro/	Date (Optional)	January 14, 2015
Name	Amedeo F. Ferraro	Registration Number	37,129
Title (if Applicant is a juristic entity)			
Applicant Name (if Applicant is a juristic entity)			

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

☑ *Total of 1 forms are submitted.

This collection of information is required by 37 CFR 1.131, 1.32, and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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

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

PTO/AIA/82B (07-13)
Approved for use through 11/30/2014. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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POWER OF ATTORNEY BY APPLICANT

I hereby revoke all previous powers of attorney given in the application identified in either the attached transmittal letter or the boxes below.

Application Number	Filing Date

(Note: The boxes above may be left blank if information is provided on form PTO/AIA/82A.)

☑ I hereby appoint the Patent Practitioner(s) associated with the following Customer Number as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above: 22882

OR

☐ I hereby appoint Practitioner(s) named in the attached list (form PTO/AIA/82C) as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the patent application referenced in the attached transmittal letter (form PTO/AIA/82A) or identified above. (Note: Complete form PTO/AIA/82C.)

Please recognize or change the correspondence address for the application identified in the attached transmittal letter or the boxes above to:

☑ The address associated with the above-mentioned Customer Number

OR

☐ The address associated with Customer Number:

OR

Firm or Individual Name					
Address					
City		State		Zip	
Country					
Telephone		Email			

I am the Applicant (if the Applicant is a juristic entity, list the Applicant name in the box):

VPN MULTICAST TECHNOLOGIES LLC

☐ Inventor or Joint Inventor (title not required below)

☐ Legal Representative of a Deceased or Legally Incapacitated Inventor (title not required below)

☑ Assignee or Person to Whom the Inventor is Under an Obligation to Assign (provide signer's title if applicant is a juristic entity)

☐ Person Who Otherwise Shows Sufficient Proprietary Interest (e.g., a petition under 37 CFR 1.46(b)(2) was granted in the application or is concurrently being filed with this document) (provide signer's title if applicant is a juristic entity)

SIGNATURE of Applicant for Patent

The undersigned (whose title is supplied below) is authorized to act on behalf of the applicant (e.g., where the applicant is a juristic entity).

Signature	/Tisha Stender/	Date (Optional)	1/5/2015
Name	Tisha Stender		
Title	Chief Operating Officer and Legal Counsel		

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

☑ Total of 1 forms are submitted.

This collection of information is required by 37 CFR 1.131, 1.32, and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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

PTO/AIA/96 (08-12)
Approved for use through 01/31/2013. OMB 0651-0031
U.S. Patent and Trademark Office;U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of1995, no persons arerequired to respond to a collection of information unless it displays a valid OMB control number.

STATEMENT UNDER 37 CFR 3.73(c)

Applicant/Patent Owner: Thomas Dye et al.

Application No./Patent No.: 13/674,233 Filed/Issue Date: November 12, 2012

Titled: AUDIO-VIDEO MULTI-PARTICIPANT CONFERENCE SYSTEMS USING PSTN AND INTERNET NETWORKS

VPN MULTICAST TECHNOLOGIES LLC, a Limited Liability Company

(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: Thomas Dye et al. To: Meetrix, Inc.

   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: Trustee of Meetrix, Inc., Randolph N. Osherow To: Great West Capital, LLC

   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**

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

PTO/AIA/96 (08-12)
Approved for use through 01/31/2013. 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 displays a valid OMB control number.

STATEMENT UNDER 37 CFR 3.73(c)

3. From: Great West Capital, LLC To: Meetrix Communications, Inc.

The document was recorded in the United States Patent and Trademark Office at
Reel 29932, Frame 738, or for which a copy thereof is attached.

4. From: Meetrix Communications, Inc. To: Copytele Patent Acquisition Corporation

The document was recorded in the United States Patent and Trademark Office at
Reel 34005, Frame 249, or for which a copy thereof is attached.

5. From: Copytele Patent Acquisition Corporation To: ITUS Patent Acquisition Corporation

The document was recorded in the United States Patent and Trademark Office at
Reel 34032, Frame 82, or for which a copy thereof is attached.

6. From: ITUS Patent Acquisition Corporation To: VPN Multicast Technologies LLC

The document was recorded in the United States Patent and Trademark Office at
Reel 34005, Frame 904, 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.

/Amedeo F. Ferraro/	January 14, 2015
Signature	Date
Amedeo F. Ferraro	37,129
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.

ASSIGNMENT

FOR GOOD AND VALUABLE CONSIDERATION, the receipt, sufficiency and adequacy of which are hereby acknowledged, the undersigned does hereby:

SELL, ASSIGN AND TRANSFER to MEETRIX CORPORATION (the "Assignee"), a corporation organized and existing under and by virtue of the laws of the State of Delaware, and having its principal place of business at 2433 Rutland, Suite 100 Austin, TX 78758, the entire right, title and interest for the United States and all foreign countries, in and to any and all improvements which are disclosed in the application for United States Letters Patent, which, was filed **March 9, 2004**, Serial No. **10/796,560**, and is entitled **MEDIA BASED COLLABORATION USING MIXED-MODE PSTN AND INTERNET NETWORKS**, such application and all divisional, continuing, substitute, renewal, reissue and all other applications for patent which have been or shall be filed in the United States and all foreign countries on any of such improvements; all original and reissued patents which have been or shall be issued in the United States and all foreign countries on such improvements; and specifically including the right to file foreign applications under the provisions of any convention or treaty and claim priority based on such application in the United States;

AUTHORIZE AND REQUEST the issuing authority to issue any and all United States and foreign patents granted on such improvements to the Assignee;

WARRANT AND COVENANT that no assignment, grant, mortgage, license or other agreement affecting the rights and property herein conveyed has been or will be made to others by the undersigned, and that the full right to convey the same as herein expressed is possessed by the undersigned;

COVENANT that, when requested and at the expense of the Assignee, to carry out in good faith the intent and purpose of this assignment, the undersigned will execute all divisional, continuing, substitute, renewal, reissue, and all other patent applications on any and all such improvements; execute all rightful oaths, declarations, assignments, powers of attorney and other papers; communicate to the Assignee all facts known to the undersigned relating to such improvements and the history thereof; and generally do everything possible which the Assignee shall consider desirable for securing, maintaining and enforcing proper patent protection for such improvements and for vesting title to such improvements in the Assignee;

COVENANT AND AGREE that the above is and will be binding on the heirs, assigns, representatives and successors of the undersigned and extend to the successors, assigns and nominees of the Assigns.

Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1005 – 340

(Signature) _____ Date: April 6th, 2004
Name: Thomas A. Dye

Witness (Signature): _____ Date: 4-6-04
Witness (Printed Name): Tristin Caramino

(Signature) _____ Date: _____
Name: Thomas A. Dundon

Witness (Signature): _____ Date: _____

Witness (Printed Name): _____

Jeffrey C. Hood
Conley, Rose & Tayon, P.C.
P.O. Box 398
Austin, TX 78767-0398

Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1005 – 341

(Signature)_____ Date: _____
Name: Thomas A. Dye

Witness (Signature): _____ Date: _____

Witness (Printed Name): _____

(Signature) Thomas A Dundon Date: 12 Apr 04
Name: Thomas A. Dundon

Witness (Signature): _____ Date: _____

Witness (Printed Name): _____

Jeffrey C. Hood
Conley, Rose & Tayon, P.C.
P.O. Box 398
Austin, TX 78767-0398

Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1005 – 342

CHAPTER 7 TRUSTEE'S BILL OF SALE

THE STATE OF TEXAS §
§
COUNTY OF BEXAR §

WHEREAS, MEETRIX, INC., filed a Chapter 11 petition in bankruptcy on June 1, 2005. On October 19, 2006, the case was converted to a Chapter 7 bankruptcy; and

WHEREAS, RANDOLPH N. OSHEROW, of 342 West Woodlawn, Suite 300, San Antonio, Texas 78212, was appointed Trustee on October 23, 2005, which appointment was filed with the Clerk of the Bankruptcy Court for the Western District of Texas, Austin Division, and is now the duly appointed, qualified, and acting Trustee of the bankruptcy estate created by the filing of the aforesaid case, which bankruptcy estate included the property described below; and

WHEREAS, all notices, hearings, procedures, and proceedings necessary as a condition precedent to the issuance of this instrument have been duly given, held, and concluded, and by virtue thereof the undersigned Trustee is fully empowered and authorized to make the conveyance described herein pursuant to Order Approving Trustee's Amended Motion to Sell Personal Property of Debtor Free and Clear of all Liens and Interests (Including 20-Day Language), signed by Frank R. Monroe on June 5, 2007 (a copy of which is attached hereto as Exhibit "A");

NOW, THEREFORE, in consideration of the sum of FIFTEEN THOUSAND & NO/100 DOLLARS ($15,000.00) cash paid to the Trustee, and other good and valuable consideration paid by Great West Capital, LLC, a California limited liability company, the receipt and sufficiency of which is hereby acknowledged, the undersigned Trustee of the estate of MEETRIX, INC., (05-13133-FRM) has BARGAINED, SOLD, and DELIVERED, and by these presents does BARGAIN, SELL, and DELIVER unto Great West Capital, LLC as the successor in interest, all of his right, title, and interest in the Debtor's personal property described as information relating to:

a. Software (object and source code), computers and servers;
b. Intellectual property – patent and trademark filings;
c. Business plans, executive summaries and other presentation materials (printed and electronic copies;
d. Marketing materials, brochures and similar type items;
e. Customer lists of Meetrix at the time of filing bankruptcy;
f. Prospective customer lists;
g. Copies of license agreements with vendors;
h. Technical specifications of the Meetrix system; and
i. Any other relevant business and technical information relating to the business of Meetrix,

Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1005 – 343

to have and to hold the aforesaid property unto Great West Capital, LLC, its successors and assigns, against the lawful claim or claims of any and all persons whomsoever, by, through, or under them but not otherwise.

The property conveyed hereby has been purchased by Buyer "AS IS" and WITH ALL FAULTS and RANDOLPH N. OSHEROW does not in any way warrant the merchantability of the goods sold hereby; there are no warranties which extend beyond the description on the face hereof and no warranties of any kind are to be implied in this transaction.

RANDOLPH N. OSHEROW makes no personal guarantees or warranties herein. All representations, guarantees or warranties made herein are made solely in the capacity as Trustee for the estate.

Dated at San Antonio, Bexar County, Texas, this 7th day of June 2007.

RANDOLPH N. OSHEROW, Chapter 7 Trustee of the Bankruptcy Estate of MEETRIX, INC., Case No. 05-13133-FRM

THE STATE OF TEXAS §
§
COUNTY OF BEXAR §

This instrument was acknowledged before me on the 7th day of June 2007, by Randolph N. Osherow, as Trustee of the Bankruptcy Estate of MEETRIX, INC., Case No. 05-13133-FRM.

LINDA A. KIVELL
Notary Public, State of Texas
My Commission Expires
October 16, 2007

Notary Public, State of Texas

C:\WP\Meetrix\Bill of of Sale.doc

IT IS HEREBY ADJUDGED and DECREED that the below described is SO ORDERED.

Dated: June 05, 2007

FRANK R. MONROE
UNITED STATES BANKRUPTCY JUDGE

IN THE UNITED STATES BANKRUPTCY COURT
FOR THE WESTERN DISTRICT OF TEXAS
AUSTIN DIVISION

IN RE:	§	CASE NO. 05-13133-FRM
	§	
MEETRIX, INC.,	§	
	§	
DEBTOR.	§	CHAPTER 7 PROCEEDING

ORDER AUTHORIZING TRUSTEE TO SELL PERSONAL PROPERTY
OF DEBTOR FREE AND CLEAR OF ALL LIENS AND INTERESTS

On the day this Order was signed, came to be considered by the United States Bankruptcy Judge the Trustee's Amended Motion to Sell Personal Property of Debtor Free and Clear of all Liens and Interests. The Court having considered the Amended Motion finds that it has merit and should be granted. It is, therefore,

ORDERED, ADJUDGED, and DECREED that the Trustee is hereby authorized to sell Debtor's personal property described as information relating to:

a. Software (object and source code), computers and servers;
b. Intellectual property – patent and trademark filings;
c. Business plans, executive summaries and other presentation materials (printed and electronic copies;
d. Marketing materials, brochures and similar type items;
e. Customer lists of Meetrix at the time of filing bankruptcy;
f. Prospective customer lists;
g. Copies of license agreements with vendors;

C:\WP\meetrix\Amended Motion to Sell-Order.doc

EXHIBIT "A"

h. Technical specifications of the Meetrix system; and
i. Any other relevant business and technical information relating to the business of Meetrix,

which property is to be sold AS IS and WHERE IS. It is further

ORDERED, ADJUDGED, and DECREED that the sale of the foregoing property shall be free and clear of all liens and interests, valid and invalid, except this sale is subject to any ad valorem taxes due, if any, and the same is hereby approved and affirmed. It is further

ORDERED, ADJUDGED, and DECREED that the Trustee is authorized to execute the documents necessary to effectuate the sale of the above-described property. It is further

ORDERED, ADJUDGED, and DECREED that the Trustee is authorized to pay the secured creditors as follows:

a. 14% - Claim #10 filed by John A. McEntire in the amount of $55,068.06 ($1,862.00 to be paid)
b. 28% - Claim #11 filed by Murray Goldman in the amount of $110,136.10 ($3,724.00 to be paid)
c. 14% - Claim #12 filed by Hugh Barnes in the amount of $55,068.06 ($1,862.00 to be paid)
d. 3% - Claim #14 filed by Eric Cumming in the amount of $10,000.00 ($399.00 to be paid)
e. 13% - Claim #15 filed by Kerry Brooks in the amount of $50,000.00 ($1,729.00 to be paid)
f. 3% - Claim #16 filed by Eric Lund in the amount of $10,000.00 ($399.00 to be paid)
g. 3% - Claim #17 filed by David L. Throckmorton in the amount of $10,000.00 ($399.00 to be paid)
h. 3% - Claim #18 (amends #9) filed by Sylvan Schwartz in the amount of $10,000.00 ($399.00 to be paid)
i. 13% - Claim #19 filed by Rich Bowler in the amount of $50,000.00 ($1,729.00 to be paid)
j. 3% - Claim #20 filed by John Lang in the amount of $10,000.00 ($399.00 to be paid)
k. 3% - Claim #21 filed by Les Menkes in the amount of $10,000.00 ($399.00 to be paid)

###

RANDOLPH N. OSHEROW
342 West Woodlawn, Suite 300
San Antonio, Texas 78212
(210) 738-3001 - Telephone
(210) 737-6312 - Telefax
rosherow@hotmail.com

Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1005 – 346

Electronic Acknowledgement Receipt

EFS ID:	21212751
Application Number:	13674233
International Application Number:	
Confirmation Number:	5197
Title of Invention:	AUDIO-VIDEO MULTI-PARTICIPANT CONFERENCE SYSTEMS USING PSTN AND INTERNET NETWORKS
First Named Inventor/Applicant Name:	Thomas Dye
Customer Number:	48008
Filer:	Amedeo F. Ferraro/Chloe Hong
Filer Authorized By:	Amedeo F. Ferraro
Attorney Docket Number:	MEET 12.003
Receipt Date:	14-JAN-2015
Filing Date:	12-NOV-2012
Time Stamp:	18:44:47
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	Power of Attorney	POA.pdf	387259 6f96868c4afd740a32b4a0b90048c2076798a7f8	no	2

Warnings:	
Information:	

Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1005 – 347

2	Assignee showing of ownership per 37 CFR 3.73.	373c_statement_with_attachments.pdf	361578 149e90e26c94d7e027db1f5af6cc06f9de4d73b3	no	10

Warnings:	
Information:	
Total Files Size (in bytes):	748837

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.

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)

48008 7590 10/07/2014
KERR IP GROUP, LLC
MICHAEL A. KERR
P.O. Box 18600
RENO, NV 89511

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.

MARIE MARTIN KERR	(Depositor's name)
	(Signature)
JAN 6, 2015	(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/674,233	11/12/2012	Thomas Dye	MEET 12.003	5197

TITLE OF INVENTION: AUDIO-VIDEO MULTI-PARTICIPANT CONFERENCE SYSTEMS USING PSTN AND INTERNET NETWORKS

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	$480	$0	$0	$480	01/07/2015

EXAMINER	ART UNIT	CLASS-SUBCLASS
NI, SUHAN	2656	370-260000

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 MICHAEL A. KERR
2 KERR IP GROUP, LLC
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: VPN MULTICAST TECHNOLOGIES LLC
(B) RESIDENCE: (CITY and STATE OR COUNTRY): PLANO, TX

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 505930 (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 JAN. 6, 2015
Typed or printed name MICHAEL A. KERR Registration No. 42,722

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

Zhu Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1005 – 349

Electronic Patent Application Fee Transmittal

Application Number:	13674233
Filing Date:	12-Nov-2012
Title of Invention:	AUDIO-VIDEO MULTI-PARTICIPANT CONFERENCE SYSTEMS USING PSTN AND INTERNET NETWORKS
First Named Inventor/Applicant Name:	Thomas Dye
Filer:	Michael A. Kerr/MARIE KERR
Attorney Docket Number:	MEET 12.003

Filed as Small 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	2501	1	480	480

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
			Total in USD ($)	**480**

Electronic Acknowledgement Receipt

EFS ID:	21136115
Application Number:	13674233
International Application Number:	
Confirmation Number:	5197
Title of Invention:	AUDIO-VIDEO MULTI-PARTICIPANT CONFERENCE SYSTEMS USING PSTN AND INTERNET NETWORKS
First Named Inventor/Applicant Name:	Thomas Dye
Customer Number:	48008
Filer:	Michael A. Kerr/MARIE KERR
Filer Authorized By:	Michael A. Kerr
Attorney Docket Number:	MEET 12.003
Receipt Date:	06-JAN-2015
Filing Date:	12-NOV-2012
Time Stamp:	18:12:37
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	$480
RAM confirmation Number	4428
Deposit Account	
Authorized User	

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	Issue Fee Payment (PTO-85B)	issuefee.pdf	41393 f9d4a7e0f880a236740f702a9d43f76aabaccb94	no	1
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	30582 22b30c5c47b589924da67b87c998c9288e8540ae	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	71975		

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

48008 7590 10/07/2014

KERR IP GROUP, LLC
MICHAEL A. KERR
P.O. Box 18600
RENO, NV 89511

EXAMINER
NI, SUHAN

ART UNIT	PAPER NUMBER
2656	

DATE MAILED: 10/07/2014

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
13/674,233	11/12/2012	Thomas Dye	MEET 12.003	5197

TITLE OF INVENTION: AUDIO-VIDEO MULTI-PARTICIPANT CONFERENCE SYSTEMS USING PSTN AND INTERNET NETWORKS

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	$480	$0	$0	$480	01/07/2015

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.

Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1005 – 354

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)

48008 7590 10/07/2014
KERR IP GROUP, LLC
MICHAEL A. KERR
P.O. Box 18600
RENO, NV 89511

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.
13/674,233	11/12/2012	Thomas Dye	MEET 12.003	5197

TITLE OF INVENTION: AUDIO-VIDEO MULTI-PARTICIPANT CONFERENCE SYSTEMS USING PSTN AND INTERNET NETWORKS

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	SMALL	$480	$0	$0	$480	01/07/2015

EXAMINER	ART UNIT	CLASS-SUBCLASS
NI, SUHAN	2656	370-260000

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. _____

Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1005 - 355

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.
13/674,233	11/12/2012	Thomas Dye	MEET 12.003	5197

48008 7590 10/07/2014

KERR IP GROUP, LLC
MICHAEL A. KERR
P.O. Box 18600
RENO, NV 89511

EXAMINER	
NI, SUHAN	

ART UNIT	PAPER NUMBER
2656	

DATE MAILED: 10/07/2014

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.

Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1005 – 356

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.

Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1005 – 357

Notice of Allowability	Application No. 13/674,233	Applicant(s) DYE ET AL.	
	Examiner SUHAN NI	Art Unit 2656	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 *9/24/2014*.
   ☐ 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 *12-35*. 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 _____
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
4. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____ .
5. ☐ Examiner's Amendment/Comment
6. ☐ Examiner's Statement of Reasons for Allowance
7. ☐ Other _____.

/SUHAN NI/
Primary Examiner, Art Unit 2656

Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1005 – 358

Issue Classification	Application/Control No.	Applicant(s)/Patent under Reexamination	
	13/674,233	DYE ET AL.	
	Examiner	Art Unit	
	SUHAN NI	2656	

ISSUE CLASSIFICATION

ORIGINAL			CROSS REFERENCE(S)						
CLASS	SUBCLASS	CLASS	SUBCLASS (ONE SUBCLASS PER BLOCK)						
370	260	370	352	354					
INTERNATIONAL CLASSIFICATION									
H 0 4 L 12/66									
/									
/									
/									
/									

(Assistant Examiner) (Date)	/Suhan Ni/ 9/30/2014	Total Claims Allowed: 24
(Legal Instruments Examiner) (Date)	(Primary Examiner) (Date)	O.G. Print Claim(s): 1 / O.G. Print Fig.: 4

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

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
	1	21	31										
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Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1005 – 359

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13674233	DYE ET AL.
	Examiner	Art Unit
	SUHAN NI	2656

CPC- SEARCHED		
Symbol	Date	Examiner

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner
370	260-263, 265, 352-356.	6/16/2014	SN
		9/30/2014	SN

SEARCH NOTES		
Search Notes	Date	Examiner
EAST	6/16/2014	SN
	9/30/2014	SN

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner
	ALL ABOVE	9/30/2014	SN

	/SUHAN NI/ Primary Examiner.Art Unit 2656

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Exhibit 1005 – 360

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13674233	DYE ET AL.
	Examiner	**Art Unit**
	SUHAN NI	2656

✓	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	06/16/2014	09/30/2014							
	1	-								
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	3	-								
	4	-								
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	10	-								
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1	12	✓	=							
2	13	✓	=							
3	14	✓	=							
4	15	✓	=							
5	16	✓	=							
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7	18	✓	=							
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21	31	✓	=							
22	32	✓	=							
23	33	✓	=							
24	34	✓	=							
12	35	✓	=							

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Exhibit 1005 – 361

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	13674233
Filing Date	2012-11-12
First Named Inventor	DYE, Thomas
Art Unit	TBD 2656
Examiner Name	TBD Suhan Ni
Attorney Docket Number	MEET 12.003

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
/SN/	1	7339929	B2	2008-03-04	Zelig, David	
/SN/	2	7461157	B2	2008-12-02	Ahlard, David	
/SN/	3	6298062	B1	2001-10-02	Gardell, Steven E.	
/SN/	4	6981022	B2	2005-12-27	Boundy, Mark	
/SN/	5	7653192	B1	2010-01-26	Sylvain, Dany	

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/SN/	1	20020016926	A1	2002-02-07	Nguyen, Thomas	

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Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1005 – 362

INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	13674233
Filing Date	2012-11-12
First Named Inventor	DYE, Thomas
Art Unit	TBD
Examiner Name	TBD
Attorney Docket Number	MEET 12.003

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]
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EXAMINER SIGNATURE

Examiner Signature	/Suhan Ni/	Date Considered	09/30/2014

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Exhibit 1005 – 363

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BIB DATA SHEET

CONFIRMATION NO. 5197

SERIAL NUMBER	FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
13/674,233	11/12/2012 RULE	370	2656	MEET 12.003

APPLICANTS

MEETRIX COMMUNICATION, INC., Santa Monica, CA

INVENTORS

Thomas Dye, Austin, TX;
Thomas Dundon, San Marcos, TX;

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

This application is a CON of 12/646,892 12/23/2009 PAT 8339997
which is a CON of 10/796,560 03/09/2004 PAT 7664056
which claims benefit of 60/453,307 03/10/2003

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

**** IF REQUIRED, FOREIGN FILING LICENSE GRANTED **** ** SMALL ENTITY **
12/03/2012

Foreign Priority claimed	Met after Allowance	STATE OR COUNTRY	SHEETS DRAWINGS	TOTAL CLAIMS	INDEPENDENT CLAIMS
☐ Yes ☑ No	☐	TX	6	24	3
35 USC 119(a-d) conditions met ☐ Yes ☐ No					
Verified and Acknowledged /SUHAN NI/ Examiner's Signature	Initials				

ADDRESS

KERR IP GROUP, LLC
MICHAEL A. KERR
P.O. Box 18600
RENO, NV 89511
UNITED STATES

TITLE

AUDIO-VIDEO MULTI-PARTICIPANT CONFERENCE SYSTEMS USING PSTN AND INTERNET NETWORKS

FILING FEE RECEIVED	FEES: Authority has been given in Paper	
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Application Number	Application/Control No.	Applicant(s)/Patent under Reexamination	
	13/674,233	DYE ET AL.	

Document Code - DISQ	Internal Document – DO NOT MAIL

TERMINAL DISCLAIMER	☒ APPROVED	☐ DISAPPROVED
Date Filed : 24 SEPT 2014	This patent is subject to a Terminal Disclaimer	

Approved/Disapproved by:

JAB

U.S. Patent and Trademark Office

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant(s): **DYE, Thomas**	Group Art Unit: **2656**
Application Serial No.: **13/674,233**	Examiner: **NI, Suhan**
Filed: **November 12, 2012**	Conf. No.: **5197**
Title: **AUDIO-VIDEO MULTI-PARTICIPANT CONFERENCE SYSTEMS USING PSTN AND INTERNET NETWORKS**	

AMENDMENT AND RESPONSE TO OFFICE ACTION

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

Dear Sir/Madam:

This Amendment and Response is filed in response to the Office Action dated June 24, 2014 in the above-referenced patent application making this Response timely if filed by September 24, 2014. Allowance of the pending claims in view of the following amendments and remarks is respectfully requested.

Amendments to the Claims begin on Page 2.
Remarks begin on Page 8.

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Amendments to the Claims:

1-11. (Cancelled)

12. (Currently Amended) A multi-participant conference system comprising:

a public switched telephone network (PSTN) client that communicates ~~configured to communicate~~ audio data;

at least one remote client connected to the Internet that receives ~~configured to receive~~ audio-video data;

a first participant client that receives ~~configured to receive~~ audio-video data, wherein the first participant client includes,

a voice over IP encoder that compresses audio data transported to the PSTN client,

a voice over IP decoder that decodes audio data from the PSTN client,

a first audio mixer that mixes the decoded audio data from the PSTN client with the audio-video data from the first participant into a first mixed audio-video data stream, wherein the first mixed audio-video data stream is transmitted to the at least one remote client communicatively coupled ~~connected~~ to the Internet;

a second audio mixer that mixes the audio-video data stream from the first participant with the audio-video data stream from the at least one remote client communicatively coupled ~~connected~~ to the Internet into a second mixed audio, wherein the second mixed audio is compressed by the voice over IP encoder, which is then transmitted to the PSTN client.

13. (Previously Presented) The system of claim 12 further comprising a third audio mixer that mixes the audio data from the PSTN client with the audio-video data stream from the at least one remote client into a third mixed audio, wherein the third mixed audio stream and audio-video data stream is transmitted to the first participant.

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14. (Previously Presented) The system of claim 12 wherein data between the first participant and the PSTN client is transported through a virtual private network tunnel.

15. (Previously Presented) The system of claim 12 wherein data between the moderator and the remote client is transported through a virtual private network tunnel.

16. (Previously Presented) The system of claim 12 further comprising a first message communicated to each of a plurality of multicast appliances over the Internet, wherein the first message comprises a group address which identifies participants.

17. (Currently Amended) The system of claim 16 further comprising each of the multicast appliances that receives ~~configured to receive~~ the first message.

18. (Previously Presented) The system of claim 17 further comprising a plurality of virtual private networks across the Internet that are established between the multicast appliances.

19. (Currently Amended) The system of claim 18 wherein the PSTN client communicates ~~is configured to communicate~~ with a PSTN gateway that communicates with a VoIP server, which is communicatively coupled to the plurality of virtual private networks.

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20. (Currently Amended) A system for supporting a multi-participant conference call comprising:

a first mixer that mixes ~~configured to mix~~ a Public Switched Telephone Network (PSTN) client audio data stream with a moderator audio-video data stream into a first mixed data stream;

a first transport output that transmits ~~configured to transmit~~ the first mixed data stream to at least one remote client that receives ~~configured to receive~~ the first mixed data stream, the at least one remote client communicatively coupled ~~connected~~ to the Internet, which generates ~~and configured to generate~~ a remote client audio-video data stream;

a second mixer that mixes ~~configured to mix~~ the moderator audio-video data stream with the remote client audio-video data stream into a second mixed data stream; and

a second transport output that transmits ~~configured to transmit~~ a mixed audio data stream, corresponding to the second mixed data stream, to the PSTN client.

21. (Currently Amended) The system of claim 20 further comprising a third mixer that mixes ~~configured to mix~~ the audio data from the PSTN client with the audio-video data stream from the remote client into a third mixed data stream and communicates ~~communicating~~ the third mixed data stream to the moderator.

22. (Currently Amended) The system of claim 20 further comprising a VoIP decoder that receives ~~configured to receive~~ IP packets including ~~containing~~ the audio data stream generated by the PSTN client, the VoIP decodes decodes ~~and further configured to decode~~ the IP packets including ~~containing~~ the audio data from the PSTN client.

23. (Currently Amended) The system of claim 20 further comprising at least one audio decompressor that decodes ~~configured to decode~~ IP packets including ~~containing~~ the audio-video data stream generated by the remote client.

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24. (Currently Amended) The system of claim 20 wherein the PSTN client audio data stream and the moderator audio-video data stream are ~~configured to be~~ transported across a virtual private network tunnel.

25. (Currently Amended) The system of claim 20 wherein the moderator audio-video data stream and the remote client audio-video data stream are ~~configured to be~~ transported across a virtual private network tunnel.

26. (Currently Amended) The system of claim 25 further comprising an encoder that receives ~~configured to receive~~ the first mixed data stream and encodes ~~encode~~ the first mixed voice data before transmitting the first mixed data stream to the remote client.

27. (Currently Amended) The system of claim 24 further comprising a VoIP encoder that encodes ~~configured to encode~~ the second mixed data stream and encode the second mixed voice data before transmitting the second mixed data stream to the PSTN client.

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28. (Previously Presented) A method for supporting a multi-participant conference call, the method comprising:

receiving a PSTN audio data stream from a public switched telephone network (PSTN) client;

receiving a moderator audio-video data stream from a moderator;

receiving a remote client audio-video data stream from at least one remote client connected to the Internet;

mixing the PSTN audio data stream with the moderator audio-video data stream into a first mixed data stream;

transmitting the first mixed data stream to the remote client;

mixing the moderator audio-video data stream with the remote client audio-video data stream into a second mixed data stream;

transmitting a mixed audio data stream, corresponding to the second mixed data stream, to the PSTN client.

29. (Previously Presented) The method of claim 28 further comprising mixing the PSTN audio data stream with the remote client audio-video data stream into a third mixed data stream.

30. (Currently Amended) The method of claim 28 wherein receiving the PSTN audio data stream from the PSTN client at a moderator client includes receiving IP packets and decoding the IP packets including ~~containing~~ the PSTN audio data stream.

31. (Currently Amended) The method of claim 28 wherein receiving the remote client audio-video data at a moderator computer client includes decoding the IP packets including ~~containing~~ the audio-video data generated by the remote client.

32. (Previously Presented) The method of claim 28 further comprising transporting through a virtual private network the PSTN client audio stream and the moderator audio-video data stream.

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33. (Previously Presented) The method of claim 28 further comprising transporting the moderator audio-video data stream and the remote client audio-video data stream through a virtual private network.

34. (Previously Presented) The method of claim 33 further comprising receiving the first mixed data stream and encoding the first mixed voice data before transmitting the first mixed data stream to the remote client.

35. (Previously Presented) The method of claim 22 further comprising encoding the second mixed data stream and encoding the second mixed voice data before transmitting the second mixed data stream to the PSTN client.

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REMARKS

The present remarks are in response to the Office Action dated June 24, 2014, in which the Office Action indicated that claims 12-35 are rejected. In this response, the Applicant has amended claims 12, 17, 19-27, and 30-31. In view of the Amendments and Remarks submitted herewith, the Applicant respectfully requests that the pending claims be placed in a state of allowance. No new matter has been added.

A. Claim Amendments

The Applicant has amended the claims to remove the "configured to" language in the system claims. Additionally, the claims that have the term "containing" have been amended and the term has been replaced with "including." The Applicant respectfully submits that support for these claim amendments is not necessary.

B. Double Patenting Rejection

The Examiner's Action includes a Double Patenting rejection for claims 12-35 that is based on the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-8 of U.S. Patent No. 7,664,056. Additionally, the Examiner rejected claims 12-35 under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-18 in U.S. Patent No. 8,339,997.

To overcome the Examiner's rejection, Applicant submits herewith a Terminal Disclaimer

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C. Conclusion

In view of all the foregoing, claims 12-35 overcome the Office Action rejections herein and are now patentably distinct and in condition for allowance, which action is respectfully requested.

The Director is authorized to charge any additional fee(s) or any underpayment of fee(s) or credit any overpayment(s) to Deposit Account No. 50-5930 of Kerr IP Group, LLC.

Respectfully Submitted:

Dated: September 24, 2014

/Michael A. Kerr/

Michael A. Kerr
Reg. No. 42,722

Michael A. Kerr
KERR IP GROUP, LLC.
P.O. Box 18600
Reno, NV 89511
Tel: (775) 624-8700
Fax:(775) 622-0686

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Exhibit 1005 – 374

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TERMINAL DISCLAIMER TO OBVIATE A DOUBLE PATENTING REJECTION OVER A "PRIOR" PATENT	Docket Number (Optional) MEET 12.003

In re Application of: Thomas Dye

Application No.: 13/674,233

Filed: November 12, 2012

For: AUDIO-VIDEO MULTI-PARTICIPANT CONFERENCE SYSTEM USING PSTN AND INTERNET NETWORKS

The applicant, Meetrix Communications, Inc., owner of 100 percent interest in the instant application hereby disclaims, except as provided below, the terminal part of the statutory term of any patent granted on the instant application which would extend beyond the expiration date of the full statutory term of **prior patent** No. 7,664,056; 8,339,997 as the term of said **prior patent** is presently shortened by any terminal disclaimer. The applicant hereby agrees that any patent so granted on the instant application shall be enforceable only for and during such period that it and the **prior patent** are commonly owned. This agreement runs with any patent granted on the instant application and is binding upon the grantee, its successors or assigns.

In making the above disclaimer, the applicant does not disclaim the terminal part of the term of any patent granted on the instant application that would extend to the expiration date of the full statutory term of the **prior patent**, "as the term of said **prior patent** is presently shortened by any terminal disclaimer," in the event that said **prior patent** later:

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is found invalid by a court of competent jurisdiction;
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/Michael A. Kerr/	09/22/2014
Signature	Date
Michael A. Kerr	
Typed or printed name	
Attorney of record	775-624-8700
Title	Telephone Number

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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 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.

Electronic Patent Application Fee Transmittal

Application Number:	13674233
Filing Date:	12-Nov-2012
Title of Invention:	AUDIO-VIDEO MULTI-PARTICIPANT CONFERENCE SYSTEMS USING PSTN AND INTERNET NETWORKS
First Named Inventor/Applicant Name:	Thomas Dye
Filer:	Michael A. Kerr/Julie Dawes
Attorney Docket Number:	MEET 12.003

Filed as Small Entity

Utility under 35 USC 111(a) Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
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Claims:				
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Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
Statutory or Terminal Disclaimer	1814	1	160	160
		Total in USD ($)		**160**

Electronic Acknowledgement Receipt

EFS ID:	20236908
Application Number:	13674233
International Application Number:	
Confirmation Number:	5197
Title of Invention:	AUDIO-VIDEO MULTI-PARTICIPANT CONFERENCE SYSTEMS USING PSTN AND INTERNET NETWORKS
First Named Inventor/Applicant Name:	Thomas Dye
Customer Number:	48008
Filer:	Michael A. Kerr/Julie Dawes
Filer Authorized By:	Michael A. Kerr
Attorney Docket Number:	MEET 12.003
Receipt Date:	24-SEP-2014
Filing Date:	12-NOV-2012
Time Stamp:	18:36:52
Application Type:	Utility under 35 USC 111(a)

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Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)

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Exhibit 1005 – 379

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		OAR_092414.pdf	39149 59d598145982236c166e74f7b05bbad59846e86d	yes	9

Multipart Description/PDF files in .zip description		
Document Description	**Start**	**End**
Amendment/Req. Reconsideration-After Non-Final Reject	1	1
Claims	2	7
Applicant Arguments/Remarks Made in an Amendment	8	9

Warnings:					
Information:					
2	Terminal Disclaimer Filed	terminal_disclaimer.pdf	161031 066bcadcaf67a81b4d603c2fd191378e10b1b33f	no	2
Warnings:					
Information:					
3	Fee Worksheet (SB06)	fee-info.pdf	30205 d0a639b67c766dc713bb9e3485c6b43e74381e1f	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	230385		

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/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 13/674,233	Filing Date 11/12/2012	☐ To be Mailed

ENTITY: ☐ LARGE ☒ SMALL ☐ MICRO

APPLICATION AS FILED – PART I

FOR	(Column 1) NUMBER FILED	(Column 2) 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

09/24/2014	(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))	* 24	Minus	** 24	= 0	X $40 =	0
Independent (37 CFR 1.16(h))	* 3	Minus	***3	= 0	X $210 =	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
/ROSALIND BALL/

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.

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	13674233
Filing Date	2012-11-12
First Named Inventor	DYE, Thomas
Art Unit	TBD
Examiner Name	TBD
Attorney Docket Number	MEET 12.003

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	7339929	B2	2008-03-04	Zelig, David	
	2	7461157	B2	2008-12-02	Ahlard, David	
	3	6298062	B1	2001-10-02	Gardell, Steven E.	
	4	6981022	B2	2005-12-27	Boundy, Mark	
	5	7653192	B1	2010-01-26	Sylvain, Dany	

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	20020016926	A1	2002-02-07	Nguyen, Thomas	

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

FOREIGN PATENT DOCUMENTS Remove

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	13674233
	Filing Date	2012-11-12
	First Named Inventor	DYE, Thomas
	Art Unit	TBD
	Examiner Name	TBD
	Attorney Docket Number	MEET 12.003

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							☐

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]
	1		☐

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.

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Exhibit 1005 – 384

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	13674233
	Filing Date	2012-11-12
	First Named Inventor	DYE, Thomas
	Art Unit	TBD
	Examiner Name	TBD
	Attorney Docket Number	MEET 12.003

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 A. Kerr/	Date (YYYY-MM-DD)	2014-08-20
Name/Print	Michael A. Kerr	Registration Number	42722

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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Exhibit 1005 – 385

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.

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Exhibit 1005 – 386

Electronic Patent Application Fee Transmittal

Application Number:	13674233
Filing Date:	12-Nov-2012
Title of Invention:	AUDIO-VIDEO MULTI-PARTICIPANT CONFERENCE SYSTEMS USING PSTN AND INTERNET NETWORKS
First Named Inventor/Applicant Name:	Thomas Dye
Filer:	Michael A. Kerr/Julie Dawes
Attorney Docket Number:	MEET 12.003

Filed as Small Entity

Utility under 35 USC 111(a) Filing Fees

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($)
Miscellaneous:				
Submission- Information Disclosure Stmt	2806	1	90	90
		Total in USD ($)		**90**

Electronic Acknowledgement Receipt

EFS ID:	19920330
Application Number:	13674233
International Application Number:	
Confirmation Number:	5197
Title of Invention:	AUDIO-VIDEO MULTI-PARTICIPANT CONFERENCE SYSTEMS USING PSTN AND INTERNET NETWORKS
First Named Inventor/Applicant Name:	Thomas Dye
Customer Number:	48008
Filer:	Michael A. Kerr/Julie Dawes
Filer Authorized By:	Michael A. Kerr
Attorney Docket Number:	MEET 12.003
Receipt Date:	20-AUG-2014
Filing Date:	12-NOV-2012
Time Stamp:	18:10:31
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	$90
RAM confirmation Number	4417
Deposit Account	
Authorized User	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)

Zoho Corp. and Zoho Corp. Pvt. Ltd.
Exhibit 1005 – 389

1	Information Disclosure Statement (IDS) Form (SB08)	updated_IDS.pdf	612432 d3868c2beae3e79f50a2b41ca4487852ce9945f1	no	4
Warnings:					
Information:					
2	Fee Worksheet (SB06)	fee-info.pdf	30499 ded8246b6bad534e8d46f90b3e03281beb33bc6f	no	2
Warnings:					
Information:					
			Total Files Size (in bytes):	642931	

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.
13/674,233	11/12/2012	Thomas Dye	MEET 12.003	5197

48008 7590 06/24/2014

KERR IP GROUP, LLC
MICHAEL A. KERR
P.O. Box 18600
RENO, NV 89511

EXAMINER
NI, SUHAN

ART UNIT	PAPER NUMBER
2656	

NOTIFICATION DATE	DELIVERY MODE
06/24/2014	ELECTRONIC

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.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

MICK@KIPG.COM
mmk@kipg.com
admin@kipg.com

Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1005 – 391

Office Action Summary	Application No. 13/674,233	Applicant(s) DYE ET AL.	
	Examiner SUHAN NI	Art Unit 2656	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 *11/12/2012*.

☐ 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) *12-35* 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) *12-35* 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 _____.

3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

4) ☐ Other: _____.

Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1005 – 392

DETAILED ACTION

1. The Art Unit location of your application in the PTO has changed. To aid in correlating any papers for this application, all further correspondence regarding this application should be directed to Group Art Unit **2656**.

2. This communication is responsive to the preliminary amendment filed 11/12/2012.

Double Patenting

The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. See *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and, *In re Thorington,* 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent is shown to be commonly owned with this application. See 37 CFR 1.130 (b).

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

3. Claims 12-35 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-8 of U. S. Patent No. 7,664,056. Although the conflicting claims are not identical, they are not patentably distinct from each other because claims 1-8 of U. S. Patent No. 7,664,056 are similar in scope to the rejected claim 12-35 of the U. S. Pat. App (No. 13/674,233) with obvious wording variations.

4. Claims 12-35 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claims 1-18 of U. S. Patent No. 8,339,997. Although the conflicting claims are not identical, they are not patentably distinct from each other because claims 1-18 of U. S. Patent No. 8,339,997 are similar in scope to the rejected claim 12-35 of the U. S. Pat. App (No. 13/674,233) with obvious wording variations.

Conclusion

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

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to **Suhan Ni** whose telephone number is **(571)-272-7505**, and the number for fax machine is **(571)-273-7505**. The examiner can normally be reached on Tuesday and Thursday from 10:00 am to 8:00 pm, and may be reached on Monday, Wednesday and Friday from 10:00 am to 8:00 pm. If it is necessary, the examiner's supervisor, **Curtis A. Kuntz**, can be reached at **(571)-272-7499**.

7. 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).

8. Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the group receptionist whose telephone number is **(571)-272-2600**, or please see http://www.uspto.gov/web/info/2600.

/SUHAN NI/
Primary Examiner, Art Unit 2656

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	13674233
Filing Date	2012-11-12
First Named Inventor	DYE, Thomas
Art Unit	TBD 2656
Examiner Name	TBD Suhan Ni
Attorney Docket Number	MEET 12.003

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
/SN/	1	7724744	B2	2010-05-25	Shur et al.	
/SN/	2	6870842	B1	2005-03-22	Caronni et al.	
/SN/	3	6977929	B1	2005-12-20	Caronni et al.	
/SN/	4	6788681	B1	2004-09-07	Hurren et al.	
/SN/	5	6640251	B1	2003-10-28	Wiget et al.	

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

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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
/SN/	1	20100228879	A1	2010-09-10	Wiget et al.	

Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1005 – 396

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	13674233
	Filing Date	2012-11-12
	First Named Inventor	DYE, Thomas
	Art Unit	TBD
	Examiner Name	TBD
	Attorney Docket Number	MEET 12.003

/SN/	2	20030110288	A1	2003-06-12	Ramanujan et al.	
/SN/	3	20030147392	A1	2003-08-07	Hayashi et al.	
/SN/	4	20060039388	A1	2006-02-23	Shur et al.	
/SN/	5	20020029350	A1	2002-03-07	Cooper 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]
/SN/	1	WO 03003665	WO	A1	2003-01-03	Ahlard, David		☐

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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]
/SN/	1	Higgins, L. et al., "Tunneling Multicast Traffic Through Non-Multicast Aware Networks and Encryption Devices," MILCOM 2001. Proceedings. Communications for Network-Centric Operations: Creating the Information Force, McLean, VA October 28-30, 2001; IEEE Military Communications Conference, New York, NY: IEEE, US, Vol. 1 of 2, October 28, 2001, pages 296-300.	☐
/SN/	2	International Search Report, International Application No. PCT/US2004/007341, mailed September 7, 2004.	☐

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

Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1005 – 397

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	13674233
	Filing Date	2012-11-12
	First Named Inventor	DYE, Thomas
	Art Unit	TBD
	Examiner Name	TBD
	Attorney Docket Number	MEET 12.003

EXAMINER SIGNATURE			
Examiner Signature	/Suhan Ni/	Date Considered	06/16/2014

*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.

Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1005 – 398

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13674233	DYE ET AL.
	Examiner	Art Unit
	SUHAN NI	2656

CPC- SEARCHED		
Symbol	Date	Examiner

CPC COMBINATION SETS - SEARCHED		
Symbol	Date	Examiner

US CLASSIFICATION SEARCHED			
Class	Subclass	Date	Examiner
370	260-263, 265, 352-356.	6/16/2014	SN

SEARCH NOTES		
Search Notes	Date	Examiner
EAST	6/16/2014	SN

INTERFERENCE SEARCH			
US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner

	/SUHAN NI/ Primary Examiner.Art Unit 2656

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	13674233	DYE ET AL.
	Examiner	Art Unit
	SUHAN NI	2656

✓	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	06/16/2014								
	1	-								
	2	-								
	3	-								
	4	-								
	5	-								
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	8	-								
	9	-								
	10	-								
	11	-								
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	32	✓								
	33	✓								
	34	✓								
	35	✓								

Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1005 – 400

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
13/674,233	11/12/2012	Thomas Dye	MEET 12.003

CONFIRMATION NO. 5197

PUBLICATION NOTICE

48008
KERR IP GROUP, LLC
MICHAEL A. KERR
P.O. Box 18600
RENO, NV 89511

OC000000062231138

Title:AUDIO-VIDEO MULTI-PARTICIPANT CONFERENCE SYSTEMS USING PSTN AND INTERNET NETWORKS

Publication No.US-2013-0162754-A1
Publication Date:06/27/2013

NOTICE OF PUBLICATION OF APPLICATION

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.

The publication may be accessed through the USPTO's publically available Searchable Databases via the Internet at www.uspto.gov. The direct link to access the publication is currently http://www.uspto.gov/patft/.

The publication process established by the Office does not provide for mailing a copy of the publication to applicant. A copy of the publication may be obtained from the Office upon payment of the appropriate fee set forth in 37 CFR 1.19(a)(1). Orders for copies of patent application publications are handled by the USPTO's Office of Public Records. The Office of Public Records can be reached by telephone at (703) 308-9726 or (800) 972-6382, by facsimile at (703) 305-8759, by mail addressed to the United States Patent and Trademark Office, Office of Public Records, Alexandria, VA 22313-1450 or via the Internet.

In addition, information on the status of the application, including the mailing date of Office actions and the dates of receipt of correspondence filed in the Office, may also be accessed via the Internet through the Patent Electronic Business Center at www.uspto.gov using the public side of the Patent Application Information and Retrieval (PAIR) system. The direct link to access this status information is currently http://pair.uspto.gov/. Prior to publication, such status information is confidential and may only be obtained by applicant using the private side of PAIR.

Further assistance in electronically accessing the publication, or about PAIR, is available by calling the Patent Electronic Business Center at 1-866-217-9197.

Office of Data Managment, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1005 – 401

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
13/674,233	11/12/2012	Thomas Dye	MEET 12.003

CONFIRMATION NO. 5197

POA ACCEPTANCE LETTER

48008
KERR IP GROUP, LLC
MICHAEL A. KERR
P.O. Box 18600
RENO, NV 89511

OC000000060634535

Date Mailed: 04/29/2013

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 04/16/2013.

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.

/hsarwari/

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1005 – 402

Doc Code: PA..

Document Description: Power of Attorney

PTO/AIA/82A (07-12)
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NOTE: This form is to be submitted with the Power of Attorney by Applicant form (PTO/AIA/82B or equivalent) to identify the application to which the Power of Attorney is directed, in accordance with 37 CFR 1.5. If the Power of Attorney by Applicant form is not accompanied by this transmittal form or an equivalent, the Power of Attorney will not be recognized in the application.

Application Number	13/674,233
Filing Date	November 12, 2012
First Named Inventor	Dye, Thomas
Title	AUDIO-VIDEO MULTI-PARTICIPANT CONFERENCE SYSTEM USING PSTN AND INTERNET NETWORKS
Art Unit	TBD
Examiner Name	TBD
Attorney Docket Number	MEET 12.003

SIGNATURE of Applicant or Patent Practitioner

Signature	/Michael A. Kerr/	Date	03/06/2013
Name	Michael A. Kerr	Telephone	775-264-8700
Registration Number	42722		

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

■ *Total of 1 forms are submitted.

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.**

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Doc Code: PA..

Document Description: Power of Attorney

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POWER OF ATTORNEY BY APPLICANT

I hereby revoke all previous powers of attorney given in the application identified in the attached transmittal letter.

■ I hereby appoint Practitioner(s) associated with the following Customer Number as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the application referenced in the attached transmittal letter (form PTO/AIA/82A or equivalent): 48008

OR

■ I hereby appoint Practitioner(s) named below as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the application referenced in the attached transmittal letter (form PTO/AIA/82A or equivalent):

Name	Registration Number	Name	Registration Number
Michael A. Kerr	42722		

Please recognize or change the correspondence address for the application identified in the attached transmittal letter to:

■ The address associated with the above-mentioned Customer Number.

OR

■ The address associated with Customer Number: 48008

OR

■ Firm or Individual Name	Michael A. Kerr				
Address	P.O. Box 18600				
City	Reno	State	NV	Zip	89511
Country	US				
Telephone	775-824-8700	Email	mick@kipg.com		

I am the Applicant:

☐ Inventor or Joint Inventor

☐ Legal Representative of a Deceased or Legally Incapacitated Inventor

■ Assignee or Person to Whom the Inventor is Under an Obligation to Assign

☐ Person Who Otherwise Shows Sufficient Proprietary Interest (*e.g.*, a petition under 37 CFR 1.46(b)(2) was granted in the application or is concurrently being filed with this document)

SIGNATURE of Applicant for Patent

Signature	Jeff Dykstra	Date	1/15/2012
Name	Jeff Dykstra	Telephone	316-428-7219
Title and Company	Board Member of Meevix Communications, Inc.		

NOTE: Signature - This form must be signed by the applicant in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. Submit multiple forms for more than one signature, see below *.

■ *Total of 1 forms are submitted.

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.**

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MARCH 8, 2013

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MICHAEL A. KERR
P.O. BOX 18600
RENO, NV 89511

502255074

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RECORDATION DATE: 03/06/2013 REEL/FRAME: 029932/0738
NUMBER OF PAGES: 7

BRIEF: ASSIGNMENT OF ASSIGNORS INTEREST (SEE DOCUMENT FOR DETAILS).

DOCKET NUMBER: MEET 12.003

ASSIGNOR:
GREAT WEST CAPITAL, LLC DOC DATE: 09/01/2012

ASSIGNEE:
MEETRIX COMMUNICATIONS, INC.
2261 23RD STREET
SANTA MONICA, CALIFORNIA 90405

APPLICATION NUMBER: 13674233 FILING DATE: 11/12/2012
PATENT NUMBER: ISSUE DATE:
TITLE: AUDIO-VIDEO MULTI-PARTICIPANT CONFERENCE SYSTEMS USING PSTN AND INTERNET NETWORKS

ASSIGNMENT RECORDATION BRANCH
PUBLIC RECORDS DIVISION

Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1005 – 405

PATENT ASSIGNMENT

Electronic Version v1.1
Stylesheet Version v1.1

SUBMISSION TYPE:	NEW ASSIGNMENT
NATURE OF CONVEYANCE:	ASSIGNMENT

CONVEYING PARTY DATA

Name	Execution Date
Great West Capital, LLC	09/01/2012

RECEIVING PARTY DATA

Name:	Meetrix Communications, Inc.
Street Address:	2261 23rd Street
City:	Santa Monica
State/Country:	CALIFORNIA
Postal Code:	90405

PROPERTY NUMBERS Total: 1

Property Type	Number
Application Number:	13674233

CORRESPONDENCE DATA

Fax Number: 7756220686
Correspondence will be sent via US Mail when the fax attempt is unsuccessful.
Phone: 7756248700
Email: admin@kipg.com
Correspondent Name: Michael A. Kerr
Address Line 1: P.O. Box 18600
Address Line 4: Reno, NEVADA 89511

OP $40.00 13674233

ATTORNEY DOCKET NUMBER:	MEET 12.003
NAME OF SUBMITTER:	Julie Dawes

Total Attachments: 6
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source=Assignment#page3.tif
source=Assignment#page4.tif
source=Assignment#page5.tif
source=Assignment#page6.tif

ASSIGNMENT

This Assignment is made by Great West Capital, LLC ("Assignor"), a California limited liability company, having a place of business at 1055 Sunset Drive, Hermosa Beach CA 90254 to Meetrix Communications, Inc. ("Assignee"), a Delaware corporation, having a place of business at 2261 23rd Street, Santa Monica, California 90405.

WHEREAS, Assignor has acquired the entire right, title and interest in and to all Letters Patent, patent applications, and corresponding foreign counterparts as listed on Exhibit A, along with all related materials of the respective inventors and all inventions relating to any of the foregoing ("Patent Portfolio"); and

WHEREAS, Assignee desires to acquire by formal, recordable assignment the entire right, title and interest in and to the Patent Portfolio, along with any and all Letters Patents that may be granted for said patent applications, foreign counterparts, related materials and inventions in the United States and throughout the world;

NOW, THEREFORE, for good and valuable consideration, the receipt and sufficiency of which are hereby acknowledged, Assignor has sold, assigned, transferred and set over, and by these presents hereby sells, assigns, transfers and sets over to Assignee all of Assignor's right, title and interest in, to and under said Patent Portfolio including but not limited to (a) the right to apply for patents in the United States of America and in all foreign countries for any invention(s) found therein, (b) all Application(s) for patents for said invention(s) or based on said Application in all countries, now filed or to be filed, including all provisional, non-provisional, divisional, renewal, substitute, continuation, continuation-in-part and convention Application based in whole or in part upon said invention(s) or upon said Application, (c) all patents which may issue on said invention(s) and on any application transferred by this Assignment in the United States and foreign countries, and any and all reissues, extensions, divisions, renewals, substitutes, continuations or continuations-in-part of patents granted for said invention(s) or upon such Application, for the full term or terms for which the patents may be issued, (d) every priority right that is or may be predicated upon or arise from said invention(s), said Application and such patents under any applicable international or bilateral treaty, agreement or convention, and (e) all rights to sue, license and collect damages, costs, and attorney's fees for any infringement, either pre-dating this assignment or hereafter. Assignor hereby authorizes Assignee to file a patent Application in all countries for any or all of said invention(s) in Assignors' name, or in Assignee's name, or otherwise as Assignee may deem advisable, under any international or bilateral treaty, agreement or convention, or otherwise.

Further, Assignor agrees that, upon request and without further compensation, but at no expense to Assignor, it and its legal representative(s) and assigns will do all lawful acts, including having the appropriate inventors execute papers and give testimony, that may be necessary or desirable for obtaining, sustaining, reissuing or enforcing a Letters Patent in the United States and throughout the world for said Patent Portfolio, and for perfecting, recording or maintaining the title of Assignee, its successors and assigns, to said Patent Portfolio, and any Letters Patent granted for said Patent Portfolio in the United States and throughout the world.

Assignor represents and warrants that it has not granted and will not grant to others any rights inconsistent with the rights granted herein.

Assignor authorizes and requests the Commissioner of Patents and Trademarks of the United States and of all foreign countries to issue any Letters Patent granted for said inventions, whether on said applications or on any subsequently filed division, continuation, continuation-in-part or reissue applications, to Assignee, its successors and assigns, as the assignee of the entire interest in said invention.

IN WITNESS WHEREOF, Assignor has executed this Assignment on the date written herein below.

Date: September 1, 2012

Great West Capital, LLC

Print Name: Jebb Dykstra
Title: Chief Executive Officer

EXHIBIT A: PATENT APPLICATIONS

Title of Invention: "AUDIO-VIDEO MULTI-PARTICIPANT CONFERENCE SYSTEM USING PSTN AND INTERNET NETWORKS"

Application Serial No.: 13/674,233

Our Docket No.: MEET 12.003

Date Filed: November 12, 2012

**This application is a continuation of application number 12/646,892 filed on December 23, 2009, which is a continuation of application number 10/796,560 filed on March 9, 2004.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNDER SECRETARY OF COMMERCE FOR INTELLECTUAL PROPERTY AND
DIRECTOR OF THE UNITED STATES PATENT AND TRADEMARK OFFICE

MARCH 8, 2013

PTAS

MICHAEL A. KERR
P.O. BOX 18600
RENO, NV 89511

502255012

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RECORDATION DATE: 03/06/2013 REEL/FRAME: 029932/0456
NUMBER OF PAGES: 7

BRIEF: ASSIGNMENT OF ASSIGNORS INTEREST (SEE DOCUMENT FOR DETAILS).

DOCKET NUMBER: MEET 12.003

ASSIGNOR:
DYE, THOMAS DOC DATE: 04/06/2004

ASSIGNOR:
DUNDON, THOMAS A. DOC DATE: 04/12/2004

ASSIGNEE:
MEETRIX CORPORATION
2433 RUTLAND DR., SUITE 100
AUSTIN, TEXAS 78758

APPLICATION NUMBER: 10796560 FILING DATE: 03/09/2004
PATENT NUMBER: 7664056 ISSUE DATE: 02/16/2010
TITLE: MEDIA BASED COLLABORATION USING MIXED-MODE PSTN AND INTERNET NETWORKS

ASSIGNMENT RECORDATION BRANCH
PUBLIC RECORDS DIVISION

Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1005 – 409

PATENT ASSIGNMENT

Electronic Version v1.1
Stylesheet Version v1.1

SUBMISSION TYPE:	NEW ASSIGNMENT
NATURE OF CONVEYANCE:	ASSIGNMENT

CONVEYING PARTY DATA

Name	Execution Date
Thomas Dye	04/06/2004
Thomas A. Dundon	04/12/2004

RECEIVING PARTY DATA

Name:	Meetrix Corporation
Street Address:	2433 Rutland Dr., Suite 100
City:	Austin
State/Country:	TEXAS
Postal Code:	78758

PROPERTY NUMBERS Total: 1

Property Type	Number
Application Number:	10796560

OP $40.00 10796560

CORRESPONDENCE DATA

Fax Number: 7756220686
Correspondence will be sent via US Mail when the fax attempt is unsuccessful.
Phone: 7756248700
Email: admin@kipg.com
Correspondent Name: Michael A. Kerr
Address Line 1: P.O. Box 18600
Address Line 4: Reno, NEVADA 89511

ATTORNEY DOCKET NUMBER:	MEET 12.003
NAME OF SUBMITTER:	Julie Dawes

Total Attachments: 6
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CHAPTER 7 TRUSTEE'S BILL OF SALE

THE STATE OF TEXAS §
§
COUNTY OF BEXAR §

WHEREAS, MEETRIX, INC., filed a Chapter 11 petition in bankruptcy on June 1, 2005. On October 19, 2006, the case was converted to a Chapter 7 bankruptcy; and

WHEREAS, RANDOLPH N. OSHEROW, of 342 West Woodlawn, Suite 300, San Antonio, Texas 78212, was appointed Trustee on October 23, 2005, which appointment was filed with the Clerk of the Bankruptcy Court for the Western District of Texas, Austin Division, and is now the duly appointed, qualified, and acting Trustee of the bankruptcy estate created by the filing of the aforesaid case, which bankruptcy estate included the property described below; and

WHEREAS, all notices, hearings, procedures, and proceedings necessary as a condition precedent to the issuance of this instrument have been duly given, held, and concluded, and by virtue thereof the undersigned Trustee is fully empowered and authorized to make the conveyance described herein pursuant to Order Approving Trustee's Amended Motion to Sell Personal Property of Debtor Free and Clear of all Liens and Interests (Including 20-Day Language), signed by Frank R. Monroe on June 5, 2007 (a copy of which is attached hereto as Exhibit "A");

NOW, THEREFORE, in consideration of the sum of FIFTEEN THOUSAND & NO/100 DOLLARS ($15,000.00) cash paid to the Trustee, and other good and valuable consideration paid by Great West Capital, LLC, a California limited liability company, the receipt and sufficiency of which is hereby acknowledged, the undersigned Trustee of the estate of MEETRIX, INC., (05-13133-FRM) has BARGAINED, SOLD, and DELIVERED, and by these presents does BARGAIN, SELL, and DELIVER unto Great West Capital, LLC as the successor in interest, all of his right, title, and interest in the Debtor's personal property described as information relating to:

a. Software (object and source code), computers and servers;
b. Intellectual property – patent and trademark filings;
c. Business plans, executive summaries and other presentation materials (printed and electronic copies;
d. Marketing materials, brochures and similar type items;
e. Customer lists of Meetrix at the time of filing bankruptcy;
f. Prospective customer lists;
g. Copies of license agreements with vendors;
h. Technical specifications of the Meetrix system; and
i. Any other relevant business and technical information relating to the business of Meetrix,

Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1005 – 411

to have and to hold the aforesaid property unto Great West Capital, LLC, its successors and assigns, against the lawful claim or claims of any and all persons whomsoever, by, through, or under them but not otherwise.

The property conveyed hereby has been purchased by Buyer "AS IS" and WITH ALL FAULTS and RANDOLPH N. OSHEROW does not in any way warrant the merchantability of the goods sold hereby; there are no warranties which extend beyond the description on the face hereof and no warranties of any kind are to be implied in this transaction.

RANDOLPH N. OSHEROW makes no personal guarantees or warranties herein. All representations, guarantees or warranties made herein are made solely in the capacity as Trustee for the estate.

Dated at San Antonio, Bexar County, Texas, this 7th day of June 2007.

RANDOLPH N. OSHEROW, Chapter 7 Trustee of the Bankruptcy Estate of MEETRIX, INC., Case No. 05-13133-FRM

THE STATE OF TEXAS §
§
COUNTY OF BEXAR §

This instrument was acknowledged before me on the 7th day of June 2007, by Randolph N. Osherow, as Trustee of the Bankruptcy Estate of MEETRIX, INC., Case No. 05-13133-FRM.

LINDA A. KIVELL
Notary Public, State of Texas
My Commission Expires
October 16, 2007

Notary Public, State of Texas

C:\WP\Meetrix\Bill of of Sale.doc

IT IS HEREBY ADJUDGED and DECREED that the below described is SO ORDERED.

Dated: June 05, 2007

FRANK R. MONROE
UNITED STATES BANKRUPTCY JUDGE

IN THE UNITED STATES BANKRUPTCY COURT
FOR THE WESTERN DISTRICT OF TEXAS
AUSTIN DIVISION

IN RE:	§	CASE NO. 05-13133-FRM
	§	
MEETRIX, INC.,	§	
	§	
DEBTOR.	§	CHAPTER 7 PROCEEDING

ORDER AUTHORIZING TRUSTEE TO SELL PERSONAL PROPERTY
OF DEBTOR FREE AND CLEAR OF ALL LIENS AND INTERESTS

On the day this Order was signed, came to be considered by the United States Bankruptcy Judge the Trustee's Amended Motion to Sell Personal Property of Debtor Free and Clear of all Liens and Interests. The Court having considered the Amended Motion finds that it has merit and should be granted. It is, therefore,

ORDERED, ADJUDGED, and DECREED that the Trustee is hereby authorized to sell Debtor's personal property described as information relating to:

a. Software (object and source code), computers and servers;
b. Intellectual property – patent and trademark filings;
c. Business plans, executive summaries and other presentation materials (printed and electronic copies;
d. Marketing materials, brochures and similar type items;
e. Customer lists of Meetrix at the time of filing bankruptcy;
f. Prospective customer lists;
g. Copies of license agreements with vendors;

EXHIBIT "A"

Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1005 – 413

h. Technical specifications of the Meetrix system; and
i. Any other relevant business and technical information relating to the business of Meetrix,

which property is to be sold AS IS and WHERE IS. It is further

ORDERED, ADJUDGED, and DECREED that the sale of the foregoing property shall be free and clear of all liens and interests, valid and invalid, except this sale is subject to any ad valorem taxes due, if any, and the same is hereby approved and affirmed. It is further

ORDERED, ADJUDGED, and DECREED that the Trustee is authorized to execute the documents necessary to effectuate the sale of the above-described property. It is further

ORDERED, ADJUDGED, and DECREED that the Trustee is authorized to pay the secured creditors as follows:

a. 14% - Claim #10 filed by John A. McEntire in the amount of $55,068.06 ($1,862.00 to be paid)
b. 28% - Claim #11 filed by Murray Goldman in the amount of $110,136.10 ($3,724.00 to be paid)
c. 14% - Claim #12 filed by Hugh Barnes in the amount of $55,068.06 ($1,862.00 to be paid)
d. 3% - Claim #14 filed by Eric Cumming in the amount of $10,000.00 ($399.00 to be paid)
e. 13% - Claim #15 filed by Kerry Brooks in the amount of $50,000.00 ($1,729.00 to be paid)
f. 3% - Claim #16 filed by Eric Lund in the amount of $10,000.00 ($399.00 to be paid)
g. 3% - Claim #17 filed by David L. Throckmorton in the amount of $10,000.00 ($399.00 to be paid)
h. 3% - Claim #18 (amends #9) filed by Sylvan Schwartz in the amount of $10,000.00 ($399.00 to be paid)
i. 13% - Claim #19 filed by Rich Bowler in the amount of $50,000.00 ($1,729.00 to be paid)
j. 3% - Claim #20 filed by John Lang in the amount of $10,000.00 ($399.00 to be paid)
k. 3% - Claim #21 filed by Les Menkes in the amount of $10,000.00 ($399.00 to be paid)

###

RANDOLPH N. OSHEROW
342 West Woodlawn, Suite 300
San Antonio, Texas 78212
(210) 738-3001 - Telephone
(210) 737-6312 - Telefax
rosherow@hotmail.com

Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1005 – 414

RECEIVED
FEB 1 2005

UNITED STATES PATENT AND TRADEMARK OFFICE

UNDER SECRETARY OF COMMERCE FOR INTELLECTUAL PROPERTY AND
DIRECTOR OF THE UNITED STATES PATENT AND TRADEMARK OFFICE

JANUARY 12, 2005

PTAS

102792984A

MEYERTONS, HOOD, KIVLIN, KOWERT &
GOETZEL, P.C.
JEFFREY C. HOOD
P.O. BOX 398
AUSTIN, TX 78767-0398

UNITED STATES PATENT AND TRADEMARK OFFICE
NOTICE OF RECORDATION OF ASSIGNMENT DOCUMENT

THE ENCLOSED DOCUMENT HAS BEEN RECORDED BY THE ASSIGNMENT DIVISION OF THE U.S. PATENT AND TRADEMARK OFFICE. A COMPLETE MICROFILM COPY IS AVAILABLE AT THE ASSIGNMENT SEARCH ROOM ON THE REEL AND FRAME NUMBER REFERENCED BELOW.

PLEASE REVIEW ALL INFORMATION CONTAINED ON THIS NOTICE. THE INFORMATION CONTAINED ON THIS RECORDATION NOTICE REFLECTS THE DATA PRESENT IN THE PATENT AND TRADEMARK ASSIGNMENT SYSTEM. IF YOU SHOULD FIND ANY ERRORS OR HAVE QUESTIONS CONCERNING THIS NOTICE, YOU MAY CONTACT THE EMPLOYEE WHOSE NAME APPEARS ON THIS NOTICE AT 703-308-9723. PLEASE SEND REQUEST FOR CORRECTION TO: U.S. PATENT AND TRADEMARK OFFICE, ASSIGNMENT DIVISION, BOX ASSIGNMENTS, CG-4, 1213 JEFFERSON DAVIS HWY, SUITE 320, WASHINGTON, D.C. 20231.

RECORDATION DATE: 07/07/2004

REEL/FRAME: 015557/0645
NUMBER OF PAGES: 4

BRIEF: ASSIGNMENT OF ASSIGNOR'S INTEREST (SEE DOCUMENT FOR DETAILS).

ASSIGNOR:
DYE, THOMAS A.

DOC DATE: 04/06/2004

ASSIGNOR:
DUNDON, THOMAS A.

DOC DATE: 04/12/2004

ASSIGNEE:
MEETRIX CORPORATION
2433 RUTLAND DR., SUITE 100
AUSTIN, TEXAS 78758

SERIAL NUMBER: 10796560

FILING DATE: 03/09/2004

PATENT NUMBER:

ISSUE DATE:

TITLE: MEDIA BASED COLLABORATION USING MIXED-MODE PSTN AND INTERNET NETWORKS

Atty Dkt#: 5757-00601 Atty: _____
Transferred ☐ Due Date: _____
Action: 30 Day ☐ 1Mo. ☐ 2 Mo ☐
3 Mo. ☐ Final Action ☐ Advsy Action ☐
Ntc of Allow ☐ Drawings ☐ Issue Fee ☐
Other: _____
5/2

Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1005 – 415

ANTIONE ROYALL, EXAMINER
ASSIGNMENT DIVISION
OFFICE OF PUBLIC RECORDS

FORM PTO-1595
1-31-92

07-16-2004

102792984

U.S. DEPARTMENT OF COMMERCE
Patent and Trademark Office

JUL 12 2004

To the Honorable Commissioner of Patents and Trademarks. Please record the attached original documents or copy thereof.

1. Name of conveying party(ies):

Thomas A. Dye and Thomas A. Dundon 7.12.04

Additional name(s) of conveying party(ies) attached? ☐ Yes ☑ No

2. Name and address of receiving party(ies):

Name: MEETRIX CORPORATION

Street Address: 2433 Rutland Dr., Suite 100

City Austin State TX ZIP 78758

Additional name(s) & address(es) attached? ☐ Yes ☑ No

3. Nature of Conveyance:

☒ Assignment
☐ Merger
☐ Security Agreement
☐ Change of Name
☐ Other _____

Execution Date: April 6, 2004 and April 12, 2004

4. Application number(s) or patent number(s):
If this document is being filed together with a new application, the execution date of this application is:

A. Patent Application No.(s)
10/796,560 filed on March 9, 2004

B. Patent No.(s)

Additional numbers attached? ☐ Yes ☑ No

5. Name and address of party to whom correspondence concerning document should be mailed:

Name: Jeffrey C. Hood

Internal Address: Meyertons, Hood, Kivlin, Kowert & Goetzel PC

Street Address: P.O. Box 398

City Austin State TX ZIP 78767-0398

6. Total number of applications and patents involved: 1

7. Total fee (37 CFR 3.41): .....$ 40.00

☑ Fee Authorization Form Enclosed

☑ Authorized to be charged to deposit account

8. Deposit account number: 501505/5757-00601
(Attach a duplicate copy of this page if paying by deposit account)

DO NOT USE THIS SPACE

9. Statement and Signature.

To the best of my knowledge and belief, the foregoing information is true and correct and any attached copy is a true copy of the original document.

Jeffrey C. Hood
Name of Person Signing
Reg. No. 35,198

Signature

7/7/2004
Date

Total number of pages comprising cover sheet: 1

OMB No. 0651-011 (exp.4/94)

07/15/2004 GTON11 00000094 501505 10796560
01 FC:8021 40.00 DA

Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1005 – 417

ASSIGNMENT

FOR GOOD AND VALUABLE CONSIDERATION, the receipt, sufficiency and adequacy of which are hereby acknowledged, the undersigned does hereby:

SELL, ASSIGN AND TRANSFER to MEETRIX CORPORATION (the "Assignee"), a corporation organized and existing under and by virtue of the laws of the State of Delaware, and having its principal place of business at 2433 Rutland, Suite 100 Austin, TX 78758, the entire right, title and interest for the United States and all foreign countries, in and to any and all improvements which are disclosed in the application for United States Letters Patent, which, was filed **March 9, 2004**, Serial No. **10/796,560**, and is entitled **MEDIA BASED COLLABORATION USING MIXED-MODE PSTN AND INTERNET NETWORKS**, such application and all divisional, continuing, substitute, renewal, reissue and all other applications for patent which have been or shall be filed in the United States and all foreign countries on any of such improvements; all original and reissued patents which have been or shall be issued in the United States and all foreign countries on such improvements; and specifically including the right to file foreign applications under the provisions of any convention or treaty and claim priority based on such application in the United States;

AUTHORIZE AND REQUEST the issuing authority to issue any and all United States and foreign patents granted on such improvements to the Assignee;

WARRANT AND COVENANT that no assignment, grant, mortgage, license or other agreement affecting the rights and property herein conveyed has been or will be made to others by the undersigned, and that the full right to convey the same as herein expressed is possessed by the undersigned;

COVENANT that, when requested and at the expense of the Assignee, to carry out in good faith the intent and purpose of this assignment, the undersigned will execute all divisional, continuing, substitute, renewal, reissue, and all other patent applications on any and all such improvements; execute all rightful oaths, declarations, assignments, powers of attorney and other papers; communicate to the Assignee all facts known to the undersigned relating to such improvements and the history thereof; and generally do everything possible which the Assignee shall consider desirable for securing, maintaining and enforcing proper patent protection for such improvements and for vesting title to such improvements in the Assignee;

COVENANT AND AGREE that the above is and will be binding on the heirs, assigns, representatives and successors of the undersigned and extend to the successors, assigns and nominees of the Assigns.

Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1005 – 418

(Signature) _____ Date: April 6th, 2004
Name: Thomas A. Dye

Witness (Signature): _____ Date: 4-6-04
Witness (Printed Name): Tristin Caramino

(Signature) _____ Date: _____
Name: Thomas A. Dundon

Witness (Signature): _____ Date: _____

Witness (Printed Name): _____

Jeffrey C. Hood
Conley, Rose & Tayon, P.C.
P.O. Box 398
Austin, TX 78767-0398

Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1005 – 419

(Signature)_____ Date: _____
Name: Thomas A. Dye

Witness (Signature): _____ Date: _____

Witness (Printed Name): _____

(Signature) Thomas A Dundon Date: 12 Apr 04
Name: Thomas A. Dundon

Witness (Signature): _____ Date: _____

Witness (Printed Name): _____

Jeffrey C. Hood
Conley, Rose & Tayon, P.C.
P.O. Box 398
Austin, TX 78767-0398

Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1005 – 420

Electronic Acknowledgement Receipt

EFS ID:	15533829
Application Number:	13674233
International Application Number:	
Confirmation Number:	5197
Title of Invention:	AUDIO-VIDEO MULTI-PARTICIPANT CONFERENCE SYSTEMS USING PSTN AND INTERNET NETWORKS
First Named Inventor/Applicant Name:	Thomas Dye
Customer Number:	48008
Filer:	Michael A. Kerr/Julie Dawes
Filer Authorized By:	Michael A. Kerr
Attorney Docket Number:	MEET 12.003
Receipt Date:	16-APR-2013
Filing Date:	12-NOV-2012
Time Stamp:	17:23:25
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	Assignee showing of ownership per 37 CFR 3.73.	statement.pdf	121775 db10f8944db07f46f3546eb208536208b2128777	no	3

Warnings:	
Information:	

Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1005 – 421

2	Power of Attorney	poa_cover_sheet.pdf	130796 c4bbb6a251be5fc66192e67fb32405c2462671bb	no	1
Warnings:					
Information:					
3	Power of Attorney	poa.pdf	72125 3daf5288b8a2e4716f132e6be377f47d26f22710	no	1
Warnings:					
Information:					
4	Assignee showing of ownership per 37 CFR 3.73.	Binder2.pdf	14015216 1b8e175723a8f2dad023192470663600ba94e432	no	16
Warnings:					
Information:					
		Total Files Size (in bytes):	14339912		

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/AIA/96 (08-12)
Approved for use through 01/31/2013. OMB 0651-0031
U.S. Patent and Trademark Office;U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of1995, no persons arerequired to respond to a collection of information unless it displays a valid OMB control number.

STATEMENT UNDER 37 CFR 3.73(c)

Applicant/Patent Owner: Meetrix Communications, Inc.

Application No./Patent No.: 13/674,233 Filed/Issue Date: November 12, 2012

Titled: AUDIO-VIDEO MULTI-PARTICIPANT CONFERENCE SYSTEM USING PSTN AND INTERNET NETWORKS

Meetrix Communications, 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: Thomas Dye and Thomas Dundon To: Meetrix Corporation

   The document was recorded in the United States Patent and Trademark Office at
   Reel 015557, Frame 0645, or for which a copy thereof is attached.

2. From: Meetrix Corpration To: Great West Capital

   The document was recorded in the United States Patent and Trademark Office at
   Reel 029932, Frame 0738, 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**

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

PTO/AIA/96 (08-12)
Approved for use through 01/31/2013. 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 displays a valid OMB control number.

STATEMENT UNDER 37 CFR 3.73(c)

3. From: Great West Capital To: Meetrix Communications, Inc.

The document was recorded in the United States Patent and Trademark Office at
Reel 029932, Frame 0738, 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.

/Michael A. Kerr/	April 2, 2013
Signature	Date
Michael A. Kerr	42722
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.

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
13/674,233	11/12/2012	Thomas Dye	MEET 12.003

CONFIRMATION NO. 5197

48008
KERR IP GROUP, LLC
MICHAEL A. KERR
P.O. Box 18600
RENO, NV 89511

NOTICE

OC00000059870729

Date Mailed: 03/20/2013

INFORMATIONAL NOTICE TO APPLICANT

Applicant is notified that the above-identified application contains the deficiencies noted below. No period for reply is set forth in this notice for correction of these deficiencies. However, if a deficiency relates to the inventor's oath or declaration, the applicant must file 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 actual inventor no later than the expiration of the time period set in the "Notice of Allowability" to avoid abandonment. See 37 CFR 1.53(f).

The item(s) indicated below are also required and should be submitted with any reply to this notice to avoid further processing delays.

A new inventor's oath or declaration that identifies this application (e.g., by Application Number and filing date) is required. The inventor's oath or declaration does not comply with 37 CFR 1.63 in that it:

- does not state that the above-identified application was made or authorized to be made by the person executing the oath or declaration.

Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1005 – 426

PATENT APPLICATION FEE DETERMINATION RECORD

Substitute for Form PTO-875

Application or Docket Number: 13/674,233

APPLICATION AS FILED - PART I

FOR	(Column 1) NUMBER FILED	(Column 2) NUMBER EXTRA	SMALL ENTITY RATE($)	SMALL ENTITY FEE($)	OR	OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY FEE($)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	70		N/A	
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A	300		N/A	
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	360		N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	24 minus 20 =	* 4	x 40 =	160	OR		
INDEPENDENT CLAIMS (37 CFR 1.16(h))	3 minus 3 =	*	x 210 =	0.00			
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).			0.00			
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				0.00			
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL	890		TOTAL	

APPLICATION AS AMENDED - PART II

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

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

UNITED STATES PATENT AND TRADEMARK OFFICE

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

APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
13/674,233	11/12/2012	2447	722	MEET 12.003	24	3

CONFIRMATION NO. 5197

UPDATED FILING RECEIPT

48008
KERR IP GROUP, LLC
MICHAEL A. KERR
P.O. Box 18600
RENO, NV 89511

OC00000059870728

Date Mailed: 03/20/2013

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)

Thomas Dye, Austin, TX;
Thomas Dundon, San Marcos, TX;

Applicant(s)

Meetrix Communication, Inc., Santa Monica, CA

Assignment For Published Patent Application

MEETRIX COMMUNICATION, INC., Santa Monica, CA

Power of Attorney: None

Domestic Priority data as claimed by applicant

This application is a CON of 12/646,892 12/23/2009 PAT 8339997
which is a CON of 10/796,560 03/09/2004 PAT 7664056
which claims benefit of 60/453,307 03/10/2003

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: 12/03/2012
The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 13/674,233**
Projected Publication Date: 06/27/2013
Non-Publication Request: No
Early Publication Request: No

Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1005 – 428

**** SMALL ENTITY ****

Title

AUDIO-VIDEO MULTI-PARTICIPANT CONFERENCE SYSTEMS USING PSTN AND INTERNET NETWORKS

Preliminary Class

709

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications:

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 (1-866-999-4158).

Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1005 – 429

LICENSE FOR FOREIGN FILING UNDER

Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

GRANTED

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).

SelectUSA

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.

UNITED STATES PATENT AND TRADEMARK OFFICE

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
13/674,233	11/12/2012	Thomas Dye	MEET 12.003

CONFIRMATION NO. 5197

IMPROPER CPOA LETTER

48008
KERR IP GROUP, LLC
MICHAEL A. KERR
P.O. Box 18600
RENO, NV 89511

OC00000059870775

Date Mailed: 03/20/2013

NOTICE REGARDING POWER OF ATTORNEY

This is in response to the power of attorney filed 03/06/2013. The power of attorney in this application is not accepted for the reason(s) listed below:

- The power of attorney has not been accepted because the party who is giving power of attorney has not been identified. power of attorney may only be signed by the applicant for patent (37 CFR 1.42) or the patent owner. A patent owner who was not the applicant must appoint any power of attorney in compliance with 37 CFR 3.71 and 3.73. See 37 CFR 1.32(b)(4).

/ydemisse/

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1005 – 431

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant(s): **Dye, et al.** Application Serial No.: **13/674,233** Filed: **November 12, 2012** Title: **AUDIO-VIDEO MULTI-PARTICIPANT CONFERENCE SYSTEM USING PSTN AND INTERNET NETWORKS**	Group Art Unit: **TBD** Examiner name: **TBD** Confirmation No: **5197**

RESPONSE TO NOTICE TO FILE MISSING PARTS OF NONPROVISIONAL APPLICATION

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

Dear Sir/Madam:

Applicant hereby files this Response to the Notice to File Missing Parts of Nonprovisional Application issued by the United States Patent and Trademark Office ("USPTO") on December 6, 2012. The Notice requests that Applicant submit fees totaling $722 for the $98 statutory basic filing fee, $65 surcharge, $310 search fee, $125 examination fee, and $124 for four claims over 20, all of which is submitted herein. In addition, Applicant submits a one-month Petition for Extension of Time with the $75 fee. Applicant also hereby makes an assertion of entitlement to small entity status and is paying only the fee amounts required for a small entity.

Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1005 – 432

Respectfully Submitted;

Dated: March 6, 2013

/Michael A. Kerr/
Michael A. Kerr
Reg. No. 42,722

Michael A. Kerr
KERR IP GROUP, LLC
P.O. Box 18600
Reno, NV 89511
Tel: (775) 624-8700
Fax: (775) 622-0686

Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1005 – 433

PTO/AIA/22 (10-12)
Approved for use through 2/28/2013. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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PETITION FOR EXTENSION OF TIME UNDER 37 CFR 1.136(a)

Docket Number (Optional): MEET 12.003

Application Number: 13/674,233 | Filed: 11/12/2012

For: AUDIO-VIDEO MULTI-PARTICIPANT CONFERENCE SYSTEM USING PSTN AND INTERNET NETWORKS

Art Unit: TBD | Examiner: TBD

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	
☒ One month (37 CFR 1.17(a)(1))	$150	$75	$ 75
☐ Two months (37 CFR 1.17(a)(2))	$570	$285	$
☐ Three months (37 CFR 1.17(a)(3))	$1,290	$645	$
☐ Four months (37 CFR 1.17(a)(4))	$2,010	$1,005	$
☐ Five months (37 CFR 1.17(a)(5))	$2,730	$1,365	$

☒ Applicant claims small entity status. See 37 CFR 1.27.

☐ 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 _____.

☒ 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 42722.

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

/Michael A. Kerr/ — Signature

03/06/2013 — Date

Michael A. Kerr — Typed or printed name

775-624-8700 — 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.

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.

Doc Code: PA..

Document Description: Power of Attorney

PTO/AIA/82B(07-12)
Approved for use through 11/30/2014. OMB 0651-0035
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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POWER OF ATTORNEY BY APPLICANT

I hereby revoke all previous powers of attorney given in the application identified in the attached transmittal letter.

■ I hereby appoint Practitioner(s) associated with the following Customer Number as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the application referenced in the attached transmittal letter (form PTO/AIA/82A or equivalent): 48008

OR

■ I hereby appoint Practitioner(s) named below as my/our attorney(s) or agent(s), and to transact all business in the United States Patent and Trademark Office connected therewith for the application referenced in the attached transmittal letter (form PTO/AIA/82A or equivalent):

Name	Registration Number	Name	Registration Number
Michael A. Kerr	42722		

Please recognize or change the correspondence address for the application identified in the attached transmittal letter to:

■ The address associated with the above-mentioned Customer Number.

OR

■ The address associated with Customer Number: 48008

OR

■ Firm or Individual Name	Michael A. Kerr				
Address	P.O. Box 18600				
City	Reno	State	NV	Zip	89511
Country	US				
Telephone	775-624-8700	Email	mick@kipg.com		

I am the Applicant:

☐ Inventor or Joint Inventor

☐ Legal Representative of a Deceased or Legally Incapacitated Inventor

■ Assignee or Person to Whom the Inventor is Under an Obligation to Assign

☐ Person Who Otherwise Shows Sufficient Proprietary Interest (*e.g.*, a petition under 37 CFR 1.46(b)(2) was granted in the application or is concurrently being filed with this document)

SIGNATURE of Applicant for Patent

Signature	[signature]	Date	1/15/2012
Name	Jeb Dykstra	Telephone	316-428-9819
Title and Company	Board Member		

NOTE: Signature - This form must be signed by the applicant in accordance with 37 CFR 1.33. See 37 CFR 1.4 for signature requirements and certifications. Submit multiple forms for more than one signature, see below *.

■ *Total of 1 forms are submitted.

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.

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	13674233
Filing Date	2012-11-12
First Named Inventor	DYE, Thomas
Art Unit	TBD
Examiner Name	TBD
Attorney Docket Number	MEET 12.003

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	7724744	B2	2010-05-25	Shur et al.	
	2	6870842	B1	2005-03-22	Caronni et al.	
	3	6977929	B1	2005-12-20	Caronni et al.	
	4	6788681	B1	2004-09-07	Hurren et al.	
	5	6640251	B1	2003-10-28	Wiget 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	20100228879	A1	2010-09-10	Wiget et al.	

Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1005 – 437

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	13674233
	Filing Date	2012-11-12
	First Named Inventor	DYE, Thomas
	Art Unit	TBD
	Examiner Name	TBD
	Attorney Docket Number	MEET 12.003

	2	20030110288	A1	2003-06-12	Ramanujan et al.	
	3	20030147392	A1	2003-08-07	Hayashi et al.	
	4	20060039388	A1	2006-02-23	Shur et al.	
	5	20020029350	A1	2002-03-07	Cooper 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]
	1	WO 03003665	WO	A1	2003-01-03	Ahlard, David		☐

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]
	1	Higgins, L. et al., "Tunneling Multicast Traffic Through Non-Multicast Aware Networks and Encryption Devices," MILCOM 2001. Proceedings. Communications for Network-Centric Operations: Creating the Information Force, McLean, VA October 28-30, 2001; IEEE Military Communications Conference, New York, NY: IEEE, US, Vol. 1 of 2, October 28, 2001, pages 296-300.	☐
	2	International Search Report, International Application No. PCT/US2004/007341, mailed September 7, 2004.	☐

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

Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1005 – 438

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	13674233
	Filing Date	2012-11-12
	First Named Inventor	DYE, Thomas
	Art Unit	TBD
	Examiner Name	TBD
	Attorney Docket Number	MEET 12.003

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.

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	13674233
	Filing Date	2012-11-12
	First Named Inventor	DYE, Thomas
	Art Unit	TBD
	Examiner Name	TBD
	Attorney Docket Number	MEET 12.003

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 A. Kerr/	Date (YYYY-MM-DD)	2012-12-12
Name/Print	Michael A. Kerr	Registration Number	42722

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A3

PATENT COOPERATION TREATY

From the INTERNATIONAL SEARCHING AUTHORITY

PCT

INVITATION TO PAY ADDITIONAL FEES

(PCT Article 17(3)(a) and Rule 40.1)

To:
MEYERTONS, HOOD, KIVLIN, KOWERT
& GOETZEL, P.C.
Attn. Hood, Jeffrey C.
P.O. Box 398
Austin TX 78767-0398
UNITED STATES OF AMERICA

Date of mailing *(day/month/year)*	07/09/2004
Applicant's or agent's file reference: 5757-00402	**PAYMENT DUE** within 45 ~~months~~/days from the above date of mailing
International application No.: PCT/US2004/007341	International filing date *(day/month/year)*: 10/03/2004

Applicant

MEETRIX CORPORATION

1. This International Searching Authority

(i) considers that there are 3 *(number of)* inventions claimed in the international application covered by the claims indicated ~~below~~/on the extra sheet:

and it considers that the international application does not comply with the requirements of unity of invention (Rules 13.1, 13.2 and 13.3) for the reasons indicated ~~below~~/on the extra sheet:

(ii) [X] has carried out a partial international search (see Annex) [ ] will establish the international search report on those parts of the international application which relate to the invention first mentioned in claims Nos.:

1-9

(iii) will establish the international search report on the other parts of the international application only if, and to the extent to which, additional fees are paid

2. The applicant is hereby **invited,** within the time limit indicated above, to pay the amount indicated below:

EUR 1,550.00	x	2	=	EUR 3,100.00
Fee per additional invention		number of additional inventions		total amount of additional fees

Or, _____ x _____ = _____

The applicant is informed that, according to Rule 40.2(c), **the payment of any additional fee may be made under protest,** i.e., a reasoned statement to the effect that the international application complies with the requirement of unity of invention or that the amount of the required additional fee is excessive.

3. [ ] Claim(s) Nos. _____ have been found to be unsearchable under Article 17(2)(b) because of defects under Article 17(2)(a) and therefore have not been included with any invention.

Name and mailing address of the International Searching Authority	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Alistair Finnie

Form PCT/ISA/206 (July 1992)

Annex to Form PCT/ISA/206
COMMUNICATION RELATING TO THE RESULTS OF THE PARTIAL INTERNATIONAL SEARCH

International Application No
PCT/US2004/007341

1. The present communication is an Annex to the invitation to pay additional fees (Form PCT/ISA/206). It shows the results of the international search established on the parts of the international application which relate to the invention first mentioned in claims Nos.:
see 'Invitation to pay additional fees'
2. This communication is not the international search report which will be established according to Article 18 and Rule 43.

3. If the applicant does not pay any additional search fees, the information appearing in this communication will be considered as the result of the international search and will be included as such in the international search report.

4. If the applicant pays additional fees, the international search report will contain both the information appearing in this communication and the results of the international search on other parts of the international application for which such fees will have been paid.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	HIGGINS L ET AL: "Tunneling multicast traffic through non-multicast-aware networks and encryption devices" MILCOM 2001. PROCEEDINGS. COMMUNICATIONS FOR NETWORK-CENTRIC OPERATIONS: CREATING THE INFORMATION FORCE. MCLEAN, VA, OCT. 28 - 30, 2001, IEEE MILITARY COMMUNICATIONS CONFERENCE, NEW YORK, NY : IEEE, US, vol. VOL. 1 OF 2, 28 October 2001 (2001-10-28), pages 296-300, XP010579024 ISBN: 0-7803-7225-5	1-4,7-9
Y	abstract page 296, column 2, line 28 - page 298, column 2, line 40 page 300, column 2, line 2 - line 16; figures 1,2	5,6
Y	WO 03/003665 A (BYSTROEM LEIF ; HANSSON URBAN (SE); AHLARD DAVID (SE); HYGLO AB (SE);) 9 January 2003 (2003-01-09)	5,6
A	abstract page 1, line 32 - page 5, line 20	2-4,7-9

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

☒ Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

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INVITATION TO PAY ADDITIONAL FEES

International application No.
PCT/US2004/007341

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

1. claims: 1-9

Method for data transport on an IP network using tunneling

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2. claims: 10-11

Method for reduction of multipoint transport delay

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3. claims: 12-16

Method for establishing multi-participant conferences

The application lacks unity, Rule 13.1 PCT, as the application does not relate to one single invention or group of inventions linked as to form a single inventive concept.
The only technical relationship between the three alleged inventions lies in the fact that data is transported or transmitted. However, this concept is not new since it corresponds to a well known and wide technical field.
Thus, there is no special technical feature which could serve as a basis for a common inventive concept.
Hence, the Search Division considers that the application comprises the above listed three different inventions, which are not linked so as to form a single inventive concept.

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Patent Family Annex

Information on patent family members

International Application No
PCT/US2004/007341

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 03003665 A	09-01-2003	WO 03003665 A1	09-01-2003
		EP 1413094 A1	28-04-2004

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(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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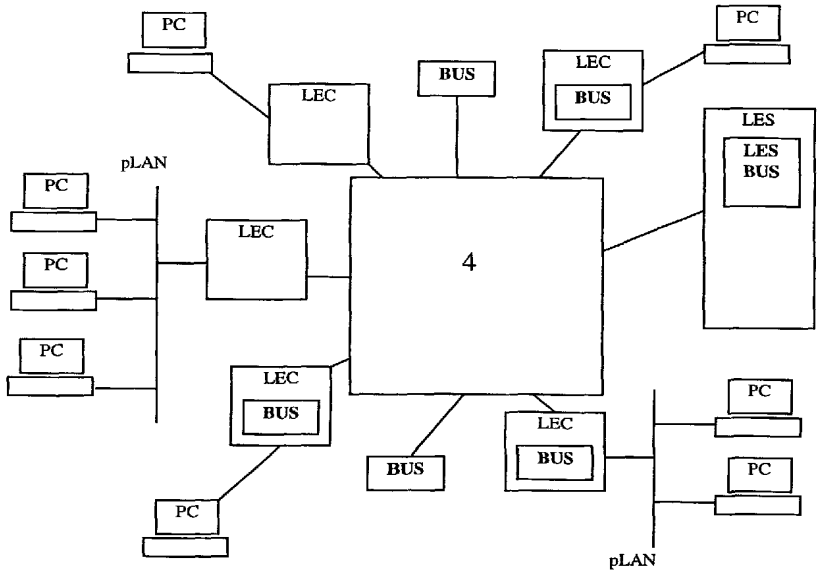
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Published:
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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: DISTRIBUTED SERVER FUNCTIONALITY FOR EMULATED LAN



(57) Abstract: A system for emulating a local are network on top of a global communication network (4), the system comprising clients units (LEC) and a server (LES) which are connected to said global network (4), and a broadcast functionality (BUS) for relaying messages to all clients in the emulated local area network. The system is characterized in that said broadcast functionality is distributed and implemented in more than one network unit node in the emulated local area network. The global network is preferably an IP network, such as the Internet, and act as a backbone for the emulated local area network.

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DISTRIBUTED SERVER FUNCTIONALITY FOR EMULATED LAN

Field if the invention

The invention relates in general to computer networks and more in particular to enabling mechanisms for delegation and distribution of centralised network server functions to the edge of computer networks. Specifically, the invention relates to distributed broadcast server functionality used for emulated local area networks (LAN) on global networks.

Background

Most enterprises are located at multiple sites where each site has its own local area network (LAN). A site is defined as anything from a head-quarter, or an affiliation company site, to a single employee's remote office site. Some kind of communication infrastructure is then used to interconnect the different sites. The Internet evolution can roughly be categorised into two main areas:

a) Internet as the global communication infrastructure. Traditionally, companies used so called leased lines, provided by telephone companies to interconnect their sites. Separated firewall solutions were used for accessing the Internet. During the last years, companies are no longer using Internet only for external communication, more and more companies are trying out new network solutions that enables them to also use Internet for company-internal communication. Internet has become their site-to-site interconnecting medium.

b) Broadband Internet access. In parallel with the above, more and more broadband access solutions are rolled out by different network access providers. This enables anyone to upgrade their access to Internet from a traditional dial-up PSTN/ISDN (Public Switched Telephone Network/Integrated Services Digital Network) access solution to a broadband solution, e.g. ADSL (Asymmetric Digital Subscriber Line), Cable or Ethernet, with direct access to Internet. Apart from the obvious broadband benefits, the network access user is also able to always be connected to the Internet.

The common name for most of the network solutions that interconnects multiple sites over Internet is "virtual private networks" (VPN). VPNs can be implemented in numerous ways, this is well explained in e.g. the IETF by B. Gleeson et. al, "A Framework for IP Based Virtual private Networks", RFC 2764, February 2000, IP meaning Internet Protocol. A VPN is a private network that is configured within a public network. For years, common carriers have built VPNs that appear as private national or international networks to the customer, but physically share backbone trunks with other customers. VPNs enjoy the security of a

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private network via access control and encryption, while taking advantage of the economies of scale and built-in management facilities of large public networks. Today, there is tremendous interest in VPNs over the Internet, especially due to the constant threat of hacker attacks. The VPN adds that extra layer of security, and a huge growth in VPN use is expected. In general, the different VPN solutions can be categorized into two main groups; customer premises equipment (CPE) based solutions or network based solutions.

Internet is a public data network based on network paradigms such as equal and best effort traffic treatment. All traffic crossing the Internet is public and insecure resulting in a number of problems that need to be solved, e.g. end-to-end security communication between enterprise sites. Some problems have solutions supported by several VPN system vendors, such as encrypted IP tunnelling between end-users using the IPSec architecture described by S. Kent and R. Atkinson in "Security Architecture for the Internet Protocol", RFC 2401, November 1998, or stand-alone firewall solutions, desktop software VPN clients. e.g. Microsoft® VPN, etc. A PC that is connected to Internet can, not easily but it is possible, be used as a transit node by a hacker, e.g. the hacker could use a Trojan horse program to get inside the PC. Well inside, the Trojan horse program may be adapted to release application software that will act as some authenticated software installed by the owner of the PC. It is very difficult for layer 2 and 3 firmware/software to detect this kind of malicious applications. Therefore, it is recommendable to have VPN control and management software and firmware functions and end-user applications, such as service login software, "authenticated" software applications that in some way uses the network infrastructure provided by the VPN service, separated on different hardware platforms. What generally should be avoided, is having PC clients that are responsible for configuring the actual VPN setup, i.e. having access to the lookup-table for other VPN members public IP addresses, having access to information on how to authenticate, perform integrity check and encrypt traffic aimed for the VPN etc.

When a Virtual Private Network (VPN) is implemented as an emulated LAN on top of a standard IP network such as Internet, one have to provide for the broadcast functionality that is a basic (intrinsic) function on a level-2 media such as Ethernet. A number of broadcast based services are defined on the link-level. Examples are service discovery protocols and the layer-2 Address Resolution Protocol (ARP). The broadcast functionality could be implemented in different ways. Examples of different architectures are:

- Broadcast functionality implemented as a centralized server;
- Broadcast functionality implemented using IP multicast;
- Broadcast functionality implemented using emulated multicast.

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ATM Forum's LANE (LAN Emulation) standard is an example of centralised server architecture. This server emulates the broadcast functionality on the LAN. When a LAN Emulating Client (LEC) sends a broadcast, the broadcast is sent to the BUS (Broadcast and Unknown Server) that relays this message to all of the other clients on the emulated LAN.

The technical problems with the described architecture are related to scalability and reliability. When a large number of LAN emulating clients are sending broadcasts to the broadcast server each client will experience a performance degradation of the broadcast service due to the load on the broadcast server. The traffic load on the link connecting the broadcast server will also increase with a large number of LAN clients. This will ultimately becomes a bottleneck. This bottleneck will further reduce the broadcast performance experienced by the LAN clients. In addition to the performance problem, a single broadcast server will also be a single point of failure for broadcast based services offered by the emulated LAN.

When the broadcast functionality is implemented by using IP multicast, the LAN emulating clients joins a multicast network. This network constitutes the broadcast medium for the emulated LAN. Obviously, to be able to use IP multicast as the broadcast medium, the clients have to interact with a multicast service offered by underlying IP network. This interaction could be done via a LAN emulating server, the management system of the emulated LAN or by other means. A technical problem with this solution is the dependency of the IP multicast functionality in the IP backbone and the need for the emulated LAN to interact with IP backbone.

Summary of the invention

According to first aspect of the invention, a system for emulating a local area network on top of a global communication network is provided. The system comprises clients units and a server which are connected to said global network. Furthermore, the system comprises a broadcast functionality for relaying messages to all clients in the emulated local area network. According to the invention said broadcast functionality is distributed and implemented in more than one network unit node in the emulated local area network. Said global network preferably acts as a backbone for the emulated local area network.

In one embodiment a choice of which clients unit has an up and running broadcast functionality unit is defined by the server, and is based on predetermined performance criteria, such as available bandwidth to the backbone network.

Preferably the distributed broadcast functionality is hierarchically structured, wherein a master and initial broadcast functionality unit, constituting the top of said hierarchy, is configured in said server.

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In one embodiment the connections between the nodes of the emulated local area network are implemented as a multicast network transmitted through the global network. In another embodiment the connections between the nodes of the emulated local area network may is implemented as single-cast addresses, forming tunnels through said global network.

Preferably each network unit having a distributed broadcasting functionality comprises means for executing an algorithm for preventing broadcast messages from being indefinitely sent between the network unit nodes having the distributed broadcasting functionality. In one embodiment this is arranged by an algorithm being based on a checksum of the broadcast packet, which checksum uniquely identifies the broadcast packet. The checksum is cached by the broadcasting functionality for the purpose of dropping subsequently arriving broadcast packets having the same checksum. In another embodiment another algorithm is used, based on a hop counter which is decremented by each broadcasting functionality unit upon arrival, said algorithm functioning to drop subsequent incoming packets when the counter has reached zero.

Preferably said global network is an Internet Protocol network, such as the Internet.

According to a second aspect of the invention, a method is provided for taking the steps described in this application, for emulating a distributed local area network.

Brief description of the drawings

Preferred embodiments of the invention are described below with references being made to the drawings, on which

Fig. 1 illustrates the system overview according to an embodiment of the present invention;

Fig. 2 illustrates traffic monitoring and session overtaking according to an embodiment of the present invention;

Fig. 3 Illustrates a distributed broadcasting functionality based on a global network backbone, according to an embodiment of the invention; and

Fig. 4 illustrates the hierarchical configuration of the broadcasting functionality according to an embodiment of the invention.

Fig. 5 illustrates an emulated LAN on top of a global IP network, according to an embodiment of the invention.

Detailed description of preferred embodiments

According to one aspect, the system according to the present invention is based on a standard IP network like the public Internet. The system comprises multiple

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VPN clients and at least one server. One server can be a distributed cluster of physical boxes. The VPN clients could be implemented as drivers on the client computer but are for security reasons preferably implemented in a stand alone hardware box. A purpose of this mechanism is to establish dynamic and secure Virtual Local area Networks between some or all of the clients. A virtual network is created by establishing connection groups in a VPN server. The server has a service device for keeping track of connected machines and mapping them to IP addresses. In one embodiment this is obtained using ARP (Address Resolution Protocol), an IP protocol used to obtain a node's physical address. A client station sends an ARP request to the VPN server with the VPN internal IP address of the target node it wishes to communicate with, and the VPN server responds by sending back the external IP address so that packets can be transmitted. ARP returns the layer-2 address for a layer-3 address. This mechanism also handles distribution of public keys to form complete security associations. For handling broadcasts an emulated broadcast service is implemented in the server, preferably using an IP multicast group or as a separate broadcast service. Data sent directly from one machine in the virtual network to another is tunnelled over IP directly to the IP address of the receiving client. The mechanism includes both the case where data packets are tunnelled directly over IP and when an layer-2 media such as Ethernet is bridged onto the IP network.

Fig. 5 illustrates an embodiment of the system according to the present mechanism, wherein a network 4 comprises five nodes; four VPN clients 31 - 34 with global addresses C1 - C4, and a server S. All of these are connected to and have a valid address in the physical network 4. These nodes are interconnected using standard Internet routing procedures, but the clients 31 - 34 are not on the same LAN. On top of this network infrastructure, clients 31, 32 and 33 form a virtual network 30 with local addresses D1, D2 and D3. In the illustrated case the clients in this VPN appear to be on the same local area network. The reason for this is the broadcast service, i.e. the service device, which delivers all packets for the local broadcast domain to all machines on the VPN 30. Thus service discovery mechanisms or layer-2 ARP operate transparently on top of the virtual network. When client 31 on the VPN wants to transmit a packet directly to client 32 the client-software requests the physical address C2 from server S, based upon the local address D2, and possible security keys required for talking to D2 from S. D1 is then able to transmit the packet in a secure tunnel directly to D2 without passing the server S.

The above provides an effective and user friendly mechanism for establishing Virtual Private Networks over generic IP connections. Broadcast services and service discovery protocols that normally require a direct layer-2 interconnection

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may work independently of the actual network structure. It also provides the possibilities of distributed network broadcast handling, where rules and configuration options may be cached in the end nodes of the network instead of in a centralised server. The described mechanism is unique in that it presents a complete distributed emulated LAN on top of an IP network where access and attributes such as security associations are completely controlled by a server. Most current solutions uses static tunnels. Either permanent connections are set up between the members of the VPN or tunnel servers which basically works as modem pools only you "dial" an IP number. This means that all traffic no matter it's final destination goes through this one box. In particular traffic going to sites in the VLAN (Virtual LAN) other than that of the VLAN server comes in through the server access and turns. The broadcast service allows service discovery protocols designed for local networks to function on the VPN while the ARP mechanism allows for dynamic establishment of secure tunnels directly between endpoints. The well known LANE (LAN Emulation) standard was focused entirely on ATM (Asynchronous Transfer Mode) and featured no integrated security handling. Lane introduces, inter alia, the ability to connect Ethernet and Token Ring networks together via ATM. LANE makes the process transparent, requiring no modification to Ethernet and Token Ring stations. LANE allows common protocols, such as IP, IPX, AppleTalk and DECnet, to ride over an ATM backbone. LAN emulation has been implemented and verified over ATM. However, since the system architecture itself by design avoids sending all data through the server, the bottleneck problem with overloaded server links is completely avoided.

In general, the target system relies on a decision scheme for a third-party overtaking of a client role in a two-party communication session. Turning to Fig. 1, the system processes comprises end user clients located at the end user premises equipment 1, a central VPN system server 2, and network edge located VPN system clients 3. Full lines indicate physical communication lines, whereas arrows indicate communicating ends, without specifying which route the communication takes between those communicating ends.

The end user client process preferably resides in a PC, the VPN client process preferably resides within a standalone hardware unit, and the VPN server process resides within any kind of server hardware unit, such as an IBM® server. By process is here meant the functionality for the particular client or server, as described herein. The VPN server 2 and the VPN client 3 are parts of a VPN system that provides the end user client 1 with access to required VPNs. The end user client 1 hardware is physically connected via a communication line 11 to the VPN client 3 hardware. The VPN client 3 hardware is physically connected to a layer-two termination that enables the VPN client 3 to access Internet over a communication

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line 12. The layer-two protocol is preferably Ethernet but could practically be any known layer-two protocol used for the encapsulation and transport of IP (Internet Protocol) packets between IP nodes. The VPN server 2 is connected to Internet via a communication line 13 in the same way as the VPN client 3.

According to an embodiment of the target system the end user client 1 initiates a communication session with the VPN server 2 in order to acquire access to a virtual private network. During the initialisation phase, the VPN server 2 authenticates and authorises the end user client 1 as a registered user of VPN services that are provided by the VPN server 2. The VPN client 3 is passive in that it does not initiate any new information elements during the initialisation phase. The VPN client 3 also monitors 22 the communication 21 between the end user client 1 and the VPN server 2.

When the initialisation phase between the end user client 1 and the VPN server 2 is finished, and when information has been exchanged, regarding particular VPN that the end user clients request access to, then the VPN client 3 becomes active and takes over the communication session between the end user client 1 and the VPN client 3. The VPN client 3 now requests, if it is necessary because the VPN information can already be cached by the VPN client 3, VPN configuration data from the VPN server 2. The VPN client 3 uses the configuration data to configure necessary VPN access parameters such as traffic classification parameters, performance assurance parameters, or firewall parameters such as encryption, authentication, filtering parameters, etc.

The end user client 1 is allowed to use different VPN servers 2 but cannot have simultaneous access to more than one VPN server 2. The VPN client 3 detects when an end user client 1 tries to access a certain server 2. At this moment the VPN server 2 is considered insecure until the end user client 1 has authenticated the VPN server 2 and also have been authenticated by the VPN server 2.

The monitoring and session overtaking scenarios are described more in detail in Fig. 2. The VPN client 3 has one trusted domain, which is the end user client 1 side, and one distrusted domain, the Internet domain. From the VPN client's 3 point of view, the VPN server 2 is therefore located in the distrusted domain. Since all in- and outgoing IP traffic to/from the end user client passes through the VPN client 3 hardware, the VPN client 3 is able to monitor the communication 21 between the end user client 1 and the VPN server 2. This is true if, and only if, the IP traffic not is encrypted in such a way that the VPN client 3 is unable to decrypt the IP traffic. The VPN client 3 software resides on hardware that physically interconnects the end user client 1 with Internet 4. The VPN client 3 is therefore able to monitor 22 all traffic 21 between the end user client 1 and different VPN servers 2 to whom the end user client 1 are registered as user.

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The VPN client 3 identifies when the end user client 1 starts to establish contact with a VPN server 2. The VPN client 3 treats the end user client 1 side as a trusted party and the VPN server 2 as a distrusted party. The session establishment phase 21 between the end user client 1 and the VPN server 2 could be done in numerous ways, e.g. by a traditional challenge/response handshaking sequence. The communication 21 is primarily meant to be done by web based clients but other client/server process environment solutions are possible. When the handshaking sequence between the end user client 1 and the VPN server 2 has finished, the VPN client 3 takes over the communication session. The handshaking is considered finished when the VPN server 2 has authenticated and authorised the end user client 1, and acknowledged the end user client 1 as a confirmed user. The VPN client 3 will from now on undertake proxy roles towards both the end user client 1 and the VPN server 2. Towards the end user client 1, the VPN client 3 will act as a VPN server proxy, and towards the VPN server 2 as an end user client proxy. The end user client 1 will continue it's session in belief that it still communicates with the VPN server 2. The VPN client 3 will, using the VPN server proxy role, continue the VPN setup session with the end user client 1.

Further on, the VPN client 3 is now considering the VPN server 2 as a secure source and starts up communication sessions 23 with the VPN server 2 that enables the end user client 1 to be included as members in the requested VPN.

In one embodiment the target system is implemented in a service provisioning system, where parts of the service functionality are distributed to system clients acting as server proxies. One technical advantages of the present system is that any hacker intrusions via an end user PC 1 are avoided by having critical software/firmware for control and management of VPN configuration data separated on standalone hardware 3. Another advantage is the automated overtaking of certified sessions. Another benefit is the plug-and-play behaviour for virtual services over Internet, which is made available through the system. The teachings of the present system thus differs from prior art technology, since earlier solutions to the problem have either been centralised server solutions, such as PSTN/ISDN modem-pool solutions, server centralised IP Sec tunnelling etc, or distributed solutions, which are only valid within one network operator intra-domain or within federated network operator domains. These solutions are generally referred to as network based VPN systems. The present system will function independently of whether or not the different VPN client users access the same network operator domain or a federated network domain or have access to totally independent network operator domains.

An emulated multicast comprises one or preferably several broadcast servers connected to the emulated LAN. The connection between the LAN emulating client

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LEC, herein also referred to as the VPN client, and the broadcast servers can be realised as tunnels or by other means. The broadcast servers can be configured dynamically by a LAN Emulating Server (LES) or in a static fashion via a management system.

In one embodiment of the present invention, illustrated in Fig. 3, the system comprises a distributed architecture of broadcast servers on an emulated LAN. The LAN is emulated on top of a standard IP network like the Internet. That is, the IP network acts as a backbone for the emulated LAN. In Fig. 3, pLAN stands for physical LAN, as opposed to a virtual LAN. PC indicates, in this embodiment, an ordinary personal computer, but may just as well be some other type of data communication device. The emulated LAN is implemented on top of a standard global network, preferably an IP network, such as the Internet and functions to extend the physical LAN seen on the left hand side of Fig. 3 to other, and distant locations, such as the pLAN in the right hand side of Fig. 3, or the other PCs. The emulated LAN comprises connections between the LAN Emulating Clients (LECs). A LEC is implemented as a separate physical unit and acts as a bridge between the pLAN and the emulated LAN node. A LAN Emulating Server (LES) performs the management of the emulated LAN and the connected LECs.

The Broadcast and Unknown Server (BUS) functionality could be implemented in the LEC, as a separate unit connected to the IP network, and/or implemented in the LES. Different configurations are shown in Fig. 3. If the BUS is implemented in the LECs, the function lay dormant in most of the LECs and in function in some. Some, but not all of the LECs have a running BUS functionality. The choice of which LEC that has an up and running BUS is defined by the LES and based on different performance criteria such as available bandwidth to the IP backbone and/or the number of units connected to the pLAN etc.

The BUSes are preferably arranged in a logical hierarchical architecture as shown in Fig. 4. By using a hierarchical or tree structure the efficiency is enhanced. The master and initial BUS, the LES BUS, is configured in the LES. By using several BUSes the load on the system implementing the broadcast functionality will be shared. Further, the distributed architecture will give a load sharing on the links connecting the BUSes. As a consequence of the distributed architecture there is no single point of failure for the broadcast functionality. When a LEC connects to an emulated LAN the LEC receives information from the LES about the available BUSes. The LES may at this stage configure the connecting LEC to start its BUS functionality. The connections between the LEC and the BUSes, forming the nodes of the emulated local area network, may be implemented as a multicast network or as single-cast addresses, i.e. tunnels, to each of the other LECs.

Each BUS will have an algorithm in order to exclude the possibility of a

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"broadcast storm" where broadcast messages indefinitely are sent between the BUSes. The algorithm could be based on a checksum of the broadcast packet. This checksum will uniquely identify the broadcast packet and is cached by the BUS. If another broadcast packet arrives with the same checksum the packet will be dropped and not forwarded. In an alternative embodiment another algorithm is used, based on a hop counter, similar the Time To Live (TTL) parameter used in IP networks. The counter will be decremented by each BUS. When the counter reaches zero the packet will be dropped and not forwarded.

The invention according to this description may hence be used in a VPN based on an emulated LAN on top of IP network. The invention according to the description also differs from earlier known technology, since existing VPN solutions use a single broadcast server, and a technical advantage is that it enhances the scalability of VPN implementations.

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Claims

1. System for emulating a local area network on top of a global communication network (4), the system comprising clients units (LEC) and a server (LES) which are connected to said global network (4), and a broadcast functionality (BUS) for relaying messages to all clients in the emulated local area network, **characterised in** that said broadcast functionality is distributed and implemented in more than one network unit node in the emulated local area network.

2. The system as recited in claim 1, wherein the global network acts as a backbone for the emulated local area network.

3. The system as recited in claim 2, wherein a choice of which clients unit (LEC) has an up and running broadcast functionality unit (BUS) is defined by the server (LES) and is based on predetermined performance criteria.

4. The system as recited in claim 1, wherein said distributed broadcast functionality (BUS) is hierarchically structured.

5. The system as recited in claim 4, wherein a master and initial broadcast functionality (LES BUS) unit is configured in said server (LES).

6. The system as recited in claim 1, wherein the connections between the nodes of the emulated local area network may is implemented as a multicast network transmitted through the global network.

7. The system as recited in claim 1, wherein the connections between the nodes of the emulated local area network may is implemented as single-cast addresses, forming tunnels through said global network.

8. The system as recited in claim 1, wherein each network unit having a distributed broadcasting functionality (BUS) comprises means for executing an algorithm for preventing broadcast messages from being indefinitely sent between the network unit nodes having the distributed broadcasting functionality (BUS).

9. The system as recited in claim 8, wherein said algorithm is based on a checksum of the broadcast packet, which checksum uniquely identifies the broadcast packet and is cached by the broadcasting functionality (BUS) for the purpose of dropping subsequently arriving broadcast packets having the same checksum.

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10. The system as recited in claim 8, wherein said algorithm is based on a hop counter which is decremented by each broadcasting functionality (BUS) unit upon arrival, said algorithm functioning to drop subsequent incoming packets when the counter has reached zero.

11. The system as recited in any of the previous claims, wherein said global network is an Internet Protocol network.

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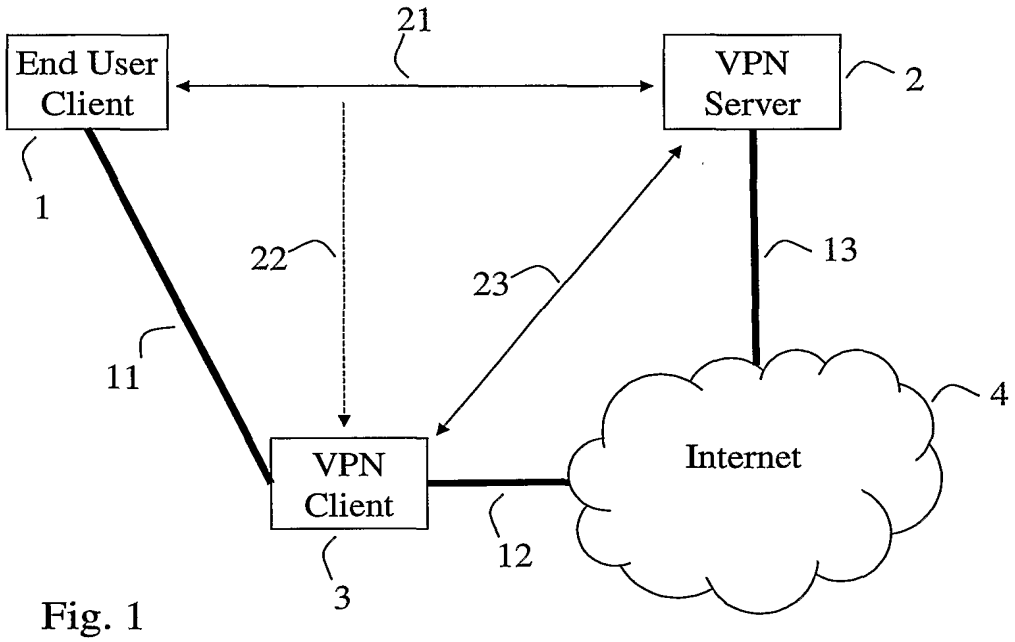


Fig. 1

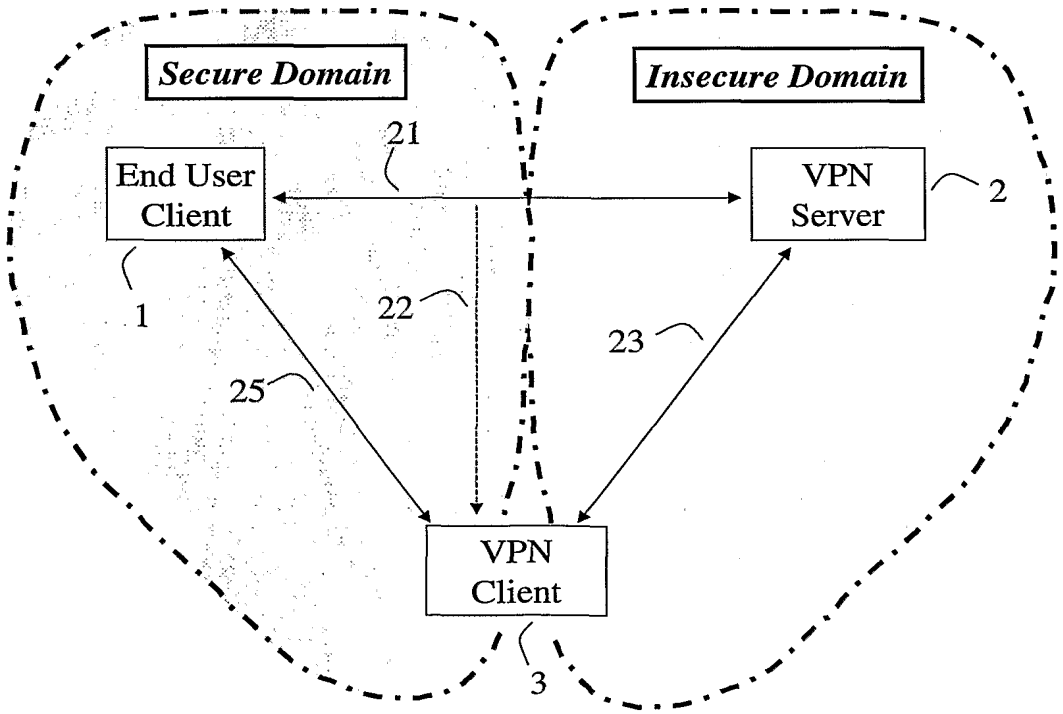


Fig. 2

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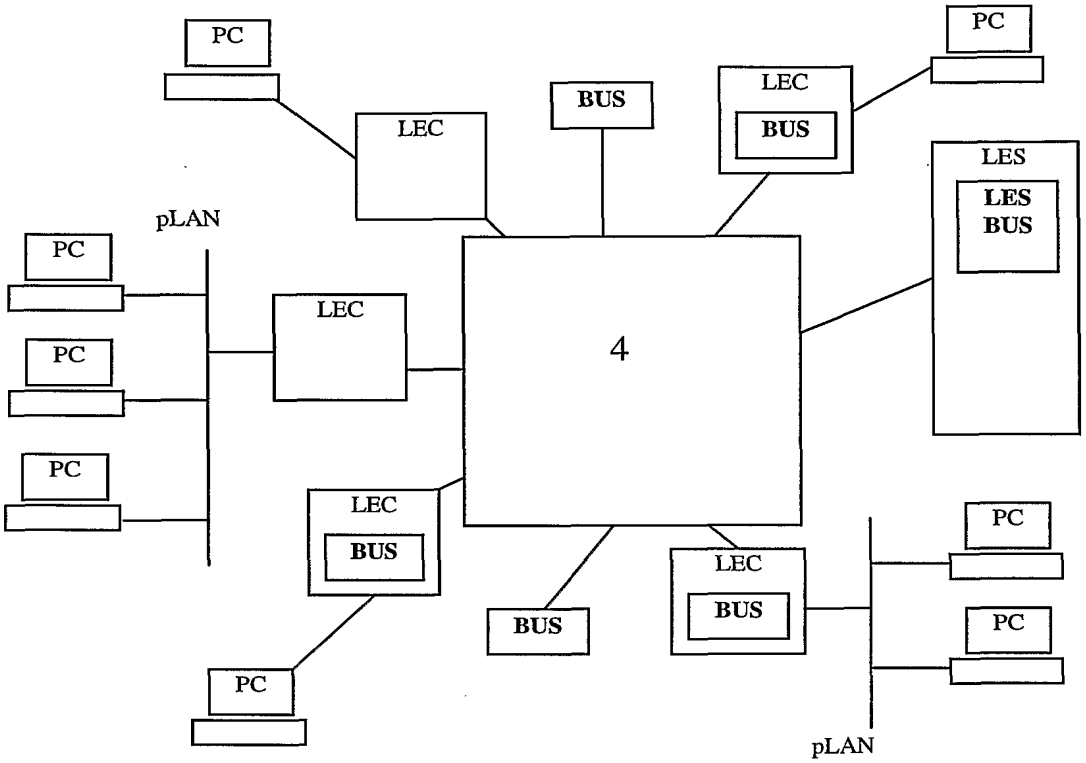


Fig. 3

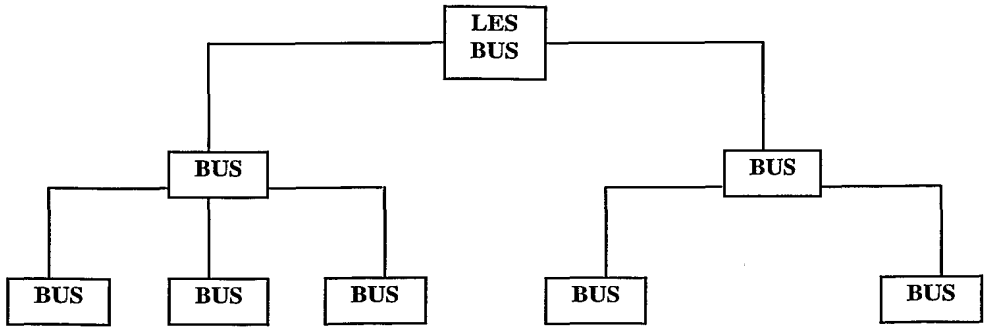


Fig. 4

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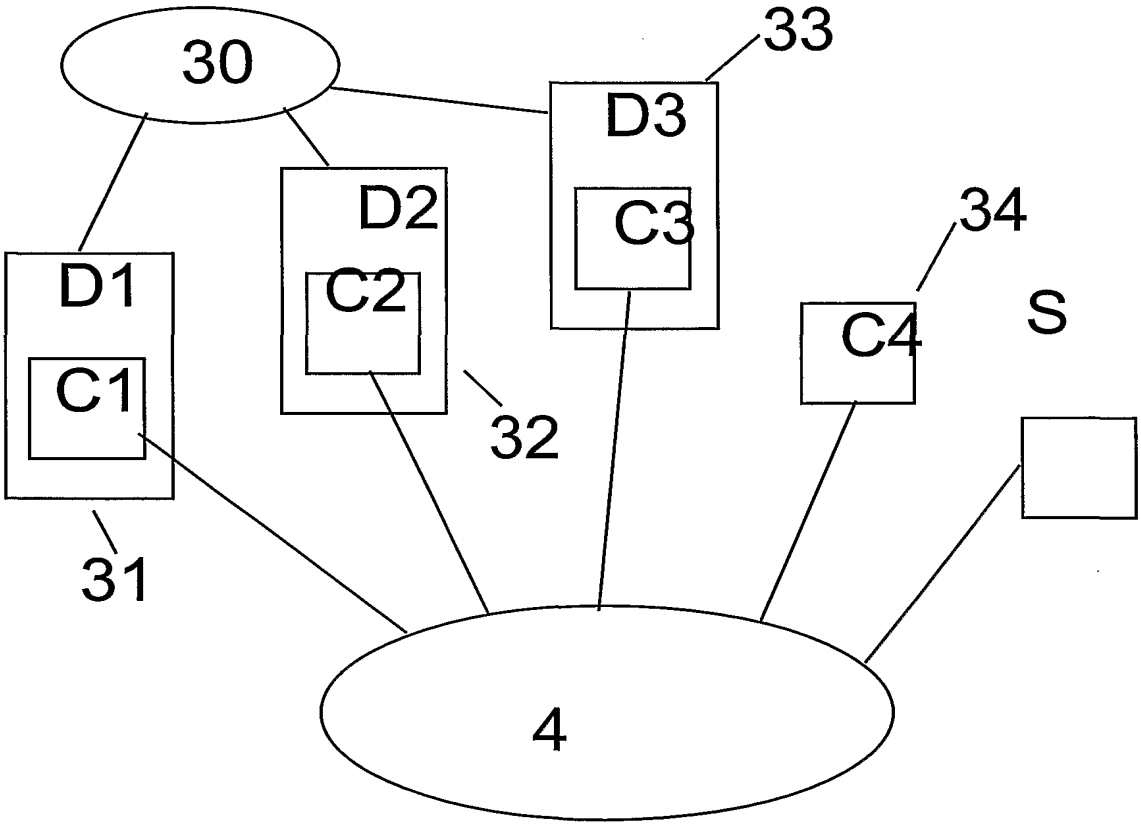


Fig 5

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 01/01473

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: H04L 12/46
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: H04L

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

SE,DK,FI,NO classes as above

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

EPO-INTERNAL, WPI DATA, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5805805 A (CIVANLAR,S. ET AL), 8 Sept 1998 (08.09.98), column 3, line 54 - column 5, line 67, figure 3, abstract ---	1,2,6-11
X	US 6041166 A (HART,J.H. ET AL), 21 March 2000 (21.03.00), column 2, line 64 - column 3, line 63; column 5, line 23 - line 27; column 10, line 47 - column 11, line 14, figures 4,10,11, abstract ---	1,2,6-11
A	US 6047325 A (JAIN,L. ET AL), 4 April 2000 (04.04.00), column 3, line 23 - column 5, line 1, abstract --- --------	1-11

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
15 January 2002	29-01-2002
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Kristoffer Ogebjer/LR Telephone No. +46 8 782 25 00

Form PCT/ISA/210 (second sheet) (July 1998)

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/SE 01/01473

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5805805 A	08/09/98	NONE	
US 6041166 A	21/03/00	AU 3728497 A	09/02/98
		GB 2330285 A,B	14/04/99
		GB 9900960 D	00/00/00
		US 6269404 B	31/07/01
		WO 9802821 A	22/01/98
		AU 6544796 A	18/02/97
		GB 2317543 A,B	25/03/98
		GB 9800046 D	00/00/00
		US 5752003 A	12/05/98
		WO 9704386 A	06/02/97
US 6047325 A	04/04/00	NONE	

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Electronic Patent Application Fee Transmittal

Application Number:	13674233
Filing Date:	12-Nov-2012
Title of Invention:	AUDIO-VIDEO MULTI-PARTICIPANT CONFERENCE SYSTEMS USING PSTN AND INTERNET NETWORKS
First Named Inventor/Applicant Name:	Thomas Dye
Filer:	Michael A. Kerr/Julie Dawes
Attorney Docket Number:	MEET 12.003

Filed as Small Entity

Utility under 35 USC 111(a) Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Utility filing Fee (Electronic filing)	4011	1	98	98
Utility Search Fee	2111	1	310	310
Utility Examination Fee	2311	1	125	125
Pages:				
Claims:				
Claims in excess of 20	2202	4	31	124
Miscellaneous-Filing:				
Late Filing Fee for Oath or Declaration	2051	1	65	65

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				
Extension - 1 month with $0 paid	2251	1	75	75
Miscellaneous:				
		Total in USD ($)		**797**

Electronic Acknowledgement Receipt

EFS ID:	15133725
Application Number:	13674233
International Application Number:	
Confirmation Number:	5197
Title of Invention:	AUDIO-VIDEO MULTI-PARTICIPANT CONFERENCE SYSTEMS USING PSTN AND INTERNET NETWORKS
First Named Inventor/Applicant Name:	Thomas Dye
Customer Number:	48008
Filer:	Michael A. Kerr/Julie Dawes
Filer Authorized By:	Michael A. Kerr
Attorney Docket Number:	MEET 12.003
Receipt Date:	06-MAR-2013
Filing Date:	12-NOV-2012
Time Stamp:	15:32:11
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	$797
RAM confirmation Number	5453
Deposit Account	
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)

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1	Applicant Response to Pre-Exam Formalities Notice	missing_parts.pdf	15474 c300c7257e13de6efb65bd7f299ac9a858b7f51e	no	2
Warnings:					
Information:					
2	Extension of Time	extension_030613.pdf	75044 cbdcaf12ab23ff588d1765b796a9ff3f61a4a84a	no	2
Warnings:					
Information:					
3	Power of Attorney	poa_cover_sheet.pdf	125914 8d202c5367f0702a7e47fededcccd1e3cb2a3030	no	1
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Information:					
4	Power of Attorney	poa.pdf	71006 d1971bbe346e657daa30bf378f027c981dc7db34	no	1
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5	Information Disclosure Statement (IDS) Form (SB08)	IDS.pdf	613086 a4e7e03dc63829c76c756b171cae122738b52ada	no	5
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Information:					
6	Non Patent Literature	higgins.pdf	389106 db91e2d366633eacdd9ef008cf14cd53fdef34d5	no	5
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Information:					
7	Other Reference-Patent/App/Search documents	pct_search.pdf	149079 c22bc40236d3445274c4df2ad24a5b060e5a7f74	no	4
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Information:					
8	Foreign Reference	wo03003665.pdf	951508 98bbe4199196bd40d51c32b9007f660f288ede2d	no	18
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Warnings:					
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Total Files Size (in bytes):	2430631

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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.

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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: PA..

Document Description: Power of Attorney

PTO/AIA/82A (07-12)

Approved for use through 11/30/2014. OMB 0651-0035

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Application Number	13/674,233
Filing Date	November 12, 2012
First Named Inventor	Dye, Thomas
Title	AUDIO-VIDEO MULTI-PARTICIPANT CONFERENCE SYSTEM USING PSTN AND INTERNET NETWORKS
Art Unit	TBD
Examiner Name	TBD
Attorney Docket Number	MEET 12.003

SIGNATURE of Applicant or Patent Practitioner

Signature	/Michael A. Kerr/	Date	03/06/2013
Name	Michael A. Kerr	Telephone	775-264-8700
Registration Number	42722		

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

■ *Total of 1 forms are submitted.

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APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
13/674,233	11/12/2012	2447	0.00	MEET 12.003	24	3

CONFIRMATION NO. 5197

48008
KERR IP GROUP, LLC
MICHAEL A. KERR
P.O. Box 18600
RENO, NV 89511

FILING RECEIPT



Date Mailed: 12/06/2012

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)

Thomas Dye, Austin, TX;
Thomas Dundon, San Marcos, TX;

Applicant(s)

Meetrix Communication, Inc., Santa Monica, CA

Assignment For Published Patent Application

MEETRIX COMMUNICATION, INC., Santa Monica, CA

Power of Attorney: None

Domestic Priority data as claimed by applicant

This application is a CON of 12/646,892 12/23/2009
which is a CON of 10/796,560 03/09/2004 PAT 7664056
which claims benefit of 60/453,307 03/10/2003

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: 12/03/2012
The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 13/674,233**
Projected Publication Date: To Be Determined - pending completion of Missing Parts
Non-Publication Request: No
Early Publication Request: No

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Exhibit 1005 – 470

**** SMALL ENTITY ****

Title

AUDIO-VIDEO MULTI-PARTICIPANT CONFERENCE SYSTEMS USING PSTN AND INTERNET NETWORKS

Preliminary Class

709

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.

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LICENSE FOR FOREIGN FILING UNDER

Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

GRANTED

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).

SelectUSA

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, facilitate, and accelerate 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.

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
13/674,233	11/12/2012	Thomas Dye	MEET 12.003

CONFIRMATION NO. 5197

48008
KERR IP GROUP, LLC
MICHAEL A. KERR
P.O. Box 18600
RENO, NV 89511

FORMALITIES LETTER

OC000000057947741

Date Mailed: 12/06/2012

NOTICE TO FILE MISSING PARTS OF NONPROVISIONAL APPLICATION

FILED UNDER 37 CFR 1.53(b)

Filing Date Granted

Items Required To Avoid Abandonment:

An application number and filing date have been accorded to this application. The item(s) indicated below, however, are missing. Applicant is given **TWO MONTHS** from the date of this Notice within which to file all required items below to avoid abandonment. Extensions of time may be obtained by filing a petition accompanied by the extension fee under the provisions of 37 CFR 1.136(a).

- The statutory basic filing fee is missing.
  *Applicant must submit $**98** to complete the basic filing fee for a small entity.*

The applicant needs to satisfy supplemental fees problems indicated below.

The required item(s) identified below must be timely submitted to avoid abandonment:

- Additional claim fees of $ **124** as a small entity, including any required multiple dependent claim fee, are required. Applicant must submit the additional claim fees or cancel the additional claims for which fees are due.
- A surcharge (for late submission of the basic filing fee, search fee, examination fee or inventor's oath or declaration) as set forth in 37 CFR 1.16(f) of $ **65** for a small entity in compliance with 37 CFR 1.27, must be submitted.

SUMMARY OF FEES DUE:

Total fee(s) required within **TWO MONTHS** from the date of this Notice is $ **722** for a small entity

- $ **98** Statutory basic filing fee.
- $ **65** Surcharge.
- The application search fee has not been paid. Applicant must submit $ **310** to complete the search fee.
- The application examination fee has not been paid. Applicant must submit $ **125** to complete the examination fee for a small entity in compliance with 37 CFR 1.27.
- Total additional claim fee(s) for this application is $ **124**
  - $ **124** for **4** total claims over 20.

Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1005 – 473

Replies must be received in the USPTO within the set time period or must include a proper Certificate of Mailing or Transmission under 37 CFR 1.8 with a mailing or transmission date within the set time period. For more information and a suggested format, see Form PTO/SB/92 and MPEP 512.

Replies should be mailed to:

Mail Stop Missing Parts
Commissioner for Patents
P.O. Box 1450
Alexandria VA 22313-1450

Registered users of EFS-Web may alternatively submit their reply to this notice via EFS-Web.
https://sportal.uspto.gov/authenticate/AuthenticateUserLocalEPF.html

For more information about EFS-Web please call the USPTO Electronic Business Center at **1-866-217-9197** or visit our website at http://www.uspto.gov/ebc.

If you are not using EFS-Web to submit your reply, you must include a copy of this notice.

/etadesse/

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1005 – 474

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 13/674,233

APPLICATION AS FILED - PART I

	(Column 1)	(Column 2)	SMALL ENTITY		OR	OTHER THAN SMALL ENTITY	
FOR	NUMBER FILED	NUMBER EXTRA	RATE($)	FEE($)		RATE($)	FEE($)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	98		N/A	
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A	310		N/A	
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	125		N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	24 minus 20 =	* 4	x 31 =	124	OR		
INDEPENDENT CLAIMS (37 CFR 1.16(h))	3 minus 3 =	*	x 125 =	0.00			
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).			0.00			
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				0.00			
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL	657		TOTAL	

APPLICATION AS AMENDED - PART II

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

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

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
13/674,233	11/12/2012	Thomas Dye	MEET 12.003

CONFIRMATION NO. 5197

IMPROPER CPOA LETTER

48008
KERR IP GROUP, LLC
MICHAEL A. KERR
P.O. Box 18600
RENO, NV 89511

OC00000057947871

Date Mailed: 12/06/2012

NOTICE REGARDING POWER OF ATTORNEY

This is in response to the power of attorney filed 11/12/2012. The power of attorney in this application is not accepted for the reason(s) listed below:

- The power of attorney has not been accepted because the party who is giving power of attorney has not been identified. power of attorney may only be signed by the applicant for patent (37 CFR 1.42) or the patent owner. A patent owner who was not the applicant must appoint any power of attorney in compliance with 37 CFR 3.71 and 3.73. See 37 CFR 1.32(b)(4).
- The power of attorney from the inventors has not been accepted because the power of attorney must be signed by the applicant for patent. See 37 CFR 1.32(b)(4).

/tlpham/

Office of Data Management, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1005 – 476

PTO/AIA/15 (07-12)
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UTILITY PATENT APPLICATION TRANSMITTAL

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Attorney Docket No.	MEET 12.003
First Inventor	DYE, Thomas
Title	AUDIO-VIDEO MULTI-PARTICIPANT CONFERENCE SYSTEM USING PSTN AND INTE
Express Mail Label No.	

APPLICATION ELEMENTS

See MPEP chapter 600 concerning utility patent application contents.

1. ☐ **Fee Transmittal Form.** (PTO/SB/17 or equivalent)
2. ☑ **Applicant claims small entity status.** See 37 CFR 1.27.
3. ☑ **Specification.** [*Total Pages* 22] Both the claims and abstract must start on a new page *(For information on the preferred arrangement, see MPEP § 608.01(a))*
4. ☑ **Drawing(s).** (*35 U.S.C. 113*) [*Total Sheets* 6]
5. **Inventor's Oath or Declaration.** [*Total Sheets* 3] *(including substitute statements under 37 CFR 1.64 and assignments serving as an oath or declaration under 37 CFR 1.63(e))*
   a. ☐ Newly executed (original or copy)
   b. ☑ A copy from a prior application (37 CFR 1.63(d))
6. ☑ **Application Data Sheet.** **See Note below.* See 37 CFR 1.76 (PTO/AIA/14 or equivalent)
7. ☐ **CD-ROM or CD-R.** in duplicate, large table or Computer Program *(Appendix)*
   ☐ Landscape Table on CD
8. **Nucleotide and/or Amino Acid Sequence Submission.** *(if applicable, items a. – c. are required)*
   a. ☐ Computer Readable Form (CRF)
   b. ☐ Specification Sequence Listing on:
      i. ☐ CD-ROM or CD-R (2 copies); or
      ii. ☐ Paper
   c. ☐ Statements verifying identity of above copies

ADDRESS TO: **Commissioner for Patents**
P.O. Box 1450
Alexandria VA 22313-1450

ACCOMPANYING APPLICATION PARTS

9. ☐ **Assignment Papers.** (cover sheet & document(s))
   Name of Assignee_____
10. ☐ **37 CFR 3.73(c) Statement.** ☑ **Power of Attorney.** *(when there is an assignee)*
11. ☐ **English Translation Document.** *(if applicable)*
12. ☐ **Information Disclosure Statement.** (PTO/SB/08 or PTO-1449)
    ☐ Copies of citations attached
13. ☐ **Preliminary Amendment.**
14. ☐ **Return Receipt Postcard.** *(MPEP § 503) (Should be specifically itemized)*
15. ☐ **Certified Copy of Priority Document(s).** *(if foreign priority is claimed)*
16. ☐ **Nonpublication Request.** Under 35 U.S.C. 122(b)(2)(B)(i). Applicant must attach form PTO/SB/35 or equivalent.
17. ☑ **Other:** Substitute specification marked, substitute specification clean.

***Note:** (1) Benefit claims under 37 CFR 1.78 and foreign priority claims under 1.55 **must** be included in an Application Data Sheet (ADS).
(2) For applications filed under 35 U.S.C. 111, the application must contain an ADS specifying the applicant if the applicant is an assignee, person to whom the inventor is under an obligation to assign, or person who otherwise shows sufficient proprietary interest in the matter. See 37 CFR 1.46(b).

18. CORRESPONDENCE ADDRESS

☑ The address associated with Customer Number: 48008 ***OR*** ☑ Correspondence address below

Name	Michael A. Kerr				
Address	P.O. Box 18600				
City	Reno	State	NV	Zip Code	89511
Country	US	Telephone	775-624-8700	Email	mick@kipg.com

Signature	/Michael A. Kerr/	Date	November 9, 2012
Name (Print/Type)	Michael A. Kerr	Registration No. (Attorney/Agent)	42722

This collection of information is required by 37 CFR 1.53(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.

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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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	MEET 12.003
	Application Number	
Title of Invention	AUDIO-VIDEO MULTI-PARTICIPANT CONFERENCE SYSTEMS USING PSTN AND INTERNET NETWORKS	

The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76.
This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.

Secrecy Order 37 CFR 5.2

☐ Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)

Inventor Information:

Inventor 1 Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
Mr.	Thomas		Dye	

Residence Information (Select One) ◉ US Residency ○ Non US Residency ○ Active US Military Service

City	Austin	State/Province	TX	Country of Residence	US

Mailing Address of Inventor:

Address 1	6621 Candle Ridge Cove
Address 2	

City	Austin	State/Province	TX
Postal Code	78731	**Country**	US

Inventor 2 Remove

Legal Name

Prefix	Given Name	Middle Name	Family Name	Suffix
Mr.	Thomas		Dundon	

Residence Information (Select One) ◉ US Residency ○ Non US Residency ○ Active US Military Service

City	San Marcos	State/Province	TX	Country of Residence	US

Mailing Address of Inventor:

Address 1	2840 Paso Del Robles
Address 2	

City	San Marcos	State/Province	TX
Postal Code	78666	**Country**	US

All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the **Add** button. Add

Correspondence Information:

Enter either Customer Number or complete the Correspondence Information section below.
For further information see 37 CFR 1.33(a).

Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1005 – 479

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	MEET 12.003
	Application Number	
Title of Invention	AUDIO-VIDEO MULTI-PARTICIPANT CONFERENCE SYSTEMS USING PSTN AND INTERNET NETWORKS	

☐ **An Address is being provided for the correspondence Information of this application.**			
Customer Number	48008		
Email Address	mick@kipg.com	Add Email	Remove Email

Application Information:

Title of the Invention	AUDIO-VIDEO MULTI-PARTICIPANT CONFERENCE SYSTEMS USING PSTN AND INTERNET NETWORKS		
Attorney Docket Number	MEET 12.003	**Small Entity Status Claimed**	☒
Application Type	Nonprovisional		
Subject Matter	Utility		
Suggested Class (if any)		**Sub Class (if any)**	
Suggested Technology Center (if any)			
Total Number of Drawing Sheets (if any)	6	**Suggested Figure for Publication (if any)**	

Publication Information:

☐ Request Early Publication (Fee required at time of Request 37 CFR 1.219)
☐ **Request Not to Publish.** I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application **has not and will not** be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32).
Either enter Customer Number or complete the Representative Name section below. If both sections are completed the customer Number will be used for the Representative Information during processing.

Please Select One:	◉ Customer Number	○ US Patent Practitioner	○ Limited Recognition (37 CFR 11.9)
Customer Number	48008		

Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, or 365(c) or indicate National Stage entry from a PCT application. Providing this information in the application data sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78.

Prior Application Status	Pending		Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)
	Continuation of	12646892	2009-12-23

Zoho Corp. and Zoho Corp. Pvt., Ltd.
Exhibit 1005 – 480

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	MEET 12.003
	Application Number	
Title of Invention	AUDIO-VIDEO MULTI-PARTICIPANT CONFERENCE SYSTEMS USING PSTN AND INTERNET NETWORKS	

Prior Application Status	Patented				Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)	Patent Number	Issue Date (YYYY-MM-DD)
12646892	Continuation of	10796560	2004-03-09	7664056	2010-02-16

Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)
10796560	non provisional of	60453307	2003-03-10

Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the **Add** button. Add

Foreign Priority Information:

This section allows for the applicant to claim benefit of foreign priority and to identify any prior foreign application for which priority is not claimed. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55(a).

Remove

Application Number	Country i	Filing Date (YYYY-MM-DD)	Priority Claimed
			○ Yes ◉ No

Additional Foreign Priority Data may be generated within this form by selecting the **Add** button. Add

Authorization to Permit Access:

☐ Authorization to Permit Access to the Instant Application by the Participating Offices

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 instant patent application is filed access to the instant 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 instant patent application is filed to have access to the instant patent application.

In accordance with 37 CFR 1.14(h)(3), access will be provided to a copy of the instant patent application with respect to: 1) the instant patent application-as-filed; 2) any foreign application to which the instant 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 instant patent application; and 3) any U.S. application-as-filed from which benefit is sought in the instant patent application.

In accordance with 37 CFR 1.14(c), access may be provided to information concerning the date of filing this Authorization.

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	MEET 12.003
	Application Number	
Title of Invention	AUDIO-VIDEO MULTI-PARTICIPANT CONFERENCE SYSTEMS USING PSTN AND INTERNET NETWORKS	

Applicant Information:

Providing assignment information in this section does not substitute for compliance with any requirement of part 3 of Title 37 of CFR to have an assignment recorded by the Office.

Applicant 1

If the applicant is the inventor (or the remaining joint inventor or inventors under 37 CFR 1.45), this section should not be completed. The information to be provided in this section is the name and address of the legal representative who is the applicant under 37 CFR 1.43; or the name and address of the assignee, person to whom the inventor is under an obligation to assign the invention, or person who otherwise shows sufficient proprietary interest in the matter who is the applicant under 37 CFR 1.46. If the applicant is an applicant under 37 CFR 1.46 (assignee, person to whom the inventor is obligated to assign, or person who otherwise shows sufficient proprietary interest) together with one or more joint inventors, then the joint inventor or inventors who are also the applicant should be identified in this section.

Remove

○ Assignee	○ Legal Representative under 35 U.S.C. 117
◉ Person to whom the inventor is obligated to assign.	○ Person who shows sufficient proprietary interest

If applicant is the legal representative, indicate the authority to file the patent application, the inventor is:

Name of the Deceased or Legally Incapacitated Inventor :

If the Assignee is an Organization check here. ☒

Organization Name	Meetrix Communication, Inc.

Mailing Address Information:

Address 1	2261 23rd Street		
Address 2			
City	Santa Monica	**State/Province**	CA
Country [i]	US	Postal Code	90405
Phone Number	310-399-7471	Fax Number	
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First Name	Michael	Last Name	Kerr	Registration Number	42722

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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	MEET 12.003
	Application Number	
Title of Invention	AUDIO-VIDEO MULTI-PARTICIPANT CONFERENCE SYSTEMS USING PSTN AND INTERNET NETWORKS	

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DECLARATION AND POWER OF ATTORNEY

As a below named inventor, I hereby declare that:

My residence, post office address, and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled "MEDIA BASED COLLABORATION USING MIXED-MODE PSTN AND INTERNET NETWORKS," the specification of which:

☐ is attached hereto.
☒ was filed on March 9, 2004 as Application Serial No. 10/796,560
and was amended on _____ (if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose to the Patent and Trademark Office all information known to me to be material to patentability of the subject matter claimed in this application, as "materiality" is defined in 37 C.F.R. § 1.56.

I hereby claim foreign priority benefits under 35 U.S.C. § 119(a)-(d) or § 365(b) of any foreign application(s) for patent or inventor's certificate listed below, or under § 365(a) of any PCT international application listed below designating at least one country other than the United States of America, and have identified below any foreign application for patent or inventor's certificate, or of any PCT international application, having a filing date before that of the application on which priority is claimed.

Prior Foreign Application No.	Country	Filing Date (mm/dd/yy)	Priority Claimed	Cert. copy Attached
N/A				

I hereby claim the benefit under 35 U.S.C. § 119(e) of any United States provisional application(s) listed below.

Provisional Application No.	Filing Date (mm/dd/yy)
60/453,307	03/10/03

I hereby claim the benefit under 35 U.S.C. § 120 of any United States application(s) listed below, or under § 365(c) of any PCT international application listed below designating the United States of America, and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT international application in the manner provided by the first paragraph of 35 U.S.C. § 112, I acknowledge the duty to disclose all information known to me to be material to the patentability of the subject matter claimed in this application, as "materiality" is defined in 37 C.F.R. § 1.56, which became available between the filing date of the prior application and the national or PCT international filing date of this application.

Parent Application No.	Filing Date (mm/dd/yy)	Parent Patent No. (if applicable) or Status
N/A		

I hereby revoke any previous Powers of Attorney and appoint Jeffrey C. Hood, Reg. No. 35,198; B. Noël Kivlin, Reg. No. 33,929; Robert C. Kowert Reg. No. 39,255; Eric B. Meyertons, Reg. No. 34,876; Mark S. Williams, Reg. No. 50,658; and Mark K. Brightwell, Reg. No. 47,446; with full power of substitution and revocation, to prosecute the application, to make alterations and amendments therein, to transact all business in the Patent and Trademark Office in connection therewith, and to receive the Letters Patent.

Please direct all communications to:

Jeffrey C. Hood
Meyertons Hood Kivlin Kowert & Goetzel PC
P.O. Box 398
Austin, Texas 78767-0398
Phone: (512) 853-8800

I hereby declare that all statements made herein of my own knowledge are true and that all statements made herein on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. § 1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Inventor's Full Name: Thomas A. Dye

Inventor's Signature:  Date: April 6th, 2004

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Post Office and Residence Address: 6621 Candle Ridge Cove, Austin, TX 78731
(Include number, street name, city, state and zip code)

Inventor's Full Name: Thomas A. Dundon

Inventor's Signature: _____ Date: _____

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Post Office and Residence Address: 3505 Eldorado Tr., Austin, TX 78739
(Include number, street name, city, state and zip code)

I hereby revoke any previous Powers of Attorney and appoint Jeffrey C. Hood, Reg. No. 35,198; B. Noël Kivlin, Reg. No. 33,929; Robert C. Kowert Reg. No. 39,255; Eric B. Meyertons, Reg. No. 34,876; Mark S. Williams, Reg. No. 50,658; and Mark K. Brightwell, Reg. No. 47,446; with full power of substitution and revocation, to prosecute the application, to make alterations and amendments therein, to transact all business in the Patent and Trademark Office in connection therewith, and to receive the Letters Patent.

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Inventor's Full Name: Thomas A. Dye

Inventor's Signature: _____ Date: _____

City and State (or Foreign Country) of Residence: Austin, TX Citizenship: U.S.A.

Post Office and Residence Address: 6621 Candle Ridge Cove, Austin, TX 78731
(Include number, street name, city, state and zip code)

Inventor's Full Name: Thomas A. Dundon

Inventor's Signature: Thomas A Dundon Date: 12 Apr 2004

City and State (or Foreign Country) of Residence: Austin, TX Citizenship: U.S.A.

Post Office and Residence Address: 3505 Eldorado Tr., Austin, TX 78739
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REVOCATION OF POWER OF ATTORNEY WITH NEW POWER OF ATTORNEY AND CHANGE OF CORRESPONDENCE ADDRESS

Application Number	10/796,560
Filing Date	March 9, 2004
First Named Inventor	Dye, Thomas A.
Art Unit	2614
Examiner Name	Ni, Suhan
Attorney Docket Number	MEET 08.002

I hereby revoke all previous powers of attorney given in the above-identified application.

☐ A Power of Attorney is submitted herewith.

OR

☑ I hereby appoint the practitioners associated with the Customer Number: 48008

☑ Please change the correspondence address for the above-identified application to:

☑ The address associated with Customer Number: 48008

OR

☑ Firm or Individual Name	Michael A. Kerr				
Address	Virtual Legal, LLC P.O. Box 22026				
City	Carson City	State	NV	Zip	89721
Country	USA				
Telephone	775-841-3388	Email	mick@invent.net		

I am the:

☐ Applicant/Inventor.

☑ Assignee of record of the entire interest. See 37 CFR 3.71.
Statement under 37 CFR 3.73(b) is enclosed. (Form PTO/SB/96)

SIGNATURE of Applicant or Assignee of Record

Signature	Jebb Dykstra		
Name	Jebb Dykstra, Managing Member		
Date	7/7/2008	Telephone	310-428-9218

NOTE: Signatures of all the inventors or assignees of record of the entire interest or their representative(s) are required. Submit multiple forms if more than one signature is required, see below*.

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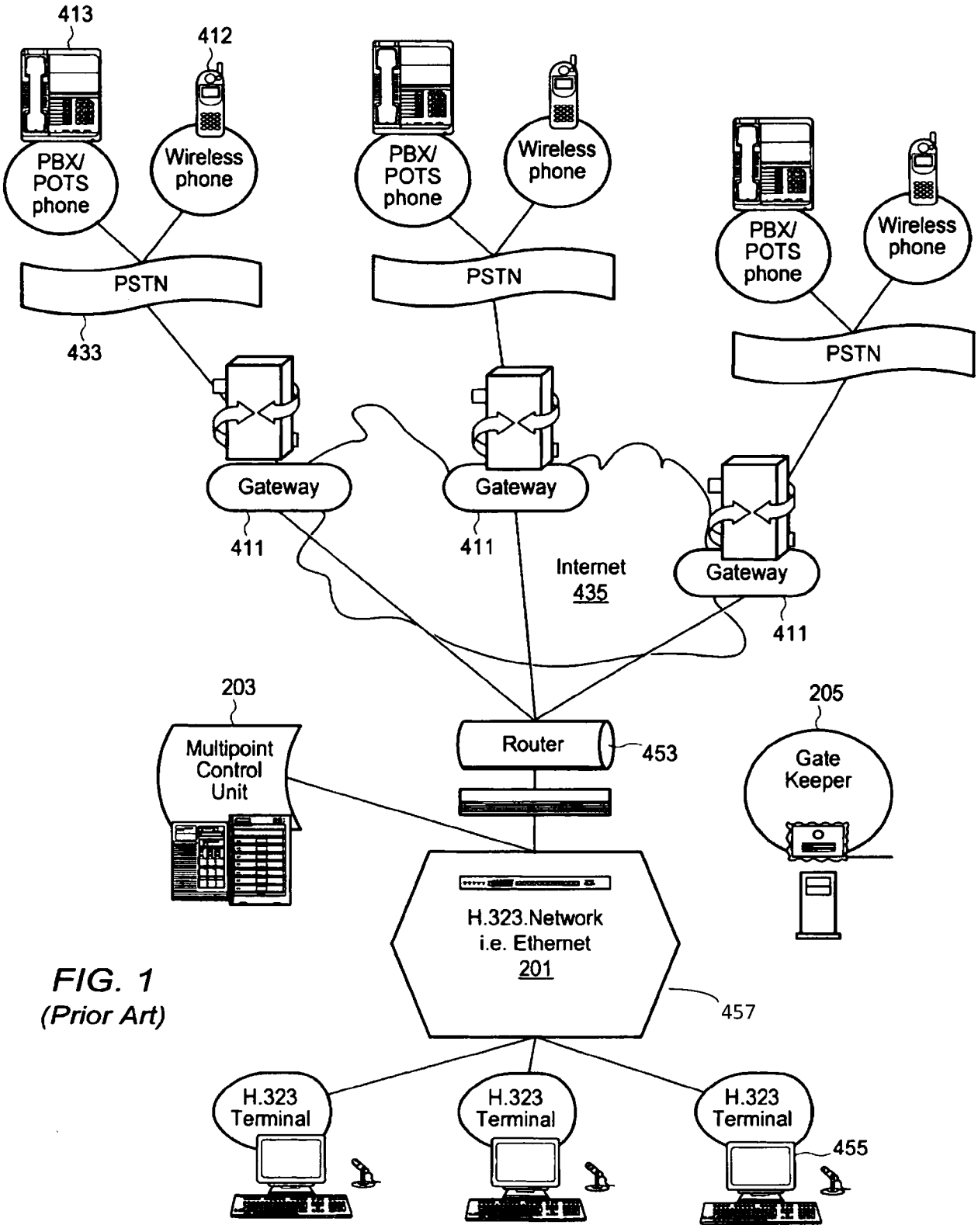


FIG. 1
(Prior Art)

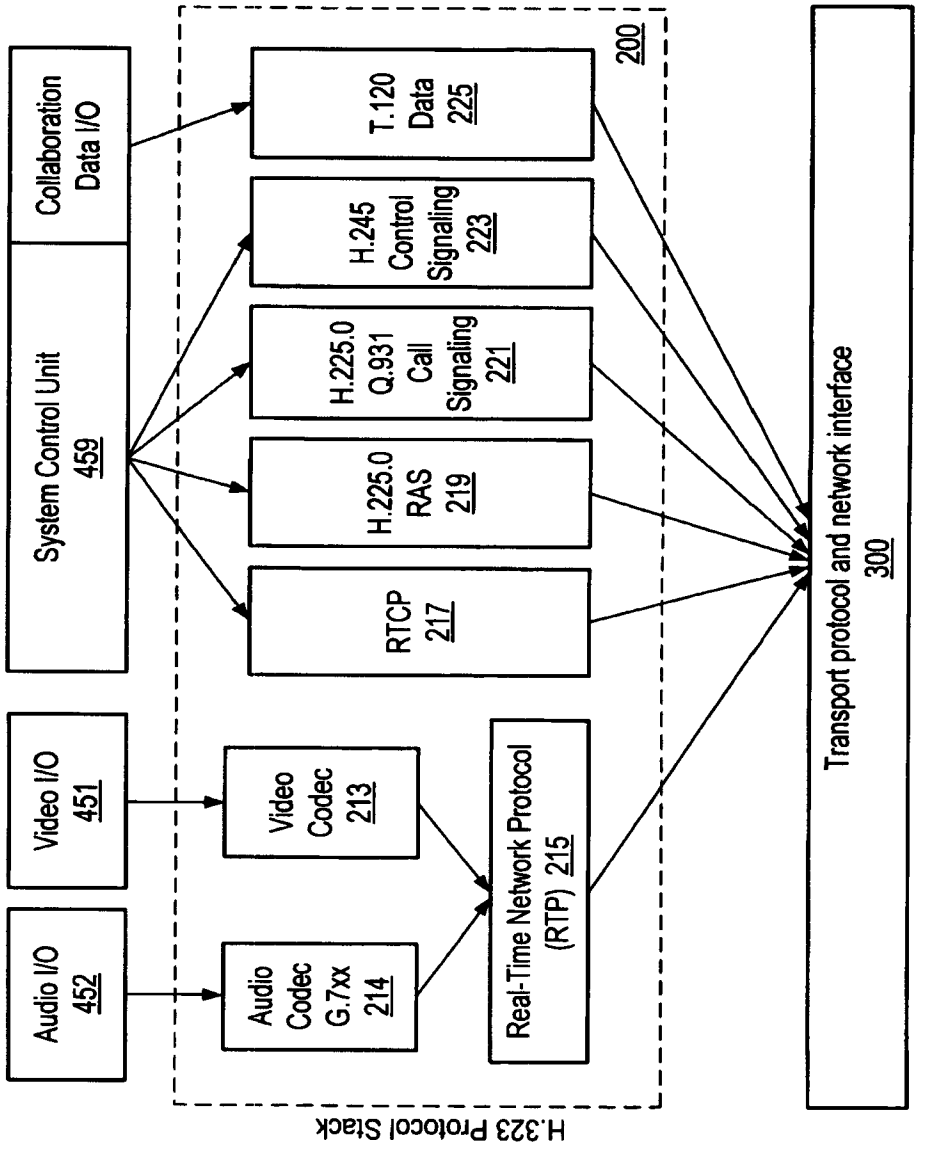


FIG. 2
(Prior Art)

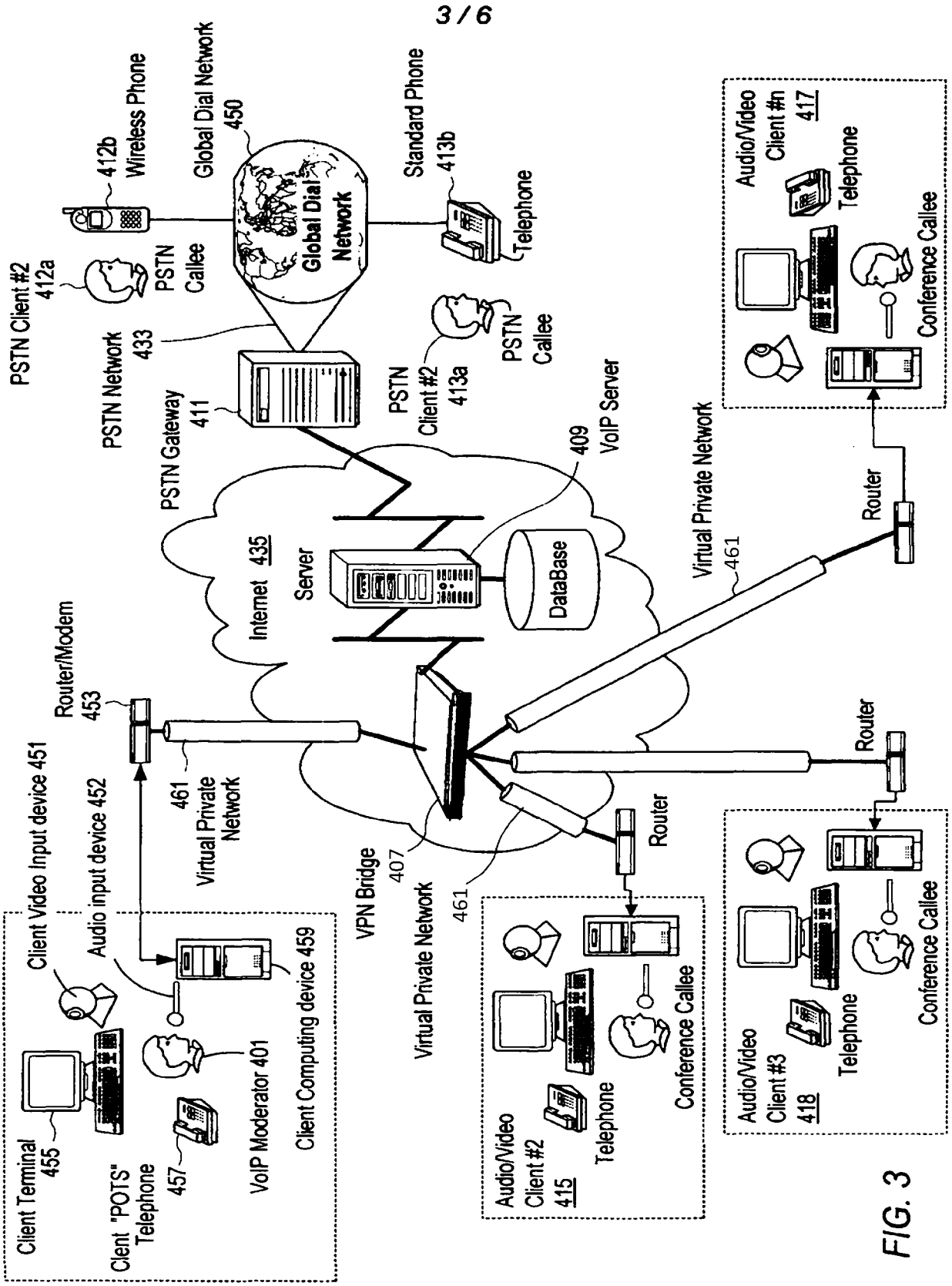

Client Terminal 455
Client Video Input device 451
Audio input device 452
Client "POTS" Telephone 457
VoIP Moderator 401
Client Computing device 459
Router/Modem 453
461 Virtual Private Network
PSTN Client #2 412a
PSTN Callee
412b Wireless Phone
PSTN Network 433
Global Dial Network 450
Global Dial Network
Standard Phone 413b
Telephone
PSTN Gateway 411
PSTN Client #2 413a
PSTN Callee
Internet 435
Server
DataBase
409 VoIP Server
VPN Bridge 407
Virtual Private Network 461
Router
Audio/Video Client #2 415
Telephone
Conference Callee
Virtual Private Network 461
Router
Router
Audio/Video Client #3 418
Telephone
Conference Callee
Audio/Video Client #n 417
Telephone
Conference Callee

FIG. 3

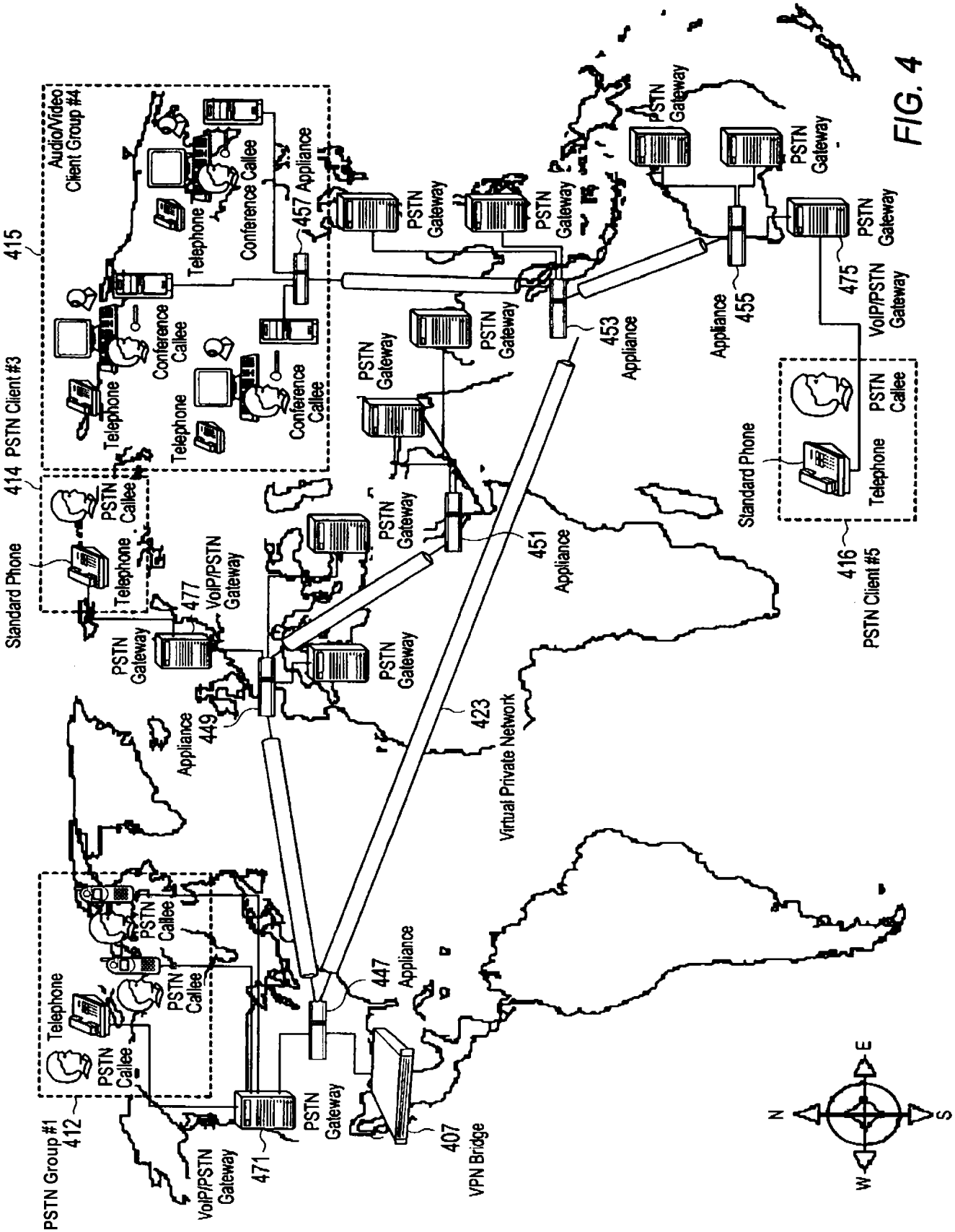

PSTN Group #1
412
Telephone
PSTN Callee
PSTN Callee
PSTN Callee
VoIP/PSTN Gateway
471
PSTN Gateway
447 Appliance
407 VPN Bridge
Virtual Private Network
423
Appliance 449
PSTN Gateway
PSTN Gateway
477 VoIP/PSTN Gateway
Standard Phone
Telephone
PSTN Callee
414 PSTN Client #3
415
Audio/Video Client Group #4
Telephone
Conference Callee
457 Appliance
Telephone
Conference Callee
Telephone
Conference Callee
PSTN Gateway
PSTN Gateway
PSTN Gateway
PSTN Gateway
451 Appliance
453 Appliance
PSTN Gateway
PSTN Gateway
PSTN Gateway
Appliance 455
475 VoIP/PSTN Gateway
Standard Phone
Telephone
PSTN Callee
416 PSTN Client #5
N
E
S
W

FIG. 4

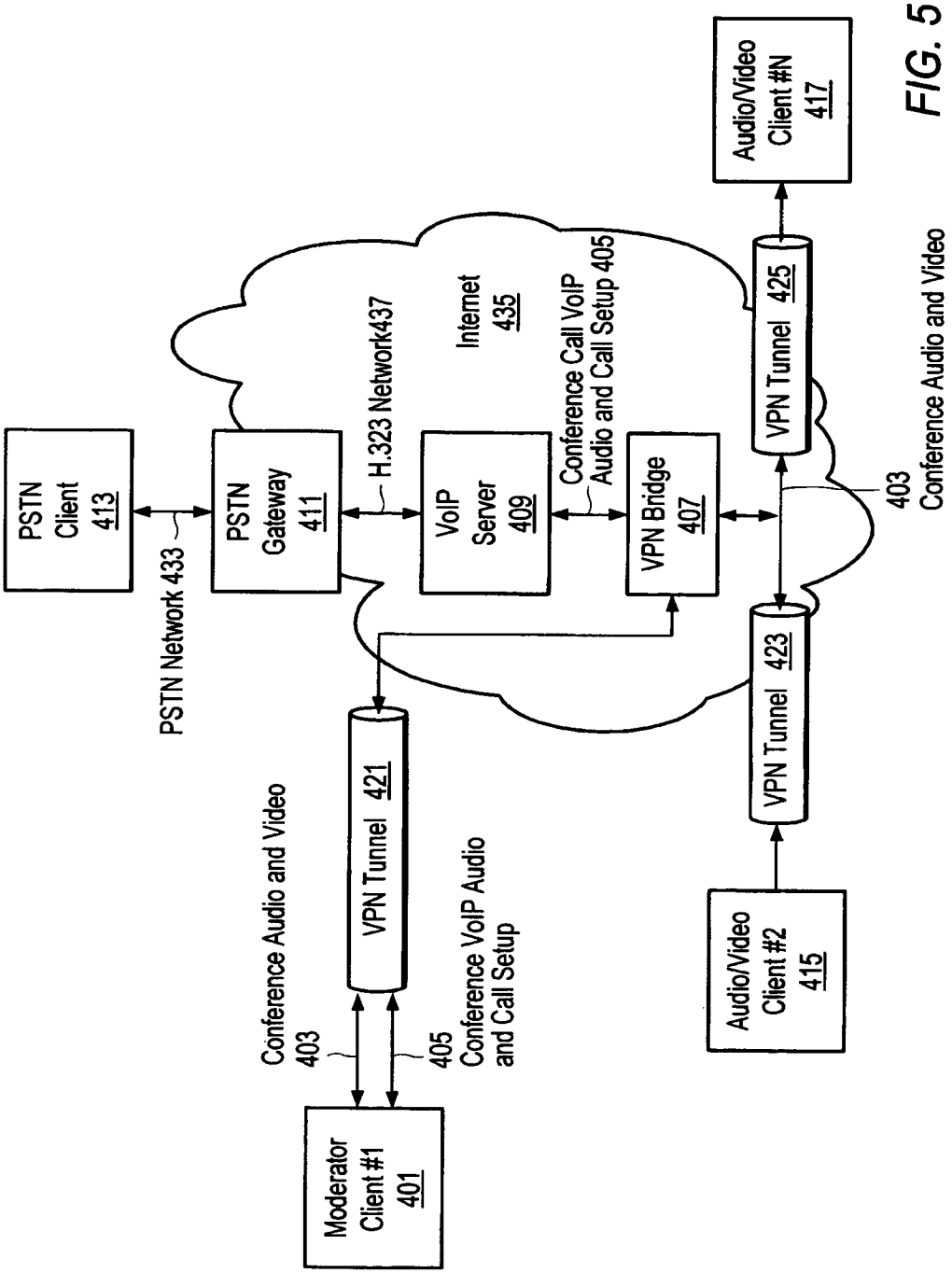

PSTN Client 413
PSTN Network 433
PSTN Gateway 411
H.323 Network437
Internet 435
VoIP Server 409
Conference Call VoIP Audio and Call Setup 405
VPN Bridge 407
VPN Tunnel 425
Audio/Video Client #N 417
403 Conference Audio and Video
VPN Tunnel 423
Audio/Video Client #2 415
VPN Tunnel 421
Conference Audio and Video 403
405 Conference VoIP Audio and Call Setup
Moderator Client #1 401

FIG. 5

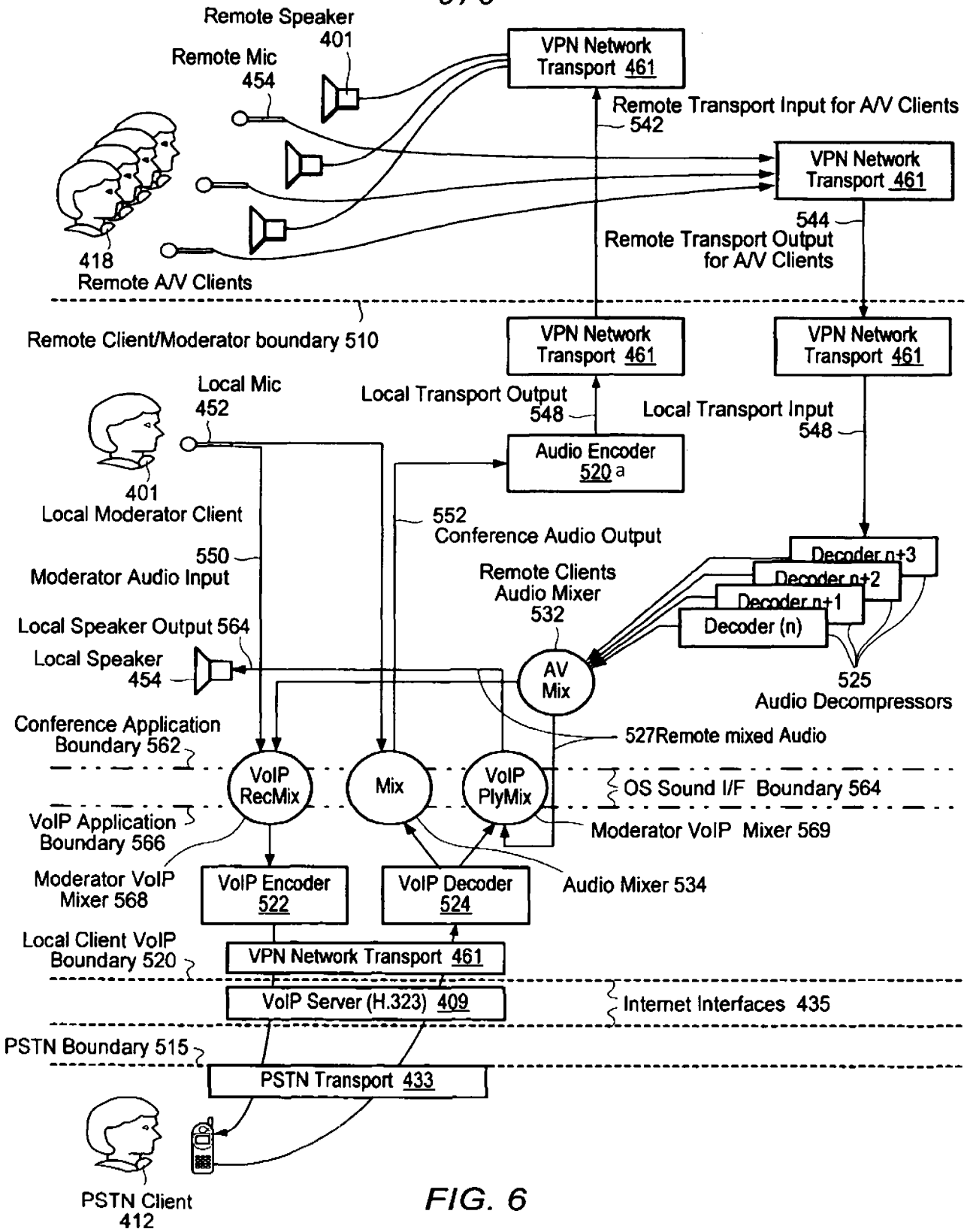

Remote Speaker
401
Remote Mic
454
VPN Network Transport 461
Remote Transport Input for A/V Clients
542
VPN Network Transport 461
544
Remote Transport Output for A/V Clients
418
Remote A/V Clients
Remote Client/Moderator boundary 510
VPN Network Transport 461
VPN Network Transport 461
Local Mic
452
Local Transport Output
548
Local Transport Input
548
Audio Encoder
520 a
401
Local Moderator Client
552
Conference Audio Output
550
Moderator Audio Input
Remote Clients
Audio Mixer
532
Decoder n+3
Decoder n+2
Decoder n+1
Decoder (n)
Local Speaker Output 564
Local Speaker
454
AV
Mix
525
Audio Decompressors
Conference Application
Boundary 562
527Remote mixed Audio
VoIP
RecMix
Mix
VoIP
PlyMix
OS Sound I/F Boundary 564
VoIP Application
Boundary 566
Moderator VoIP Mixer 569
Moderator VoIP
Mixer 568
VoIP Encoder
522
VoIP Decoder
524
Audio Mixer 534
Local Client VoIP
Boundary 520
VPN Network Transport 461
VoIP Server (H.323) 409
Internet Interfaces 435
PSTN Boundary 515
PSTN Transport 433
PSTN Client
412

FIG. 6

Priority Claim

This application claims benefit of priority of U.S. provisional application Serial No. 60/453,307 titled "THE METHOD AND PROCESS FOR MEDIA BASED COLLABORATION USING MIXED-MODE PSTN AND INTERNET NETWORKS" filed March 10, 2003, whose inventors are Thomas A. Dye and Tom Dundon which is hereby incorporated by reference in its entirety.

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to computer system architectures and more particularly to audio and video telecommunications for collaboration over hybrid networks.

Description of the Related Art

Since their introduction in the early 1980's, audio/video conferencing systems ("video conferencing systems") have enabled users to communicate between remote sites using telephone lines based on dedicated or switched networks. Recently, technology and products to achieve the same over Internet Protocol have been attempted. Many such systems have emerged on the marketplace. Such systems produce low-frame-rate and low quality communications due to the unpredictable nature of the Internet. Such connections have been known to produce long latencies with limited bandwidth, resulting in jerky video, dropped audio and loss of lip sync.

Therefore, most video conferencing solutions have relied on dedicated switched networks such as T1/T3, ISDN or ATM. These systems have the disadvantage of higher cost and complexity and a lack of flexibility due largely to interoperability issues and higher cost client equipment. High costs are typically related to expensive conferencing hardware and dedicated pay-per-minute communications usage. Most often these

dedicated communications circuits are switched circuits which use a fixed bandwidth allocation.

In most prior art systems the public switched telephone network (PSTN) is used to transfer audio during conferencing and collaboration with remote parties. It is known that quality of audio reception is poor over typical prior art Internet protocol (IP) systems. Prior art audio/video conferencing systems which use IP networks for audio and video transport lack the ability to terminate audio to client end systems through both PSTN and IP networks. Thus, it is desirable to achieve a hybrid mix of audio and video data over PSTN and IP based audio/video conferencing to achieve full duplex real-time operation for all conference participants.

Modem voice over IP telephony systems have used the H.323 standard from the international telecommunications union (1TU). The H.323 standard focuses on the transmission of audio and video information through the Internet or switched private networks. Figure 1 illustrates a prior art H.323 system. The block diagram of Figure 1 includes a number of major components, including the general Internet 435, Internet H.323 bridges or gateways 411, telecommunications PSTN 433 (Public Switched Telephone Network), wireless and land-line phone handsets 412/413, standard Internet router 453, an optional gatekeeper 205, a multipoint control unit 203, a standard local area network 457, a voice over IP server running the H.323 protocol 201, and multiple I/O and display terminals 455. Figure 1 is an example of the prior art conferencing system used between hybrid networks connecting the PSTN and Internet. Hybrid networks are used to communicate audio on internal LAN and W AN networks as well as transfer of audio to the existing telephone or PSTN network. While the H.323 recommendation allows for video conferencing, the prior art systems use private switched networks to establish transport that require expensive H.323 bridges between dedicated networks and the PSTN. Each of the components in Figure 3 serves this purpose to achieve audio telecommunications between multiple parties.

Referring again to Figure 1, the components of Figure 1 are interconnected as follows. Prior art technology uses PC or client terminals 455 connected through a local area network 457 to either a data server or a specialized audio/video server 201. The

network server 201 contains the application necessary to generate the H.323 network protocol. The data server 201 may be connected to a local gatekeeper 205 that is responsible for management control functions. As known the gatekeeper 205 is responsible for various duties such as admission control, status determination, and bandwidth management. Data server 201 functions are specified and handled through the ITU-H.225.0RAS recommendations. In addition, management control unit (MCU) 203 is connected to the data server 201. The multipoint control unit of a 203 is required by the eight-step ITU- 5 H.323 recommendation for flexibility to negotiate end points and determine compatible setups for any conference media correspondents. The multipoint control unit 203 enables communication between three or more end points. Similar to a multipoint bridge, the gatekeeper 205 and the multipoint control unit 203 are optional components of the H.323 enabled network. Another useful job of the multipoint control unit 203 is to determine whether to unicast or multicast the audio or video streams. As known by one skilled in the art, these decisions are dependent on the capability of the underlying network and the topology of the multipoint conference. The multipoint control unit 203 determines the capabilities of each client tennina1455 and status each of media stream.

Again referring to Figure 1 a standard network router 453 is connected between the local area network 457 and the Internet 435. At the outer edges of the Internet, "points of presence" are located at multiple end-point or call termination sites. Gateways 411 are used to the transcode the H.323 network information onto the PSTN 433. Standard telephone handsets 413 or wireless phones 412 are connected to the PSTN telephony system.

Figure 2 illustrates the embodiment of the H.323 protocol stack 200, its components and their interfaces to the local area network computers at the network interface 300. The input and control devices 455 along with a local area network 457 of Figure 1 are shown in Figure 2, consisting of the audio input output block 452, the video input and output block 451, the system control unit and data collaboration unit 459. These input devices are largely responsible for the delivery of media data to the H.323 protocol stack 200 shown in Figure 2.

Again referring to Figure 2 the sub blocks of functionality that make up the H.323 protocol stack 200 is described. The H.323 protocol stack consists ofan audio codec 211, a video CoDec 213 connected to the audio/video 452 451 input and output blocks. The audio and video CoDecs are responsible for compression and decompression of the audio and video sources. The real-time network protocol component 215 is connected to the audio video CoDecs and is also responsible for preparation of the media data for transport according to the RTP (real-time protocol) recommendations.

Again referring to the prior art system of Figure 2, the H.323 protocol stack has a system control unit 459 which connects to multiple control blocks within the H.323 protocol stack 200. The system control unit connects to the RTC Protocol block 217 for real-time transport of the control information used to set-up and tear down the conference. The system control unit 459 also connects to the call-signaling units 221 and 219 for call signaling protocols and media stream packetization application used for packet based multimedia communications. The system control unit 459 also connects to the control signaling block 223 used for control of protocols for multimedia communications. Lastly, the H.323 recommendation defines a data collaboration capability as known and outlined in the T.120 data collaboration unit 225.

All of the defined blocks make up the H.323 protocol network interface to the Transport protocol and network interface unit 300 for transport of data through the modem or router 453 to the Internet 435.

Summary of the Invention

The present invention comprises various embodiments which enable audio from standard and wireless telephones systems to be mixed with audio, video and collaboration data resident in IP networks in preparation for transport, preferably over a novel multicasting technique using virtual private networks. In one embodiment, audio data terminating or originating from the PSTN may be multiplexed into open or private IP networks for efficient transport to multiple local or remote client computers. This allows video and audio collaboration clients to talk with remote telephony devices during the process of Multiparty audio/video conferencing.

In an alternate embodiment, without video conferencing, the method may use public networks to transport a multicast enabled IP audio stream during multi-party audio conferencing without the need for a conventional audio bridge device. Audio data is transported in a hybrid network comprising the PSTN and IP network. In this embodiment, a local client initiates a call to the remote telephone or wireless telephony device from a local dial-out application located preferably on the clients' computer. Call set-up is initiated as a series of control packet data transfers to a Voice-over-IP (VoIP) server or PSTN gateway located at some predetermined Internet address on the world-wide-web. Control data packets are transported to the VoIP server via a sec1l;fe multicast enabled virtual private network. The local client computer compresses the audio data prior to transport to the VoIP server. The VoIP Server uses standard ITU-T, H.323 or SIP audio telephony transport protocol on the primary network connection protocol in preparation for entry to the secondary PSTN. The H.323 or SIP call instantiation is a protocol completed by the VoIP server which requests further transport of the digitized audio stream through a gateway to the public PSTN. In this embodiment, the majority of the audio data in transport over virtual private tunnels is multicast enabled such that the final termination or origination points are geographically close to the local or remote client computers. Once the proprietary data packets are handed off to the VoIP server or remote PSTN gateway, the invention ensures that standard protocols such as H.323 or SIP are used to further process for audio call set-up, tear-down and transport as know by those knowledgeable in the art.

The H.323 or Session Initiation Protocol (SIP) are used for call set-up of the network connections between the Hybrid networks and the remote telephone(s) (PSTN). Once IP network to PSTN call connection is established, compressed digitized audio packet data is grouped into multicast packets and encapsulated for traversal through the open Internet. Transport between the remote PSTN client (Callee) and the Local (Caller) is accomplished with full duplex audio between all audio and video participants within the conference. In one embodiment, compression may be accomplished with a standard audio CoDec such as that specified in the ITV-T G.729 recommendation or with a proprietary audio CoDec as know in the art. Thus, audio data transcoders at the VoIP server may be used to match the expected audio decoders

located at the PSTN gateways. The unique process compresses the "Callee" audio data at the local client computer prior to multicast transport to other remote clients and to the VoIP server. This process minimizes the transport bandwidth during the first mile connection to/from the Internet.

In one embodiment, the method for adding a telephone participant to a multiparticipant video conference operates as follows. A first message is sent to each of a plurality of multicast appliances over the Internet, wherein the first message comprises a group address which identifies participants. Each of the multicast appliances receives the first message. A plurality of virtual private networks are then established across the Internet between the multicast appliances. As a result, one or more of the participants are able to communicate in the multi-participant video conference. The telephone participant then joins the multi-participant video conference wherein this comprises a first participant contacting the telephone participant; establishing a phone number with a voIP server; the VoIP server communicating with a gateway to call the telephone participant; and the telephone participant participating in the multi-participant video conference.

In one embodiment, the telephone participant participates in the multi-participant video conference as follows: the telephone participant speaking in the video conference; generating digital voice data in response to the telephone participant speaking; transforming the digital voice data into IP packets; transmitting the IP packets containing the digital voice data to the first participant; at a computer system of the first participant, decoding the IP packets containing the digital voice data to produce the digital voice data; mixing the digital voice data of the telephone participant with digital voice data of the first participant; and providing the mixed digital voice data of the telephone participant and the first participant to the other participants.

The method may further comprise: mixing the digital voice data of the first participant and the digital voice data of the other participants; and providing the mixed digital voice data of the first participant and the other participants to the telephone participant.

In another embodiment, the telephone participant participates in the multi-participant video conference as follows: the telephone participant speaking in the video conference; generating digital voice data in response to the telephone participant speaking; transforming the digital voice data into IP packets; configuring the IP packet with a group address according to a multicast protocol to create a multicast IP packet; encapsulating the multicast IP packet as a unicast packet; transmitting the unicast packet over the virtual private networks across the Internet between one or more appliances; one or more of the appliances determining the multicast data from the unicast packet; and the appliances providing the multicast data to each of the other participants in the group address.

Brief Description of the Drawings

A better understanding of the present invention can be obtained when the following detailed description of the preferred embodiment is considered in conjunction with the following drawings, in which:

Figure 1 illustrates a typical H.323 audio and video conferencing system implemented in accordance with prior art;

Figure 2 illustrates an H.323 protocol stack and its components implemented in accordance with prior art;

Figure 3 illustrates one embodiment of the present invention;

Figure 4 illustrates an embodiment using multicast Protocol;

Figure 5 illustrates the audio and video data flow over hybrid networks; and

Figure 6 illustrates the local client data mixing used in the preferred embodiment.

Detailed Description of the Preferred Embodiment

Incorporation by Reference

The following applications and references are hereby incorporated by reference as though fully and completely set forth herein.

U.S. Application Serial No. 10/446,407 titled "Transmission Of Independently Compressed Video Objects Over Internet Protocol", Dye et al. filed May 28,2003

U.S. Application Serial No. 10/620,684 titled "Assigning Prioritization During Encode Of Independently Compressed Objects, Dye, et al. filed on July 16,2003.

International Telecommunications Union Recommendation H.323, Titled "Packet Based Multimedia Communication System." November, 2000

International Telecommunications Union Recommendation H.261, Titled "Video Coding for Audio Visual Services at Px64 kbps."

International Telecommunications Union Recommendation H.263, Titled "Video Coding for Low Bit-Rate Communications" February, 1998

One embodiment of the present invention uses a decentralized model for multipoint conferencing. The multipoint control unit insures communication capability once the media stream is transcoded to the H.323 standard as known. However, this embodiment mixes media streams at each terminal prior to multicast.

Figure 3 illustrates one embodiment of the invention. This embodiment allows audio video and data collaboration information to be securely transferred between a plurality of local and remote clients preferably within a virtual private network. This embodiment provides the ability for a moderator (single member of the conference) to dial out from a desktop computer or terminal (using a novel hybrid network structure) connecting an external telephone user's audio into the audiolvideo conference. The embodiment integrates full duplex audio, video and data connections between clients conferencing on the Internet and clients conferencing on standard telephone systems. The Internet/PSTN hybrid network is the medium used for transport. Figure 3 depicts the necessary equipment and protocols to complete the dial out to PSTN network method and process.

Now referring to Figure 3, the voice over IP moderator 401 (call initiator or caller) typically has a number of peripherals used for real input output devices at the desktop. These include a client computing devices such as a PC or other computer 459, a client terminal 455 including a keyboard and mouse for input output control, a standard

desktop telephone 457, a video input device or camera 401 and the audio input device, microphone 452. In one embodiment each conference call connected to the Internet will have similar peripheral hardware devices. Figure 3 illustrates a mUlti-party virtual conference connected over the Internet. Internet clients include audio video client 415, audio video client 418, and audio video client number and 417. In addition Figure 3 shows two possible telephony clients using standard wired 412 or wireless telephone 413 systems. PSTN client #1 412 is connected to a wireless cell-phone that in tum is connected to the global dial network 450 as specified by the PSTN 433. Remote telephony user client 2413 is connected to a standard telephone handsets 413 which again is connected to the global dial network 450 based on the PSTN 433.

Again referring to Figure 3 the Internet based clients 401 415 418 and 417 are connected through routers or modems 453 preferably in a virtual private network configuration 461. A virtual private network bridge 407 is used to connect local and remote clients together within a secure private network. A local connection from the VPN bridge 407 to the voice over IP server 409 is used to transfer conference audio from any participant on the IP network to any participant in the PSTN. Thus, the voice over IP server 409 is responsible for transcoding audio information from the virtual private network 461 to and from the PSTN gateway 411, thus bridging the PSTN and VPN together.

Figure 4 illustrates one embodiment of the present invention. The system of Figure 4 performs audio transport between multiple client groups who all share the same multicast group address such that audio/video and data may be shared interactively without the need of central servers. Multicast protocol and encapsulated media packets are implemented so that media data may be routed through public or private IP networks without the need for special hardware and software during the majority of the network transport. Figure 4 shows a system of virtual networks that interconnect as a virtual private network 423. Each VPN tunnel can be connected in a series or star topology between one or more multicasting appliances 449 - 451. One or more central servers or VPN bridge(s) 407 are at the center of the network topology. Multicasting enabled appliances 447, 449, 451,453,455 are used at the origination or

termination points for audio, video or data (media data) to from the backbone of the transport path. PSTN gateways are used to provide "points of presence" throughout and are responsible for origination or termination of audio data on and off of the PSTN from the IP network topology. Multicast enabled routing allows remote clients to be PC's or PSTN gateways which become "Listeners" of media data. Thus, media data is presented or broadcast onto a network with one or more group addresses. This method uses less bandwidth and reduces latency during transport.

Again referring to Figure 4 PSTN group #1 412 has three analog telephones which are switched into a PSTN gateway and VoIP server 471 which is networked over public or private network connection to a multicast enabled VPN appliance 447. Appliance 447 is connected to a VPN bridge server 407 also by means of a virtual private network. The VPN Bridge 407 is used to authenticate clients, assign multicast IP group addresses to various PC clients and VoIP gateway servers. In addition the VPN Bridge Server 407 may have additional meeting room or conferencing features necessary to carryout a multi-party conference. Connected to the VPN Bridge 407 are various virtual private networks which form network tunnels to one or more other multicasting appliances 449, 451, 453, 455, 457 which connect to one or more PSTN gateways typically located in geographically dispersed areas.

For the purpose of the illustration of Figure 4, PSTN group #1 412 is audio conferencing with PSTN client #3 414 and PSTN client #5 416, each of which are audio conferencing with Audio/Video client group #4 415. In the illustration of Figure 4 each member of audio/video client group #4 share audio with all the clients and video with each other. One example may be illustrated again referring to Figure 4. If telephone client #5 416 is talking, the analog audio is converted from switched network (PSTN) to IP in the VoIP/PSTN gateway 475. The digital IP is routed via Internet to an appliance 455 at the edge of the network typically co-located with the VoIPIPSTN gateway 475. The appliance has been configured to have a virtual private network creating a tunnel through Internet to appliance 453 which also has Internet based virtual private tunnels to appliance 457 and appliance 447. Audio from PSTN client #5416 is broadcast from appliance 457 whereby all the audio/video client PC's of group #4 are "listeners" and

receive the audio from PSTN client 416 at the same time. Additionally, PSTN client #5's 416 audio is routed over another virtual private network to one or more appliances in this case appliances 447 and 449. PSTN Client group #1 412 are also "listeners" of the multicast group as well as PSTN Client #3 414. Thus, audio is broadcast to multiple audio devices in both IP networks and the PSTN using a unique group address and a virtual private network structure. Interactivity is gained by using the same process no matter who in the group is the broadcaster of audio or video.

Figure 5 shows a more detailed block diagram of the embodiment of the present invention. The moderator client #1 401 initiates the call using the application code running on the voice over IP server 409. Call initiation and call transfer may be accomplished through a VPN tunnel 421 connected to the moderator client 401. Two connections to the Moderator client 1 401 through the VPN tunnel 421 are established. The first connection connects the VoIP conference data for call initiation, set-up and control 405. The second connection 403 through the VPN tunnel connects the conference audio and video 403 between the moderator client 401 and multiple remote clients 415 417 413 connected to the Internet. The VPN tunnel 421 is connected into the VPN bridge 407 which may be located within the Internet 435 at either local or remote sites. As indicated in Figure 5, the VPN bridge 407 is responsible for connecting and establishing the virtual private network used for secure conferencing. In the embodiment of the present invention the VPN bridge 407 bridges all the tunnels for data transfer. Thus, VPN tunnel 421, VPN tunnel 423 and VPN tunnel 425 are on the same virtual private network. Alternate embodiments may include a plethora of tunnels connected to through a single VPN bridge or multiple VPN bridges based on scalability of the system. An additional tunnel containing the conference voice over IP audio and call set-up data 405 is connected to a separate voice over IP server 409. The server 409 is responsible for transcoding the voice over IP audio and call set-up control 405 in preparation for data transfer across the H.323 network 437. The H.323 network 437 traverses across the Internet to one of many PSTN gateways 411. PSTN gateways 411 form the bridge between the Internet and the public switched telephone network 433. These VoIP gateways are typically located at the local exchange carrier(LEC) in a plethora of individual points of presence throughout the world. Audio telephony calls are

terminated at the voice over IP client 413. These termination points may be located throughout the world. Thus, the embodiment shown in Figure 5 allows for the dial-out to standard phones from a client terminal with audio and video capability over IP networks allowing conferencing between multiple remote sites including secure voice over IP audio components over the PSTN.

Figure 6 of the preferred embodiment shows the multiple network domains, the software applications and operating system boundaries and the operations necessary for audio manipulation and transport. It is noted that video accompanies the audio to all conference participants with the exception of the PSTN client 412. For simplicity of illustration, Figure 6 does not show the video conferencing path. The embodiment of Figure 6 includes a local moderator client 401 who is responsible for initiating a dial out for audio conferencing to the PSTN client 412. The local moderator client 401 may also be the initiator of the meeting. In this exemplary embodiment, it may be assumed that the local moderator client 401 has set up the audio video conference with remote audio video clients 418 previous to the dial out for audio conferencing to the PSTN client 412. The local moderator 401 and the remote audio video clients 418 may share audio and video data in a full duplex mode among to all participants with the exception of the PSTN client 412. The PSTN client 412 may share audio from a standard telephone or wireless telephone with all participants in the conference including the local client 401 and remote audio video clients 418. Likewise, the remote audio video clients 418 and the local moderator client 401 may share audio with the remote PSTN client 412. Thus, as indicated in Figure 6 a voice over IP call placed the standard telephone system may bring a remote telephone user into an audio/video conference with multiple remote participants.

A detailed description of Figure 6 follows. It may be assumed in this embodiment that the functions and features of Figure 6 are running on general-purpose hardware using various software to accomplish the tasks at hand. In alternate embodiments various pieces of Figure 6 may be encompassed in specialized hardware for improved speed performance. Again referring to Figure 6 and starting with the local moderator client 401, the process of call set-up is first performed. The local moderator client 401

uses a computer terminal connected to a local area network that in turn is connected to a wide area network and preferably then connected to a virtual private network 461. The local moderator client 401 is equipped with proprietary software as depicted in Figure 6 to operate as a dial-out to PSTN application. The application interface allows a point and click interface establishing the dial out phone numbers to various possible clients on the PSTN 433. In alternate embodiments "Dial-In" may be used in addition using the same techniques outlined but in a reverse path scenario.

Once the local moderator client 401 has selected the remote PSTN client 412 phone number a point and click on the name initiates the dial-out process where audio information is to be transport across hybrid networks. General tones as known in the art according to the ITT standard are sent from the local moderators computer or terminal to the voice over IP server 409 located somewhere within a" global Internet system 435. The voice over IP server 409 may be connected to a virtual private network 461. The voice over IP server 409 may use standard H.323 or SIP network protocol to establish communications as known directly to the PSTN gateway 433. Once the call set-up is complete both the PSTN client 412 and the local moderator client 401 have established a connection. In one embodiment the connection is not established for all the audio participants within the conference at this time. In the embodiment of Figure 6 it is assumed that all the remote audio video clients 418 had previously been in a conference with the local moderator client 401. In alternate embodiments the order at which callers are established may be different. With the foregoing assumption of a conference being established prior to the call-out to PSTN, further definition of the VoIP audio path is specified. The following discloses and further defines the audio paths through three layers of application software 562, 564, 566, including the audio paths through four hybrid network boundaries 510 520 435 and 515.

Starting with the remote client/moderator boundary 510 preceding to the local client voice over IP boundary 520, the Internet interface boundaries 435 and the PSTN telephone network boundary 515, each of these distinct boundaries makes up the method used to transport audio media in a hybrid mixed network system. Remote client/moderator boundary 510 may be established as a virtual private network for

transport of audio and video data between the local moderator client 401 and remote audio/video clients 418. In alternate embodiments the virtual private network may be replaced with either switched dedicated network or standard non-secure IP networks. The local clients VoIP boundary 520 may also be a virtual private network connecting audio from the local moderator client 401 to a local or remote voice over IP server 409. In alternate embodiments the local client voice over IP boundary may be established through switched networks or the open Internet. For security purposes all connections that traverse across the open Internet 435 are preferably secured by the use of encryption running within a virtual private network. Alternate embodiments may exclude encryption and virtual private networks including public non-encrypted information, public Internet interfaces or over private switched networks. Continuing with the description of the Internet interface 435 it is assumed with all the information above the PSTN boundary 515 (as indicated in Figure 6) is information which travels within local client local area networks remote client local area networks or on wide area networks through the Internet. The final boundary for network transport is the PSTN boundary 515. This is the transport interface between the wide area network (Internet) and gateways that transmit data to and from the PSTN system 433.

Again referring to Figure 6 and assuming the PSTN dial out call has been established as known in the art, (preferred to ITD H.323) the following detailed information regarding the audio processing follows. In one embodiment the interface between the conference application boundary 562 and the operating system interface boundary 564 and the voice over to IP application boundary 566 is taken under consideration. Preferably, the operations preformed on the audio occur in real-time to achieve full duplex operation. In alternate embodiments a plethora of alternative methods, operating systems application software, and input and output devices may be used to achieve the same goal as described previously. In one embodiment the operating system sound interface and API boundaries 564 are used for standard audio mixing. The audio from the local moderator client 401 is preferably mixed to be transported both to the PSTN client 412 and remote audio video clients 418. The conference application boundary 562 is responsible for the application which controls mixing of audio to the operating system sound interface 564. In one embodiment, the

operating system sound interface also performs the interface and mixing for the voice over IP application boundary 566. These layers make up the application interface for achieving the operation as described herein. Input from the local moderator client 401 is input to two mixers. First, the moderator audio input 550 is connected to the voice over IP record mixer 568. Secondly, the microphone from the moderator client 401 is also connected to another standard mixture 534. The voice over IP record mixer 568 mixes the audio from the audio decompressors 525 and the local moderator audio 401 in preparation for transport to the voice over IP encoder 522. In addition the local moderator client 401 sends audio to the audio mixture 534 mixing the audio from the voice over IP decoder 524 for output to the conference applications 562 local audio encoder 520. The audio encoder 520 combines the PSTN client 412 audio with the local moderator clients 401 audio then encodes the result for compression of the data in preparation for transport across the VPN network 461. The application software audio encoder 520 delivers both the PSTN client's audio and the local moderator client's audio to remote audio video clients 418.

The local moderator client 401 receives audio from the PSTN client 412, and thus the voice over IP player mixer 569 mixes audio previously decoded by the voice over IP decoder 524 with the audio from the remote client's 418 for presentation to the local speaker 454. All the remote audio video clients 418 hear the audio from the PSTN client 412. The PSTN client 412 transports audio through the PSTN 433 to Internet based voice over IP server 409. The voice over IP server transcodes the audio data into a format suitable for transport onto the VoIP application boundary 566. Figure 6 also depicts how audio data from the remote audio video clients 418 is prepared for transport across a VPN network 461. This audio data is input to the application's local decoders for audio decompression 525 prior to the mixing process. The remote audio video clients 418 audio is mixed with the local moderator client audio 401 in preparation for compression by the VoIP encoder 522. This audio data is then placed in the virtual private network tunnel for transport to the voice over IP server 409 and onto the gateway for audio presentation to the PSTN, terminating at the PSTN client 412.

Figure 6 outlines multiple application software boundaries used to mix audio between local and remote clients in hybrid data networks as indicated by the multiple protocol boundaries 562, 564, 566. Thus, the embodiment allows enhancements to the ability for audio video conferencing with multiple clients and the added value of dialing out to a remote telephone user located somewhere within the global dial-up network 450. Prior art techniques such as that known in the ITU H.323 recommendations have the compressor 522 and decompressors 524 located within the VoIP server running the H.323 network system as indicated in Figure 2 (audio codec 211). This poses a problem for low bit-rate networks especially when video and audio are already part of the transport data. The present embodiment uses highly compressed audio that is compressed and decompressed at the client computer. Thus, the voice over IP server can be located anywhere within the Internet 435 without concern about the limited bandwidth of the first and last mile. In addition, only a single server is required for multiple conferences. The prior art systems as shown in Figure 1 place at least one or more voice over IP server behind the fire-wall and corporate router for transcoding information to the H.323 network. This requires additional cost when a separate server is needed in each location to run the H.323 standard. The present embodiment does not require a separate server at each site, but instead requires that the desktop computer or terminal compress the data prior to transport.

Claims:

We claim:

1. A method for adding a telephone participant to a multi-participant video conference, comprising:

sending a first message to each of a plurality of multicast appliances over the Internet, wherein the first message comprises a group address which identifies participants;

each of the multicast appliances receiving the first message;

establishing a plurality of virtual private networks across the Internet between the multicast appliances;

wherein one or more of the participants are able to communicate in the multi-participant video conference;

the telephone participant joining the multi-participant video conference, wherein said joining comprises:

a first participant contacting the telephone participant

establishing a phone number with a voIP server;

the VoIP server communicating with a gateway to call the telephone participant;

the telephone participant participating in the multi-participant video conference.

2. The method of claim 1, wherein the telephone participant participating in the multi-participant video conference comprises:

the telephone participant speaking in the video conference;

generating digital voice data in response to the telephone participant speaking;

transforming the digital voice data into IP packets;

transmitting the IP packets containing the digital voice data to the first participant;

at a computer system of the first participant, decoding the IP packets containing the digital voice data to produce the digital voice data;

mixing the digital voice data of the telephone participant with digital voice data of the first participant;

providing the mixed digital voice data of the telephone participant and the first participant to the other participants.

3. The method of claim 2, further comprising:

mixing the digital voice data of the first participant and the digital voice data of the other participants;

providing the mixed digital voice data of the first participant and the other participants to the telephone participant

4. The method of claim 1, wherein the telephone participant participating in the multi-participant video conference comprises:

the telephone participant speaking in the video conference;

generating digital voice data in response to the telephone participant speaking;

transforming the digital voice data into IP packets;

configuring the IP packet with a group address according to a multicast protocol to create a multicast IP packet;

encapsulating the multicast IP packet as a unicast packet;

transmitting the unicast packet over the virtual private networks across the Internet between one or more appliances;

one or more of the appliances determining the multicast data from the unicast packet; and

the appliances providing the multicast data to each of the other participants in the group address.

5. The method of claim 1, further comprising:

one or more of the participants communicating in the multi-participant video conference, comprising:

configuring IF packets with digital media data and a group address according to a multicast protocol to create a multicast IP packet; and

encapsulating the multicast IF packet as a unicast packet and sending the unicast packet to each of the other participants in the group address.

6. The method of claim 5, wherein said encapsulating comprises encrypting the multicast IF packet.

7. The method of claim 1, further comprising:

one or more of the participants communicating in the multi-participant video conference, comprising;

generating digital media data;

transforming the digital media data into IF packets;

configuring the IF packet with a group address according to a multicast protocol to create a multicast IF packet;

encapsulating the multicast IF packet as a unicast packet;

transmitting the unicast packet over the virtual private networks across the Internet between one or more appliances;

one or more of the appliances determining the multicast data from the unicast packet;

the appliances providing the multicast data to each of the other participants in the group address;

presenting the digital media data to the other participants in the video conference.

8. The method of claim 7, wherein said encapsulating comprises encrypting the multicast IP packet.

9. A method for adding a telephone participant to a multi-participant audio-video conference, comprising:

sending a first message to each of a plurality of multicast appliances over the Internet, wherein the first message comprises a group address which identifies the participants;

each of the multicast appliances receiving the first message;

establishing a plurality of virtual private networks across the Internet routes between the multicast appliances;

one or more of the participants communicating in the multi-participant video conference;

the telephone participant joining the multi-participant video conference, wherein said joining comprises:

the telephone participant calling into a gateway server;

the telephone participant providing conference ID information;

the PSTN gateway server establishing communication with a conferencing server;

authenticating the telephone participant; and

transmitting multicast group information to the gateway server;

wherein the gateway server is operable to use the multicast group information to enable the telephone participant to participate in the multi-participant video conference.

10. The method of claim 9, wherein the telephone participant participating in the multi-participant video conference comprises:

the telephone participant speaking in the video conference;

generating digital voice data in response to the telephone participant speaking;

the gateway transforming the digital voice data into IP packets;

configuring the IP packet with a group address according to a multicast protocol to create a multicast IP packet;

encapsulating the multicast IP packet as a unicast packet;

transmitting the unicast packet over the virtual private networks across the Internet between one or more appliances;

one or more of the appliances determining the multicast data from the unicast packet; and

the appliances providing the multicast data to each of the other participants in the group address.

11. A method for adding a first telephone participant to a multi-participant video conference, comprising:

sending a first message to each of a plurality of multicast appliances over the Internet, wherein the first message comprises a group address which identifies the participants;

each of the multicast appliances receiving the first message;

establishing a plurality of virtual private networks across the Internet routes between the multicast appliances;

one or more of the participants communicating in the multi-participant video conference; and

one or more telephone participants joining the multi-participant video conference.

Abstract of the Disclosure

A method which allows standard telephone users to audio conference with video conferencing participants over IP networks in a private secure environment. A dial-out is performed from one or more conference client terminals bridging audio between the Internet and the PSTN networks. The process uses a mixed mode hybrid network architecture for call set-up, initialization and teardown including the method to mix audio at the desktop terminal instead of in a general purpose server as in the prior art. The method conferences video and audio between multiple clients and include audio from a standard telephone network within the conference. A virtual private network connects all of the IP clients together including the voice over IP server used to transcode the proprietary audio into the H.323 standard for transport into the telephony network.

Substitute Specification (with markings)

This substitute specification with markings contains no new matter.

AUDIO-VIDEO MULTI-PARTICIPANT CONFERENCE SYSTEM

USING PSTN AND INTERNET NETWORKS

Priority Claim

~~This application claims benefit of priority of U.S. provisional application Serial No. 60/453,307 titled "THE METHOD AND PROCESS FOR MEDIA BASED COLLABORATION USING MIXED-MODE PSTN AND INTERNET NETWORKS" filed March 10, 2003, whose inventors are Thomas A. Dye and Tom Dundon which is hereby incorporated by reference in its entirety.~~

This application is a continuation of U.S. Patent Application No. 12/646,892, filed December 23, 2009, which is a continuation of U.S. Patent Application No. 10/796,560, now U.S. Patent No. 7,664,056, filed March 9, 2004, which claims priority of U.S. Provisional Application No. 60/453,307, filed March 10, 2003; wherein all of the above referenced applications are incorporated by reference in their entirety.

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BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to computer system architectures and more particularly to audio and video telecommunications for collaboration over hybrid networks.

Description of the Related Art

Since their introduction in the early 1980's, audio/video conferencing systems ("video conferencing systems") have enabled users to communicate between remote sites using telephone lines based on dedicated or switched networks. Recently, technology and products to achieve the same over Internet Protocol have been attempted. Many such systems have emerged on the marketplace. Such systems produce low-frame-rate and low quality communications due to the unpredictable nature of the Internet. Such connections have been known to produce long latencies with limited bandwidth, resulting in jerky video, dropped audio and loss of lip sync.

Therefore, most video conferencing solutions have relied on dedicated switched networks such as T1/T3, ISDN or ATM. These systems have the disadvantage of higher cost and complexity and a lack of flexibility due largely to interoperability issues and higher cost client equipment. High costs are typically related to expensive conferencing hardware and dedicated pay-per-minute communications usage. Most often these dedicated communications circuits are switched circuits which use a fixed bandwidth allocation.

In most prior art systems the public switched telephone network (PSTN) is used to transfer audio during conferencing and collaboration with remote parties. It is known that quality of audio reception is poor over typical prior art Internet protocol (IP) systems. Prior art audio/video conferencing systems which use IP networks for audio and video transport lack the ability to terminate audio to client end systems through both PSTN and IP networks. Thus, it is desirable to achieve a hybrid mix of audio and video

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data over PSTN and ~~IP based~~ IP-based audio/video conferencing to achieve full duplex real-time operation for all conference participants.

Modem voice over IP telephony systems have used the H.323 standard from the international telecommunications union (1TU). The H.323 standard focuses on the transmission of audio and video information through the Internet or switched private networks. Figure 1 illustrates a prior art H.323 system. The block diagram of Figure 1 includes a number of major components, including the general Internet 435, Internet H.323 bridges or gateways 411, telecommunications PSTN 433 (Public Switched Telephone Network), wireless and land-line phone handsets 412/413, standard Internet router 453, an optional gatekeeper 205, a multipoint control unit 203, a standard local area network 457, a voice over IP server running the H.323 protocol 201, and multiple I/O and display terminals 455. Figure 1 is an example of the prior art conferencing system used between hybrid networks connecting the PSTN and Internet. Hybrid networks are used to communicate audio on internal LAN and WAN networks as well as transfer of audio to the existing telephone or PSTN network. While the H.323 recommendation allows for video conferencing, the prior art systems use private switched networks to establish transport that require expensive H.323 bridges between dedicated networks and the PSTN. Each of the components in Figure ~~3~~Figure 1 serves this purpose to achieve audio telecommunications between multiple parties.

Referring again to Figure 1, the components of Figure 1 are interconnected as follows. Prior art technology uses PC or client terminals 455 connected through a local area network 457 to either a data server or a specialized audio/video server 201. The network server 201 contains the application necessary to generate the H.323 network protocol. The data server 201 may be connected to a local gatekeeper 205 that is responsible for management control functions. As known the gatekeeper 205 is responsible for various duties such as admission control, status determination, and bandwidth management. Data server 201 functions are specified and handled through the ITU-H.225.0RAS recommendations. In addition, management control unit (MCU) 203 is connected to the data server 201. The multipoint control unit of a 203 is required by the eight-step ITU- 5 H.323 recommendation for flexibility to negotiate end points and

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determine compatible setups for any conference media correspondents. The multipoint control unit 203 enables communication between three or more end points. Similar to a multipoint bridge, the gatekeeper 205 and the multipoint control unit 203 are optional components of the H.323 enabled network. Another useful job of the multipoint control unit 203 is to determine whether to unicast or multicast the audio or video streams. As known by one skilled in the art, these decisions are dependent on the capability of the underlying network and the topology of the multipoint conference. The multipoint control unit 203 determines the capabilities of each client terminal 455 and status each of media stream.

Again referring to Figure 1, a standard network router 453 is connected between the local area network 457 and the Internet 435. At the outer edges of the Internet, "points of presence" are located at multiple ~~end-point~~ end points or call termination sites. Gateways 411 are used to the transcode the H.323 network information onto the PSTN 433. Standard telephone handsets 413 or wireless phones 412 are connected to the PSTN telephony system.

Figure 2 illustrates the embodiment of the H.323 protocol stack 200, its components and their interfaces to the local area network computers at the network interface 300. The input and control devices 455 along with a local area network 457 of Figure 1 are shown in Figure 2, consisting of the audio input output block 452, the video input and output block 451, the system control unit and data collaboration unit 459. These input devices are largely responsible for the delivery of media data to the H.323 protocol stack 200 shown in Figure 2.

Again referring to Figure 2, the sub blocks of functionality that make up the H.323 protocol stack 200 is described. The H.323 protocol stack consists of an audio codec ~~211,~~ 214, and a video CoDec 213 connected to the audio/video ~~452 451~~ input and output blocks 452 and 451, respectively. The audio and video CoDecs are responsible for compression and decompression of the audio and video sources. The real-time network protocol component 215 is connected to the audio video CoDecs and is also responsible for preparation of the media data for transport according to the RTP (real-time protocol) recommendations.

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Again referring to the prior art system of Figure 2, the H.323 protocol stack has a system control unit 459 which connects to multiple control blocks within the H.323 protocol stack 200. The system control unit connects to the RTC Protocol block 217 for ~~real-time~~ real time transport of the control information used to set-up and tear down the conference. The system control unit 459 also connects to the call-signaling units 221 and 219 for call signaling protocols and media stream packetization application used for ~~packet based~~ packet-based multimedia communications. The system control unit 459 also connects to the control signaling block 223 used for control of protocols for multimedia communications. Lastly, the H.323 recommendation defines a data collaboration capability as known and outlined in the T.120 data collaboration unit 225.

All of the defined blocks make up the H.323 protocol network interface to the Transport protocol and network interface unit 300 for transport of data through the modem or router 453 to the Internet 435.

Summary of the Invention

~~The present invention comprises various embodiments which enable audio from standard and wireless telephones systems to be mixed with audio, video and collaboration data resident in IP networks in preparation for transport, preferably over a novel multicasting technique using virtual private networks. In one embodiment, audio data terminating or originating from the PSTN may be multiplexed into open or private IP networks for efficient transport to multiple local or remote client computers. This allows video and audio collaboration clients to talk with remote telephony devices during the process of Multiparty audio/video conferencing.~~

~~In an alternate embodiment, without video conferencing, the method may use public networks to transport a multicast enabled IP audio stream during multi-party audio conferencing without the need for a conventional audio bridge device. Audio data is transported in a hybrid network comprising the PSTN and IP network. In this embodiment, a local client initiates a call to the remote telephone or wireless telephony device from a local dial-out application located preferably on the clients' computer. Call set-up is initiated as a series of control packet data transfers to a Voice-over-IP (VoIP)~~

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~~server or PSTN gateway located at some predetermined Internet address on the world-wide-web. Control data packets are transported to the VoIP server via secure multicast enabled virtual private network. The local client computer compresses the audio data prior to transport to the VoIP server. The VoIP Server uses standard ITU-T, H.323 or SIP audio telephony transport protocol on the primary network connection protocol in preparation for entry to the secondary PSTN. The H.323 or SIP call instantiation is a protocol completed by the VoIP server which requests further transport of the digitized audio stream through a gateway to the public PSTN. In this embodiment, the majority of the audio data in transport over virtual private tunnels is multicast enabled such that the final termination or origination points are geographically close to the local or remote client computers. Once the proprietary data packets are handed off to the VoIP server or remote PSTN gateway, the invention ensures that standard protocols such as H.323 or SIP are used to further process for audio call set-up, tear-down and transport as know by those knowledgeable in the art.~~

~~The H.323 or Session Initiation Protocol (SIP) are used for call set-up of the network connections between the Hybrid networks and the remote telephone(s) (PSTN). Once IP network to PSTN call connection is established, compressed digitized audio packet data is grouped into multicast packets and encapsulated for traversal through the open Internet. Transport between the remote PSTN client (Callee) and the Local (Caller) is accomplished with full duplex audio between all audio and video participants within the conference. In one embodiment, compression may be accomplished with a standard audio CoDec such as that specified in the ITV-T G.729 recommendation or with a proprietary audio CoDec as know in the art. Thus, audio data transcoders at the VoIP server may be used to match the expected audio decoders located at the PSTN gateways. The unique process compresses the "Callee" audio data at the local client computer prior to multicast transport to other remote clients and to the VoIP server. This process minimizes the transport bandwidth during the first mile connection to/from the Internet.~~

~~In one embodiment, the method for adding a telephone participant to a multiparticipant video conference operates as follows. A first message is sent to each of~~

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~~a plurality of multicast appliances over the Internet, wherein the first message comprises a group address which identifies participants. Each of the multicast appliances receives the first message. A plurality of virtual private networks are then established across the Internet between the multicast appliances. As a result, one or more of the participants are able to communicate in the multi-participant video conference. The telephone participant then joins the multi-participant video conference wherein this comprises a first participant contacting the telephone participant; establishing a phone number with a voIP server; the VoIP server communicating with a gateway to call the telephone participant; and the telephone participant participating in the multi-participant video conference.~~

~~In one embodiment, the telephone participant participates in the multi-participant video conference as follows: the telephone participant speaking in the video conference; generating digital voice data in response to the telephone participant speaking; transforming the digital voice data into IP packets; transmitting the IP packets containing the digital voice data to the first participant; at a computer system of the first participant, decoding the IP packets containing the digital voice data to produce the digital voice data; mixing the digital voice data of the telephone participant with digital voice data of the first participant; and providing the mixed digital voice data of the telephone participant and the first participant to the other participants.~~

~~The method may further comprise: mixing the digital voice data of the first participant and the digital voice data of the other participants; and providing the mixed digital voice data of the first participant and the other participants to the telephone participant.~~

~~In another embodiment, the telephone participant participates in the multi-participant video conference as follows: the telephone participant speaking in the video conference; generating digital voice data in response to the telephone participant speaking; transforming the digital voice data into IP packets; configuring the IP packet with a group address according to a multicast protocol to create a multicast IP packet; encapsulating the multicast IP packet as a unicast packet; transmitting the unicast packet over the virtual private networks across the Internet between one or more~~

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~~appliances; one or more of the appliances determining the multicast data from the unicast packet; and the appliances providing the multicast data to each of the other participants in the group address.~~

A multi-participant conference system is described. The multi-participant system comprises a public switched telephone network (PSTN) client, at least one remote client, and a first participant client. The PSTN client is configured to communicate audio data. Each of the remote clients is connected to the Internet and is configured to receive audio-video data. The first participant client is configured to receive audio-video data. The first participant client includes a voice over IP (VoIP) encoder, a VoIP decoder, a first audio mixer, and a second audio mixer. The VoIP encoder compresses audio data transported to the PSTN client. The VoIP decoder then decodes audio data from the PSTN client. The first audio mixer mixes the decoded audio data from the PSTN client with the audio-video data from the first participant into a first mixed audio-video data stream. The first mixed audio-video data stream is then transmitted to the at least one remote client connected to the Internet. The second audio mixer mixes the audio-video data stream from the first participant with the audio-video data stream from each remote client into a second mixed audio. The second mixed audio is compressed by the VoIP encoder, which is then transmitted to the PSTN client.

A system for supporting a multi-participant conference call is also described. The system includes a first mixer, a first transport output, a second mixer, and a second transport output. The first mixer is configured to mix a Public Switched Telephone Network (PSTN) client audio data stream with a moderator audio-video data stream into a first mixed data stream. The first transport output configured to transmit the first mixed data stream to at least one remote client that receives the first mixed data stream. Each remote client is connected to the Internet and configured to generate a remote client audio-video data stream. The second mixer mixes the moderator audio-video data stream with the remote client audio-video data stream into a second mixed data stream. The second transport output configured to transmit a mixed audio data stream, corresponding to the second mixed data stream, to the PSTN client.

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A method for supporting a multi-participant conference call is also described. The method includes receiving a PSTN audio data stream from a public switched telephone network (PSTN) client. Also, the method includes receiving a moderator audio-video data stream from a moderator. Additionally, the method includes receiving a remote client audio-video data stream from at least one remote client connected to the Internet. The method then mixes the PSTN audio data stream with the moderator audio-video data stream into a first mixed data stream, and transmits the first mixed data stream to the remote client. The method also mixes the moderator audio-video data stream with the remote client audio-video data stream into a second mixed data stream. The method then proceeds to transmit a mixed audio data stream, corresponding to the second mixed data stream, to the PSTN client.

Brief Description of the Drawings

A better understanding of the present invention can be obtained when the following detailed description of the preferred embodiment is considered in conjunction with the following drawings, in which:

Figure 1 illustrates a typical H.323 audio and video conferencing system implemented in accordance with prior art;

Figure 2 illustrates an H.323 protocol stack and its components implemented in accordance with prior art;

Figure 3 illustrates one embodiment of the present invention;

Figure 4 illustrates an embodiment using multicast Protocol;

Figure 5 illustrates the audio and video data flow over hybrid networks; and

Figure 6 illustrates the local client data mixing used in the preferred embodiment.

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Detailed Description of the Preferred Embodiment

Incorporation by Reference

The following applications and references are hereby incorporated by reference as though fully and completely set forth herein.

U.S. Application Serial No. 10/446,407 titled "Transmission Of Independently Compressed Video Objects Over Internet Protocol", Dye et al. filed May 28,2003

U.S. Application Serial No. 10/620,684 titled "Assigning Prioritization During Encode Of Independently Compressed Objects, Dye, et al. filed on July 16, 2003.

International Telecommunications Union Recommendation H.323, Titled "Packet Based Multimedia Communication System." November, 2000

International Telecommunications Union Recommendation H.261, Titled "Video Coding for Audio Visual Services at Px64 kbps."

International Telecommunications Union Recommendation H.263, Titled "Video Coding for Low Bit-Rate Communications" February, 1998

One embodiment of the present invention uses a decentralized model for multipoint conferencing. The multipoint control unit insures communication capability once the media stream is transcoded to the H.323 standard as known. However, this embodiment mixes media streams at each terminal prior to multicast.

Figure 3 illustrates one embodiment of the invention. This embodiment allows audio video and data collaboration information to be securely transferred between a plurality of local and remote clients preferably within a virtual private network. This embodiment provides the ability for a moderator (single member of the conference) to dial out from a desktop computer or terminal (using a novel hybrid network structure) connecting an external telephone user's audio into the audio/video conference. The embodiment integrates full duplex audio, video, and data connections between clients conferencing on the Internet and clients conferencing on standard telephone systems. The Internet/PSTN hybrid network is the medium used for transport. Figure 3 depicts the necessary equipment and protocols to complete the dial out to PSTN network method and process.

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Now referring to Figure 3, the voice over IP moderator 401 (call initiator or caller) typically has a number of peripherals used for real input output devices at the desktop. These include a client computing devices such as a PC or other computer 459, a client terminal 455 including a keyboard and mouse for input output control, a standard desktop telephone 457, a video input device or camera ~~401~~ 451 and the audio input device, microphone 452. In one embodiment each conference call connected to the Internet will have similar peripheral hardware devices. Figure 3 illustrates a multi-party virtual conference connected over the Internet. Internet clients include audio video client 415, audio video client 418, and audio video client number and 417. In addition, Figure 3 shows two possible telephony clients using standard wired ~~412~~ 413 or wireless telephone ~~413~~ 412 systems. PSTN client #1 412 is connected to a wireless cell phone that in turn is connected to the global dial network 450, as specified by the PSTN 433. Remote telephony user client #2 413 is connected to a standard telephone ~~handsets~~ handset 413 which ~~again~~ is connected to the global dial network 450 based on the PSTN 433.

Again referring to Figure 3 the ~~Internet based~~ Internet-based clients 401, 415, 418, and 417 are connected through routers or modems 453 preferably in a virtual private network configuration 461. A virtual private network bridge ~~407~~ 461 is used to connect local and remote clients together within a secure private network. A local connection from the VPN bridge 407 to the voice over IP server 409 is used to transfer conference audio from any participant on the IP network to any participant in the PSTN. Thus, the voice over IP server 409 is responsible for transcoding audio information from the virtual private network 461 to and from the PSTN gateway 411, thus bridging the PSTN and VPN together.

Figure 4 illustrates one embodiment of the present invention. The system of Figure 4 performs audio transport between multiple client groups who all share the same multicast group address such that audio/video and data may be shared interactively without the need of central servers. Multicast protocol and encapsulated media packets are implemented so that media data may be routed through public or private IP networks without the need for special hardware and software during the

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majority of the network transport. Figure 4 shows a system of virtual networks that ~~are~~ interconnect as a virtual private network 423. Each VPN tunnel can be connected in a series or star topology between one or more multicasting appliances ~~449 - 451~~ 447-457. One or more central servers or VPN bridge(s) 407 are at the center of the network topology. Multicasting enabled appliances 447, 449, 451, 453, 455, and 457 are used at the origination or termination points for audio, video, or data (media data) to and from the backbone of the transport path. PSTN gateways are used to provide "points of presence" throughout and are responsible for origination or termination of audio data on and off of the PSTN from the IP network topology. Multicast enabled routing allows remote clients to be PC's or PSTN gateways which become "Listeners" of media data. Thus, media data is presented or broadcast onto a network with one or more group addresses. This method uses less bandwidth and reduces latency during transport.

Again referring to Figure 4, PSTN group #1 412 has three analog telephones which are switched into a PSTN gateway and VoIP server 471 which is networked over public or private network connection to a multicast enabled VPN appliance 447. Appliance 447 is connected to a VPN bridge server 407 also by means of a virtual private network. The VPN Bridge 407 is used to authenticate clients, assign multicast IP group addresses to various PC clients and VoIP gateway servers. In addition the VPN Bridge Server 407 may have additional meeting room or conferencing features necessary to ~~carryout~~ carry out a multi-party conference. Connected to the VPN Bridge 407 are various virtual private networks which form network tunnels to one or more other multicasting appliances 449, 451, 453, 455, 457 which connect to one or more PSTN gateways typically located in geographically dispersed areas.

For the purpose of the illustration of Figure 4, PSTN group #1 412 is audio conferencing with PSTN client #3 414 and PSTN client #5 416, each of which are audio conferencing with Audio/Video client group #4 415. In the illustration of Figure 4, each member of audio/video client group #4 share audio with all the clients and video with each other. One example may be illustrated again referring to Figure 4. If telephone client #5 416 is talking, the analog audio is converted from switched network (PSTN) to IP in the VoIP/PSTN gateway 475. The digital IP is routed via Internet to an appliance

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455 at the edge of the network typically co-located with the VoIP/PSTN gateway 475. The appliance has been configured to have a virtual private network creating a tunnel through Internet to appliance 453 which also has ~~Internet based~~ Internet-based virtual private tunnels to appliance 457 and appliance 447. Audio from PSTN client #5 416 is broadcast from appliance 457 whereby all the audio/video client PC's of group #4 are "listeners" and receive the audio from PSTN client 416 at the same time. Additionally, PSTN client #5's 416 audio is routed over another virtual private network to one or more appliances in this case appliances 447 and 449. PSTN Client group #1 412 are also "listeners" of the multicast group as well as PSTN Client #3 414. Thus, audio is broadcast to multiple audio devices in both IP networks and the PSTN using a unique group address and a virtual private network structure. Interactivity is gained by using the same process no matter who in the group is the broadcaster of audio or video.

Figure 5 shows a more detailed block diagram of the embodiment of the present invention. The moderator client #1 401 initiates the call using the application code running on the voice over IP server 409. Call initiation and call transfer may be accomplished through a VPN tunnel 421 connected to the moderator client 401. Two connections to the Moderator client #1 401 through the VPN tunnel 421 are established. The first connection connects the VoIP conference data for call initiation, set-up and control 405. The second connection 403 through the VPN tunnel connects the conference audio and video 403 between the moderator client 401 and multiple remote clients 415, 417, 413 connected to the Internet. The VPN tunnel 421 is connected into the VPN bridge 407 which may be located within the Internet 435 at either local or remote sites. As indicated in Figure 5, the VPN bridge 407 is responsible for connecting and establishing the virtual private network used for secure conferencing. In the embodiment of the present invention the VPN bridge 407 bridges all the tunnels for data transfer. Thus, VPN tunnel 421, VPN tunnel 423 and VPN tunnel 425 are on the same virtual private network. Alternate embodiments may include a plethora of tunnels connected to through a single VPN bridge or multiple VPN bridges based on scalability of the system. An additional tunnel containing the conference voice over IP audio and call set-up data 405 is connected to a separate voice over IP server 409. The server 409 is responsible for transcoding the voice over IP audio and call set-up control 405 in

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preparation for data transfer across the H.323 network 437. The H.323 network 437 traverses across the Internet to one of many PSTN gateways 411. PSTN gateways 411 form the bridge between the Internet and the public switched telephone network 433. These VoIP gateways are typically located at the local exchange carrier (LEC) in a plethora of individual points of presence throughout the world. Audio telephony calls are terminated at the voice over IP client 413. These termination points may be located throughout the world. Thus, the embodiment shown in Figure 5 allows for the dial-out to standard phones from a client terminal with audio and video capability over IP networks allowing conferencing between multiple remote sites including secure voice over IP audio components over the PSTN.

Figure 6 of the preferred embodiment shows the multiple network domains, the software applications and operating system boundaries and the operations necessary for audio manipulation and transport. It is noted that video accompanies the audio to all conference participants with the exception of the PSTN client 412. For simplicity of illustration, Figure 6 does not show the video conferencing path. The embodiment of Figure 6 includes a local moderator client 401 who is responsible for initiating a dial out for audio conferencing to the PSTN client 412. The local moderator client 401 may also be the initiator of the meeting. In this exemplary embodiment, it may be assumed that the local moderator client 401 has set up the audio video conference with remote audio video clients 418 previous to the dial out for audio conferencing to the PSTN client 412. The local moderator 401 and the remote audio video clients 418 may share audio and video data in a full duplex mode among to all participants with the exception of the PSTN client 412. The PSTN client 412 may share audio from a standard telephone or wireless telephone with all participants in the conference including the local client 401 and remote audio video clients 418. Likewise, the remote audio video clients 418 and the local moderator client 401 may share audio with the remote PSTN client 412. Thus, as indicated in Figure 6, a voice over IP call placed the standard telephone system may bring a remote telephone user into an audio/video conference with multiple remote participants.

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A detailed description of Figure 6 follows. It may be assumed in this embodiment that the functions and features of Figure 6 are running on general-purpose hardware using various software to accomplish the tasks at hand. In alternate embodiments various pieces of Figure 6 may be encompassed in specialized hardware for improved speed performance. Again referring to Figure 6 and starting with the local moderator client 401, the process of call set-up is first performed. The local moderator client 401 uses a computer terminal connected to a local area network that in turn is connected to a wide area network and preferably then connected to a virtual private network 461. The local moderator client 401 is equipped with proprietary software, as depicted in Figure 6, to operate as a dial-out to PSTN application. The application interface allows a ~~point and click~~ point-and-click interface establishing the dial out phone numbers to various possible clients on the PSTN 433. In alternate embodiments "Dial-In" may be used in addition using the same techniques outlined but in a reverse path scenario.

Once the local moderator client 401 has selected the remote PSTN client 412 phone number, a point and click on the name initiates the dial-out process where audio information is to be transport across hybrid networks. General tones, as known in the art according to the ITT standard, are sent from the local moderators computer or terminal to the voice over IP server 409 located somewhere within a global Internet system 435. The voice over IP server 409 may be connected to a virtual private network 461. The voice over IP server 409 may use standard H.323 or SIP network protocol to establish communications as known directly to the PSTN gateway 433. Once the call set-up is complete both the PSTN client 412 and the local moderator client 401 have established a connection. In one embodiment the connection is not established for all the audio participants within the conference at this time. In the embodiment of Figure 6 it is assumed that all the remote audio video clients 418 had previously been in a conference with the local moderator client 401. In alternate embodiments the order at which callers are established may be different. With the foregoing assumption of a conference being established prior to the call-out to PSTN, further definition of the VoIP audio path is specified. The following discloses and further defines the audio paths through three layers of application software 562, 564, 566, including the audio paths through four hybrid network boundaries 510, 520, 435, and 515.

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Starting with the remote client/moderator boundary 510 preceding to the local client voice over IP boundary 520, the Internet interface boundaries 435 and the PSTN telephone network boundary 515, each of these distinct boundaries makes up the method used to transport audio media in a hybrid mixed network system. Remote client/moderator boundary 510 may be established as a virtual private network for transport of audio and video data between the local moderator client 401 and remote audio/video clients 418. In alternate embodiments the virtual private network may be replaced with either switched dedicated network or standard non-secure IP networks. The local clients VoIP boundary 520 may also be a virtual private network connecting audio from the local moderator client 401 to a local or remote voice over IP server 409. In alternate embodiments the local client voice over IP boundary may be established through switched networks or the open Internet. For security purposes all connections that traverse across the open Internet 435 are preferably secured by the use of encryption running within a virtual private network. Alternate embodiments may exclude encryption and virtual private networks including public non-encrypted information, public Internet interfaces or over private switched networks. Continuing with the description of the Internet interface 435, it is assumed ~~with~~ all the information above the PSTN boundary 515 (as indicated in Figure 6) is information which travels within local client local area networks, remote client local area networks, or on wide area networks through the Internet. The final boundary for network transport is the PSTN boundary 515. This is the transport interface between the wide area network (Internet) and gateways that transmit data to and from the PSTN system 433.

Again referring to Figure 6 and assuming the PSTN dial out call has been established as known in the art, (preferred to ITD H.323) the following detailed information regarding the audio processing follows. In one embodiment the interface between the conference application boundary 562 and the operating system interface boundary 564 and the voice over to IP application boundary 566 is taken under consideration. Preferably, the operations performed on the audio occur in ~~real-time~~ real time to achieve full duplex operation. In alternate embodiments a plethora of alternative methods, operating systems application software, and input and output devices may be used to achieve the same goal as described previously. In one embodiment the

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operating system sound interface and API boundaries 564 are used for standard audio mixing. The audio from the local moderator client 401 is preferably mixed to be transported both to the PSTN client 412 and remote audio video clients 418. The conference application boundary 562 is responsible for the application which controls mixing of audio to the operating system sound interface 564. In one embodiment, the operating system sound interface also performs the interface and mixing for the voice over IP application boundary 566. These layers make up the application interface for achieving the operation as described herein. Input from the local moderator client 401 is input to two mixers. First, the moderator audio input 550 is connected to the voice over IP record mixer 568. Secondly, the microphone from the moderator client 401 is also connected to another standard mixture 534. The voice over IP record mixer 568 mixes the audio from the audio decompressors 525 and the local moderator audio 401 in preparation for transport to the voice over IP encoder 522. In addition, the local moderator client 401 sends audio to the audio ~~mixture~~ mixer 534 ~~mixing~~ which mixes the audio from the voice over IP decoder 524 for output to the conference applications 562 local audio encoder ~~520~~ 520a. The audio encoder ~~520~~ 520a combines the PSTN client 412 audio with the local moderator clients 401 audio then encodes the result for compression of the data in preparation for transport across the VPN network 461. The application software audio encoder ~~520~~ 520a delivers both the PSTN client's audio and the local moderator client's audio to remote audio video clients 418.

The local moderator client 401 receives audio from the PSTN client 412, and thus the voice over IP player mixer 569 mixes audio previously decoded by the voice over IP decoder 524 with the audio from the remote client's 418 for presentation to the local speaker 454. All the remote audio video clients 418 hear the audio from the PSTN client 412. The PSTN client 412 transports audio through the PSTN 433 to ~~Internet based~~ Internet-based voice over IP server 409. The voice over IP server transcodes the audio data into a format suitable for transport onto the VoIP application boundary 566. Figure 6 also depicts how audio data from the remote audio video clients 418 is prepared for transport across a VPN network 461. This audio data is input to the application's local decoders for audio decompression 525 prior to the mixing process. The remote audio video clients 418 audio is mixed with the local moderator client audio

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401 in preparation for compression by the VoIP encoder 522. This audio data is then placed in the virtual private network tunnel for transport to the voice over IP server 409 and onto the gateway for audio presentation to the PSTN, terminating at the PSTN client 412.

Figure 6 outlines multiple application software boundaries used to mix audio between local and remote clients in hybrid data networks as indicated by the multiple protocol boundaries 562, 564, 566. Thus, the embodiment allows enhancements to the ability for audio video conferencing with multiple clients and the added value of dialing out to a remote telephone user located somewhere within the global dial-up network 450 (shown in Figure 3). Prior art techniques, such as that known in the ITU H.323 recommendations, have the compressor 522 and decompressors 524 located within the VoIP server running the H.323 network system as indicated in Figure 2 (audio codec 211). This poses a problem for low bit-rate networks especially when video and audio are already part of the transport data. The present embodiment uses highly compressed audio that is compressed and decompressed at the client computer. Thus, the voice over IP server can be located anywhere within the Internet 435 without concern about the limited bandwidth of the first and last mile. In addition, only a single server is required for multiple conferences. The prior art systems, as shown in Figure 1, place at least one or more voice over IP server behind the ~~fire wall~~ firewall and corporate router for transcoding information to the H.323 network. This requires additional cost when a separate server is needed in each location to run the H.323 standard. The present embodiment does not require a separate server at each site, but instead requires that the desktop computer or terminal compress the data prior to transport.

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Claims:

We claim:

~~1. A method for adding a telephone participant to a multi-participant video conference, comprising:~~

~~sending a first message to each of a plurality of multicast appliances over the Internet, wherein the first message comprises a group address which identifies participants;~~

~~each of the multicast appliances receiving the first message;~~

~~establishing a plurality of virtual private networks across the Internet between the multicast appliances;~~

~~wherein one or more of the participants are able to communicate in the multi-participant video conference;~~

~~the telephone participant joining the multi-participant video conference, wherein said joining comprises:~~

~~a first participant contacting the telephone participant~~

~~establishing a phone number with a voIP server;~~

~~the VoIP server communicating with a gateway to call the telephone participant;~~

~~the telephone participant participating in the multi-participant video conference.~~

~~2. The method of claim 1, wherein the telephone participant participating in the multi-participant video conference comprises:~~

~~the telephone participant speaking in the video conference;~~

~~generating digital voice data in response to the telephone participant speaking;~~

~~transforming the digital voice data into IP packets;~~

~~transmitting the IP packets containing the digital voice data to the first participant;~~

~~at a computer system of the first participant, decoding the IP packets containing the digital voice data to produce the digital voice data;~~

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~~mixing the digital voice data of the telephone participant with digital voice data of the first participant;~~

~~providing the mixed digital voice data of the telephone participant and the first participant to the other participants.~~

~~3. The method of claim 2, further comprising:~~

~~mixing the digital voice data of the first participant and the digital voice data of the other participants;~~

~~providing the mixed digital voice data of the first participant and the other participants to the telephone participant~~

~~4. The method of claim 1, wherein the telephone participant participating in the multi-participant video conference comprises:~~

~~the telephone participant speaking in the video conference;~~

~~generating digital voice data in response to the telephone participant speaking;~~

~~transforming the digital voice data into IP packets;~~

~~configuring the IP packet with a group address according to a multicast protocol to create a multicast IP packet;~~

~~encapsulating the multicast IP packet as a unicast packet;~~

~~transmitting the unicast packet over the virtual private networks across the Internet between one or more appliances;~~

~~one or more of the appliances determining the multicast data from the unicast packet; and~~

~~the appliances providing the multicast data to each of the other participants in the group address.~~

~~5. The method of claim 1, further comprising:~~

~~one or more of the participants communicating in the multi-participant video conference, comprising:~~

~~configuring IF packets with digital media data and a group address according to a multicast protocol to create a multicast IP packet; and~~

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~~encapsulating the multicast IF packet as a unicast packet and sending the unicast packet to each of the other participants in the group address.~~

~~6. The method of claim 5, wherein said encapsulating comprises encrypting the multicast IF packet.~~

~~7. The method of claim 1, further comprising:~~

~~one or more of the participants communicating in the multi-participant video conference, comprising;~~

~~generating digital media data;~~

~~transforming the digital media data into IF packets;~~

~~configuring the IF packet with a group address according to a multicast protocol to create a multicast IF packet;~~

~~encapsulating the multicast IF packet as a unicast packet;~~

~~transmitting the unicast packet over the virtual private networks across the Internet between one or more appliances;~~

~~one or more of the appliances determining the multicast data from the unicast packet;~~

~~the appliances providing the multicast data to each of the other participants in the group address;~~

~~presenting the digital media data to the other participants in the video conference.~~

~~8. The method of claim 7, wherein said encapsulating comprises encrypting the multicast IP packet.~~

~~9. A method for adding a telephone participant to a multi-participant audio-video conference, comprising:~~

~~sending a first message to each of a plurality of multicast appliances over the Internet, wherein the first message comprises a group address which identifies the participants;~~

~~each of the multicast appliances receiving the first message;~~

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~~establishing a plurality of virtual private networks across the Internet routes between the multicast appliances;~~

~~one or more of the participants communicating in the multi-participant video conference;~~

~~the telephone participant joining the multi-participant video conference, wherein said joining comprises:~~

~~the telephone participant calling into a gateway server;~~

~~the telephone participant providing conference ID information;~~

~~the PSTN gateway server establishing communication with a conferencing server;~~

~~authenticating the telephone participant; and~~

~~transmitting multicast group information to the gateway server;~~

~~wherein the gateway server is operable to use the multicast group information to enable the telephone participant to participate in the multi-participant video conference.~~

~~10. The method of claim 9, wherein the telephone participant participating in the multi-participant video conference comprises:~~

~~the telephone participant speaking in the video conference;~~

~~generating digital voice data in response to the telephone participant speaking;~~

~~the gateway transforming the digital voice data into IP packets;~~

~~configuring the IP packet with a group address according to a multicast protocol to create a multicast IP packet;~~

~~encapsulating the multicast IP packet as a unicast packet;~~

~~transmitting the unicast packet over the virtual private networks across the Internet between one or more appliances;~~

~~one or more of the appliances determining the multicast data from the unicast packet; and~~

~~the appliances providing the multicast data to each of the other participants in the group address.~~

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~~11. A method for adding a first telephone participant to a multi-participant video conference, comprising:~~

~~sending a first message to each of a plurality of multicast appliances over the Internet, wherein the first message comprises a group address which identifies the participants;~~

~~each of the multicast appliances receiving the first message;~~

~~establishing a plurality of virtual private networks across the Internet routes between the multicast appliances;~~

~~one or more of the participants communicating in the multi-participant video conference; and~~

~~one or more telephone participants joining the multi-participant video conference.~~

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1-11. (Cancelled)

12. (New) A multi-participant conference system comprising:

a public switched telephone network (PSTN) client configured to communicate audio data;

at least one remote client connected to the Internet configured to receive audio-video data;

a first participant client configured to receive audio-video data, wherein the first participant client includes,

a voice over IP encoder that compresses audio data transported to the PSTN client,

a voice over IP decoder that decodes audio data from the PSTN client,

a first audio mixer that mixes the decoded audio data from the PSTN client with the audio-video data from the first participant into a first mixed audio-video data stream, wherein the first mixed audio-video data stream is transmitted to the at least one remote client connected to the Internet;

a second audio mixer that mixes the audio-video data stream from the first participant with the audio-video data stream from the at least one remote client connected to the Internet into a second mixed audio, wherein the second mixed audio is compressed by the voice over IP encoder, which is then transmitted to the PSTN client.

13. (New) The system of claim 12 further comprising a third audio mixer that mixes the audio data from the PSTN client with the audio-video data stream from the at least one remote client into a third mixed audio, wherein the third mixed audio stream and audio-video data stream is transmitted to the first participant.

14. (New) The system of claim 12 wherein data between the first participant and the PSTN client is transported through a virtual private network tunnel.

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15. (New) The system of claim 12 wherein data between the moderator and the remote client is transported through a virtual private network tunnel.

16. (New) The system of claim 12 further comprising a first message communicated to each of a plurality of multicast appliances over the Internet, wherein the first message comprises a group address which identifies participants.

17. (New) The system of claim 16 further comprising each of the multicast appliances configured to receive the first message.

18. (New) The system of claim 17 further comprising a plurality of virtual private networks across the Internet that are established between the multicast appliances.

19. (New) The system of claim 18 wherein the PSTN client is configured to communicate with a PSTN gateway that communicates with a VoIP server, which is communicatively coupled to the plurality of virtual private networks.

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20. (New) A system for supporting a multi-participant conference call comprising:

a first mixer configured to mix a Public Switched Telephone Network (PSTN) client audio data stream with a moderator audio-video data stream into a first mixed data stream;

a first transport output configured to transmit the first mixed data stream to at least one remote client configured to receive the first mixed data stream, the at least one remote client connected to the Internet and configured to generate a remote client audio-video data stream;

a second mixer configured to mix the moderator audio-video data stream with the remote client audio-video data stream into a second mixed data stream; and

a second transport output configured to transmit a mixed audio data stream, corresponding to the second mixed data stream, to the PSTN client.

21. (New) The system of claim 20 further comprising a third mixer configured to mix the audio data from the PSTN client with the audio-video data stream from the remote client into a third mixed data stream and communicating the third mixed data stream to the moderator.

22. (New) The system of claim 20 further comprising a VoIP decoder configured to receive IP packets containing the audio data stream generated by the PSTN client, and further configured to decode the IP packets containing the audio data from the PSTN client.

23. (New) The system of claim 20 further comprising at least one audio decompressor configured to decode IP packets containing the audio-video data stream generated by the remote client.

24. (New) The system of claim 20 wherein the PSTN client audio data stream and the moderator audio-video data stream are configured to be transported across a virtual private network tunnel.

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25. (New) The system of claim 20 wherein the moderator audio-video data stream and the remote client audio-video data stream are configured to be transported across a virtual private network tunnel.

26. (New) The system of claim 25 further comprising an encoder configured to receive the first mixed data stream and encode the first mixed voice data before transmitting the first mixed data stream to the remote client.

27. (New) The system of claim 24 further comprising a VoIP encoder configured to encode the second mixed data stream and encode the second mixed voice data before transmitting the second mixed data stream to the PSTN client.

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28. (New) A method for supporting a multi-participant conference call, the method comprising:

receiving a PSTN audio data stream from a public switched telephone network (PSTN) client;

receiving a moderator audio-video data stream from a moderator;

receiving a remote client audio-video data stream from at least one remote client connected to the Internet;

mixing the PSTN audio data stream with the moderator audio-video data stream into a first mixed data stream;

transmitting the first mixed data stream to the remote client;

mixing the moderator audio-video data stream with the remote client audio-video data stream into a second mixed data stream;

transmitting a mixed audio data stream, corresponding to the second mixed data stream, to the PSTN client.

29. (New) The method of claim 28 further comprising mixing the PSTN audio data stream with the remote client audio-video data stream into a third mixed data stream.

30. (New) The method of claim 28 wherein receiving the PSTN audio data stream from the PSTN client at a moderator client includes receiving IP packets and decoding the IP packets containing the PSTN audio data stream.

31. (New) The method of claim 28 wherein receiving the remote client audio-video data at a moderator computer client includes decoding the IP packets containing the audio-video data generated by the remote client.

32. (New) The method of claim 28 further comprising transporting through a virtual private network the PSTN client audio stream and the moderator audio-video data stream.

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33. (New) The method of claim 28 further comprising transporting the moderator audio-video data stream and the remote client audio-video data stream through a virtual private network.

34. (New) The method of claim 33 further comprising receiving the first mixed data stream and encoding the first mixed voice data before transmitting the first mixed data stream to the remote client.

35. (New) The method of claim 22 further comprising encoding the second mixed data stream and encoding the second mixed voice data before transmitting the second mixed data stream to the PSTN client.

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Abstract of the Disclosure

~~A method which allows standard telephone users to audio conference with video conferencing participants over IP networks in a private secure environment. A dial-out is performed from one or more conference client terminals bridging audio between the Internet and the PSTN networks. The process uses a mixed mode hybrid network architecture for call set-up, initialization and teardown including the method to mix audio at the desktop terminal instead of in a general purpose server as in the prior art. The method conferences video and audio between multiple clients and include audio from a standard telephone network within the conference. A virtual private network connects all of the IP clients together including the voice over IP server used to transcode the proprietary audio into the H.323 standard for transport into the telephony network.~~

A multi-participant conference system and method is described. The multi-participant system includes a PSTN client, at least one remote client and a first participant client. The PSTN client communicates audio data and the remote clients communicate audio-video data. The first participant client includes a voice over IP (VoIP) encoder, a VoIP decoder, a first audio mixer, and a second audio mixer. The VoIP encoder compresses audio data transported to the PSTN client. The VoIP decoder then decodes audio data from the PSTN client. The first audio mixer mixes the decoded audio data from the PSTN client with the audio-video data from the first participant into a first mixed audio-video data stream transmitted to the remote client. The second audio mixer mixes the audio-video data stream from the first participant with the audio-video data stream from each remote client into a second mixed audio transmitted to the PSTN client.

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Substitute Specification (without markings)

This substitute specification without markings contains no new matter.

AUDIO-VIDEO MULTI-PARTICIPANT CONFERENCE SYSTEM

USING PSTN AND INTERNET NETWORKS

Priority Claim

This application is a continuation of U.S. Patent Application No. 12/646,892, filed December 23, 2009, which is a continuation of U.S. Patent Application No. 10/796,560, now U.S. Patent No. 7,664,056, filed March 9, 2004, which claims priority of U.S. Provisional Application No. 60/453,307, filed March 10, 2003; wherein all of the above referenced applications are incorporated by reference in their entirety.

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to computer system architectures and more particularly to audio and video telecommunications for collaboration over hybrid networks.

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Description of the Related Art

Since their introduction in the early 1980's, audio/video conferencing systems ("video conferencing systems") have enabled users to communicate between remote sites using telephone lines based on dedicated or switched networks. Recently, technology and products to achieve the same over Internet Protocol have been attempted. Many such systems have emerged on the marketplace. Such systems produce low-frame-rate and low quality communications due to the unpredictable nature of the Internet. Such connections have been known to produce long latencies with limited bandwidth, resulting in jerky video, dropped audio and loss of lip sync.

Therefore, most video conferencing solutions have relied on dedicated switched networks such as T1/T3, ISDN or ATM. These systems have the disadvantage of higher cost and complexity and a lack of flexibility due largely to interoperability issues and higher cost client equipment. High costs are typically related to expensive conferencing hardware and dedicated pay-per-minute communications usage. Most often these dedicated communications circuits are switched circuits which use a fixed bandwidth allocation.

In most prior art systems the public switched telephone network (PSTN) is used to transfer audio during conferencing and collaboration with remote parties. It is known that quality of audio reception is poor over typical prior art Internet protocol (IP) systems. Prior art audio/video conferencing systems which use IP networks for audio and video transport lack the ability to terminate audio to client end systems through both PSTN and IP networks. Thus, it is desirable to achieve a hybrid mix of audio and video data over PSTN and IP-based audio/video conferencing to achieve full duplex real-time operation for all conference participants.

Modem voice over IP telephony systems have used the H.323 standard from the international telecommunications union (1TU). The H.323 standard focuses on the transmission of audio and video information through the Internet or switched private networks. Figure 1 illustrates a prior art H.323 system. The block diagram of Figure 1

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includes a number of major components, including the general Internet 435, Internet H.323 bridges or gateways 411, telecommunications PSTN 433 (Public Switched Telephone Network), wireless and land-line phone handsets 412/413, standard Internet router 453, an optional gatekeeper 205, a multipoint control unit 203, a standard local area network 457, a voice over IP server running the H.323 protocol 201, and multiple I/O and display terminals 455. Figure 1 is an example of the prior art conferencing system used between hybrid networks connecting the PSTN and Internet. Hybrid networks are used to communicate audio on internal LAN and WAN networks as well as transfer of audio to the existing telephone or PSTN network. While the H.323 recommendation allows for video conferencing, the prior art systems use private switched networks to establish transport that require expensive H.323 bridges between dedicated networks and the PSTN. Each of the components in Figure 1 serves this purpose to achieve audio telecommunications between multiple parties.

Referring again to Figure 1, the components of Figure 1 are interconnected as follows. Prior art technology uses PC or client terminals 455 connected through a local area network 457 to either a data server or a specialized audio/video server 201. The network server 201 contains the application necessary to generate the H.323 network protocol. The data server 201 may be connected to a local gatekeeper 205 that is responsible for management control functions. As known the gatekeeper 205 is responsible for various duties such as admission control, status determination, and bandwidth management. Data server 201 functions are specified and handled through the ITU-H.225.0RAS recommendations. In addition, management control unit (MCU) 203 is connected to the data server 201. The multipoint control unit of a 203 is required by the eight-step ITU- 5 H.323 recommendation for flexibility to negotiate end points and determine compatible setups for any conference media correspondents. The multipoint control unit 203 enables communication between three or more end points. Similar to a multipoint bridge, the gatekeeper 205 and the multipoint control unit 203 are optional components of the H.323 enabled network. Another useful job of the multipoint control unit 203 is to determine whether to unicast or multicast the audio or video streams. As known by one skilled in the art, these decisions are dependent on the capability of the underlying network and the topology of the multipoint conference. The multipoint control

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unit 203 determines the capabilities of each client terminal 455 and status each of media stream.

Again referring to Figure 1, a standard network router 453 is connected between the local area network 457 and the Internet 435. At the outer edges of the Internet, "points of presence" are located at multiple end points or call termination sites. Gateways 411 are used to the transcode the H.323 network information onto the PSTN 433. Standard telephone handsets 413 or wireless phones 412 are connected to the PSTN telephony system.

Figure 2 illustrates the embodiment of the H.323 protocol stack 200, its components and their interfaces to the local area network computers at the network interface 300. The input and control devices 455 along with a local area network 457 of Figure 1 are shown in Figure 2, consisting of the audio input output block 452, the video input and output block 451, the system control unit and data collaboration unit 459. These input devices are largely responsible for the delivery of media data to the H.323 protocol stack 200 shown in Figure 2.

Again referring to Figure 2, the sub blocks of functionality that make up the H.323 protocol stack 200 is described. The H.323 protocol stack consists of an audio codec 214, and a video CoDec 213 connected to the audio/video input and output blocks 452 and 451, respectively. The audio and video CoDecs are responsible for compression and decompression of the audio and video sources. The real-time network protocol component 215 is connected to the audio video CoDecs and is also responsible for preparation of the media data for transport according to the RTP (real-time protocol) recommendations.

Again referring to the prior art system of Figure 2, the H.323 protocol stack has a system control unit 459 which connects to multiple control blocks within the H.323 protocol stack 200. The system control unit connects to the RTC Protocol block 217 for real time transport of the control information used to set-up and tear down the conference. The system control unit 459 also connects to the call-signaling units 221 and 219 for call signaling protocols and media stream packetization application used for

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packet-based multimedia communications. The system control unit 459 also connects to the control signaling block 223 used for control of protocols for multimedia communications. Lastly, the H.323 recommendation defines a data collaboration capability as known and outlined in the T.120 data collaboration unit 225.

All of the defined blocks make up the H.323 protocol network interface to the Transport protocol and network interface unit 300 for transport of data through the modem or router 453 to the Internet 435.

Summary of the Invention

A multi-participant conference system is described. The multi-participant system comprises a public switched telephone network (PSTN) client, at least one remote client, and a first participant client. The PSTN client is configured to communicate audio data. Each of the remote clients is connected to the Internet and is configured to receive audio-video data. The first participant client is configured to receive audio-video data. The first participant client includes a voice over IP (VoIP) encoder, a VoIP decoder, a first audio mixer, and a second audio mixer. The VoIP encoder compresses audio data transported to the PSTN client. The VoIP decoder then decodes audio data from the PSTN client. The first audio mixer mixes the decoded audio data from the PSTN client with the audio-video data from the first participant into a first mixed audio-video data stream. The first mixed audio-video data stream is then transmitted to the at least one remote client connected to the Internet. The second audio mixer mixes the audio-video data stream from the first participant with the audio-video data stream from each remote client into a second mixed audio. The second mixed audio is compressed by the VoIP encoder, which is then transmitted to the PSTN client.

A system for supporting a multi-participant conference call is also described. The system includes a first mixer, a first transport output, a second mixer, and a second transport output. The first mixer is configured to mix a Public Switched Telephone Network (PSTN) client audio data stream with a moderator audio-video data stream into a first mixed data stream. The first transport output configured to transmit the first mixed data stream to at least one remote client that receives the first mixed data

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stream. Each remote client is connected to the Internet and configured to generate a remote client audio-video data stream. The second mixer mixes the moderator audio-video data stream with the remote client audio-video data stream into a second mixed data stream. The second transport output configured to transmit a mixed audio data stream, corresponding to the second mixed data stream, to the PSTN client.

A method for supporting a multi-participant conference call is also described. The method includes receiving a PSTN audio data stream from a public switched telephone network (PSTN) client. Also, the method includes receiving a moderator audio-video data stream from a moderator. Additionally, the method includes receiving a remote client audio-video data stream from at least one remote client connected to the Internet. The method then mixes the PSTN audio data stream with the moderator audio-video data stream into a first mixed data stream, and transmits the first mixed data stream to the remote client. The method also mixes the moderator audio-video data stream with the remote client audio-video data stream into a second mixed data stream. The method then proceeds to transmit a mixed audio data stream, corresponding to the second mixed data stream, to the PSTN client.

Brief Description of the Drawings

A better understanding of the present invention can be obtained when the following detailed description of the preferred embodiment is considered in conjunction with the following drawings, in which:

Figure 1 illustrates a typical H.323 audio and video conferencing system implemented in accordance with prior art;

Figure 2 illustrates an H.323 protocol stack and its components implemented in accordance with prior art;

Figure 3 illustrates one embodiment of the present invention;

Figure 4 illustrates an embodiment using multicast Protocol;

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Figure 5 illustrates the audio and video data flow over hybrid networks; and

Figure 6 illustrates the local client data mixing used in the preferred embodiment.

Detailed Description of the Preferred Embodiment

Incorporation by Reference

The following applications and references are hereby incorporated by reference as though fully and completely set forth herein.

U.S. Application Serial No. 10/446,407 titled "Transmission Of Independently Compressed Video Objects Over Internet Protocol", Dye et al. filed May 28,2003

U.S. Application Serial No. 10/620,684 titled "Assigning Prioritization During Encode Of Independently Compressed Objects, Dye, et al. filed on July 16, 2003.

International Telecommunications Union Recommendation H.323, Titled "Packet Based Multimedia Communication System." November, 2000

International Telecommunications Union Recommendation H.261, Titled "Video Coding for Audio Visual Services at Px64 kbps."

International Telecommunications Union Recommendation H.263, Titled "Video Coding for Low Bit-Rate Communications" February, 1998

One embodiment of the present invention uses a decentralized model for multipoint conferencing. The multipoint control unit insures communication capability once the media stream is transcoded to the H.323 standard as known. However, this embodiment mixes media streams at each terminal prior to multicast.

Figure 3 illustrates one embodiment of the invention. This embodiment allows audio video and data collaboration information to be securely transferred between a plurality of local and remote clients preferably within a virtual private network. This embodiment provides the ability for a moderator (single member of the conference) to dial out from a desktop computer or terminal (using a novel hybrid network structure) connecting an external telephone user's audio into the audio/video conference. The

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embodiment integrates full duplex audio, video, and data connections between clients conferencing on the Internet and clients conferencing on standard telephone systems. The Internet/PSTN hybrid network is the medium used for transport. Figure 3 depicts the necessary equipment and protocols to complete the dial out to PSTN network method and process.

Now referring to Figure 3, the voice over IP moderator 401 (call initiator or caller) typically has a number of peripherals used for real input output devices at the desktop. These include a client computing devices such as a PC or other computer 459, a client terminal 455 including a keyboard and mouse for input output control, a standard desktop telephone 457, a video input device or camera 451 and the audio input device, microphone 452. In one embodiment each conference call connected to the Internet will have similar peripheral hardware devices. Figure 3 illustrates a multi-party virtual conference connected over the Internet. Internet clients include audio video client 415, audio video client 418, and audio video client number and 417. In addition, Figure 3 shows two possible telephony clients using standard wired 413 or wireless telephone 412 systems. PSTN client #1 412 is connected to a wireless cell phone that in turn is connected to the global dial network 450, as specified by the PSTN 433. Remote telephony user client #2 413 is connected to a standard telephone handset 413 which is connected to the global dial network 450 based on the PSTN 433.

Again referring to Figure 3 the Internet-based clients 401, 415, 418, and 417 are connected through routers or modems 453 preferably in a virtual private network configuration 461. A virtual private network bridge 461 is used to connect local and remote clients together within a secure private network. A local connection from the VPN bridge 407 to the voice over IP server 409 is used to transfer conference audio from any participant on the IP network to any participant in the PSTN. Thus, the voice over IP server 409 is responsible for transcoding audio information from the virtual private network 461 to and from the PSTN gateway 411, thus bridging the PSTN and VPN together.

Figure 4 illustrates one embodiment of the present invention. The system of Figure 4 performs audio transport between multiple client groups who all share the

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same multicast group address such that audio/video and data may be shared interactively without the need of central servers. Multicast protocol and encapsulated media packets are implemented so that media data may be routed through public or private IP networks without the need for special hardware and software during the majority of the network transport. Figure 4 shows a system of virtual networks that interconnect as a virtual private network 423. Each VPN tunnel can be connected in a series or star topology between one or more multicasting appliances 447-457. One or more central servers or VPN bridge(s) 407 are at the center of the network topology. Multicasting enabled appliances 447, 449, 451, 453, 455, and 457 are used at the origination or termination points for audio, video, or data (media data) to and from the backbone of the transport path. PSTN gateways are used to provide "points of presence" throughout and are responsible for origination or termination of audio data on and off of the PSTN from the IP network topology. Multicast enabled routing allows remote clients to be PC's or PSTN gateways which become "Listeners" of media data. Thus, media data is presented or broadcast onto a network with one or more group addresses. This method uses less bandwidth and reduces latency during transport.

Again referring to Figure 4, PSTN group #1 412 has three analog telephones which are switched into a PSTN gateway and VoIP server 471 which is networked over public or private network connection to a multicast enabled VPN appliance 447. Appliance 447 is connected to a VPN bridge server 407 also by means of a virtual private network. The VPN Bridge 407 is used to authenticate clients, assign multicast IP group addresses to various PC clients and VoIP gateway servers. In addition the VPN Bridge Server 407 may have additional meeting room or conferencing features necessary to carry out a multi-party conference. Connected to the VPN Bridge 407 are various virtual private networks which form network tunnels to one or more other multicasting appliances 449, 451, 453, 455, 457 which connect to one or more PSTN gateways typically located in geographically dispersed areas.

For the purpose of the illustration of Figure 4, PSTN group #1 412 is audio conferencing with PSTN client #3 414 and PSTN client #5 416, each of which are audio conferencing with Audio/Video client group #4 415. In the illustration of Figure 4, each

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member of audio/video client group #4 share audio with all the clients and video with each other. One example may be illustrated again referring to Figure 4. If telephone client #5 416 is talking, the analog audio is converted from switched network (PSTN) to IP in the VoIP/PSTN gateway 475. The digital IP is routed via Internet to an appliance 455 at the edge of the network typically co-located with the VoIP/PSTN gateway 475. The appliance has been configured to have a virtual private network creating a tunnel through Internet to appliance 453 which also has Internet-based virtual private tunnels to appliance 457 and appliance 447. Audio from PSTN client #5 416 is broadcast from appliance 457 whereby all the audio/video client PC's of group #4 are "listeners" and receive the audio from PSTN client 416 at the same time. Additionally, PSTN client #5's 416 audio is routed over another virtual private network to one or more appliances in this case appliances 447 and 449. PSTN Client group #1 412 are also "listeners" of the multicast group as well as PSTN Client #3 414. Thus, audio is broadcast to multiple audio devices in both IP networks and the PSTN using a unique group address and a virtual private network structure. Interactivity is gained by using the same process no matter who in the group is the broadcaster of audio or video.

Figure 5 shows a more detailed block diagram of the embodiment of the present invention. The moderator client #1 401 initiates the call using the application code running on the voice over IP server 409. Call initiation and call transfer may be accomplished through a VPN tunnel 421 connected to the moderator client 401. Two connections to the Moderator client #1 401 through the VPN tunnel 421 are established. The first connection connects the VoIP conference data for call initiation, set-up and control 405. The second connection 403 through the VPN tunnel connects the conference audio and video 403 between the moderator client 401 and multiple remote clients 415, 417, 413 connected to the Internet. The VPN tunnel 421 is connected into the VPN bridge 407 which may be located within the Internet 435 at either local or remote sites. As indicated in Figure 5, the VPN bridge 407 is responsible for connecting and establishing the virtual private network used for secure conferencing. In the embodiment of the present invention the VPN bridge 407 bridges all the tunnels for data transfer. Thus, VPN tunnel 421, VPN tunnel 423 and VPN tunnel 425 are on the same virtual private network. Alternate embodiments may include a plethora of tunnels

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connected to through a single VPN bridge or multiple VPN bridges based on scalability of the system. An additional tunnel containing the conference voice over IP audio and call set-up data 405 is connected to a separate voice over IP server 409. The server 409 is responsible for transcoding the voice over IP audio and call set-up control 405 in preparation for data transfer across the H.323 network 437. The H.323 network 437 traverses across the Internet to one of many PSTN gateways 411. PSTN gateways 411 form the bridge between the Internet and the public switched telephone network 433. These VoIP gateways are typically located at the local exchange carrier (LEC) in a plethora of individual points of presence throughout the world. Audio telephony calls are terminated at the voice over IP client 413. These termination points may be located throughout the world. Thus, the embodiment shown in Figure 5 allows for the dial-out to standard phones from a client terminal with audio and video capability over IP networks allowing conferencing between multiple remote sites including secure voice over IP audio components over the PSTN.

Figure 6 of the preferred embodiment shows the multiple network domains, the software applications and operating system boundaries and the operations necessary for audio manipulation and transport. It is noted that video accompanies the audio to all conference participants with the exception of the PSTN client 412. For simplicity of illustration, Figure 6 does not show the video conferencing path. The embodiment of Figure 6 includes a local moderator client 401 who is responsible for initiating a dial out for audio conferencing to the PSTN client 412. The local moderator client 401 may also be the initiator of the meeting. In this exemplary embodiment, it may be assumed that the local moderator client 401 has set up the audio video conference with remote audio video clients 418 previous to the dial out for audio conferencing to the PSTN client 412. The local moderator 401 and the remote audio video clients 418 may share audio and video data in a full duplex mode among to all participants with the exception of the PSTN client 412. The PSTN client 412 may share audio from a standard telephone or wireless telephone with all participants in the conference including the local client 401 and remote audio video clients 418. Likewise, the remote audio video clients 418 and the local moderator client 401 may share audio with the remote PSTN client 412. Thus, as indicated in Figure 6, a voice over IP call placed the standard telephone system may

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bring a remote telephone user into an audio/video conference with multiple remote participants.

A detailed description of Figure 6 follows. It may be assumed in this embodiment that the functions and features of Figure 6 are running on general-purpose hardware using various software to accomplish the tasks at hand. In alternate embodiments various pieces of Figure 6 may be encompassed in specialized hardware for improved speed performance. Again referring to Figure 6 and starting with the local moderator client 401, the process of call set-up is first performed. The local moderator client 401 uses a computer terminal connected to a local area network that in turn is connected to a wide area network and preferably then connected to a virtual private network 461. The local moderator client 401 is equipped with proprietary software, as depicted in Figure 6, to operate as a dial-out to PSTN application. The application interface allows a point-and-click interface establishing the dial out phone numbers to various possible clients on the PSTN 433. In alternate embodiments "Dial-In" may be used in addition using the same techniques outlined but in a reverse path scenario.

Once the local moderator client 401 has selected the remote PSTN client 412 phone number, a point and click on the name initiates the dial-out process where audio information is to be transport across hybrid networks. General tones, as known in the art according to the ITT standard, are sent from the local moderators computer or terminal to the voice over IP server 409 located somewhere within a global Internet system 435. The voice over IP server 409 may be connected to a virtual private network 461. The voice over IP server 409 may use standard H.323 or SIP network protocol to establish communications as known directly to the PSTN gateway 433. Once the call set-up is complete both the PSTN client 412 and the local moderator client 401 have established a connection. In one embodiment the connection is not established for all the audio participants within the conference at this time. In the embodiment of Figure 6 it is assumed that all the remote audio video clients 418 had previously been in a conference with the local moderator client 401. In alternate embodiments the order at which callers are established may be different. With the foregoing assumption of a conference being established prior to the call-out to PSTN, further definition of the VoIP

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audio path is specified. The following discloses and further defines the audio paths through three layers of application software 562, 564, 566, including the audio paths through four hybrid network boundaries 510, 520, 435, and 515.

Starting with the remote client/moderator boundary 510 preceding to the local client voice over IP boundary 520, the Internet interface boundaries 435 and the PSTN telephone network boundary 515, each of these distinct boundaries makes up the method used to transport audio media in a hybrid mixed network system. Remote client/moderator boundary 510 may be established as a virtual private network for transport of audio and video data between the local moderator client 401 and remote audio/video clients 418. In alternate embodiments the virtual private network may be replaced with either switched dedicated network or standard non-secure IP networks. The local clients VoIP boundary 520 may also be a virtual private network connecting audio from the local moderator client 401 to a local or remote voice over IP server 409. In alternate embodiments the local client voice over IP boundary may be established through switched networks or the open Internet. For security purposes all connections that traverse across the open Internet 435 are preferably secured by the use of encryption running within a virtual private network. Alternate embodiments may exclude encryption and virtual private networks including public non-encrypted information, public Internet interfaces or over private switched networks. Continuing with the description of the Internet interface 435, it is assumed all the information above the PSTN boundary 515 (as indicated in Figure 6) is information which travels within local client local area networks, remote client local area networks, or on wide area networks through the Internet. The final boundary for network transport is the PSTN boundary 515. This is the transport interface between the wide area network (Internet) and gateways that transmit data to and from the PSTN system 433.

Again referring to Figure 6 and assuming the PSTN dial out call has been established as known in the art, (preferred to ITD H.323) the following detailed information regarding the audio processing follows. In one embodiment the interface between the conference application boundary 562 and the operating system interface boundary 564 and the voice over to IP application boundary 566 is taken under

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consideration. Preferably, the operations performed on the audio occur in real time to achieve full duplex operation. In alternate embodiments a plethora of alternative methods, operating systems application software, and input and output devices may be used to achieve the same goal as described previously. In one embodiment the operating system sound interface and API boundaries 564 are used for standard audio mixing. The audio from the local moderator client 401 is preferably mixed to be transported both to the PSTN client 412 and remote audio video clients 418. The conference application boundary 562 is responsible for the application which controls mixing of audio to the operating system sound interface 564. In one embodiment, the operating system sound interface also performs the interface and mixing for the voice over IP application boundary 566. These layers make up the application interface for achieving the operation as described herein. Input from the local moderator client 401 is input to two mixers. First, the moderator audio input 550 is connected to the voice over IP record mixer 568. Secondly, the microphone from the moderator client 401 is also connected to another standard mixture 534. The voice over IP record mixer 568 mixes the audio from the audio decompressors 525 and the local moderator audio 401 in preparation for transport to the voice over IP encoder 522. In addition, the local moderator client 401 sends audio to the audio mixer 534 which mixes the audio from the voice over IP decoder 524 for output to the conference applications 562 local audio encoder 520a. The audio encoder 520a combines the PSTN client 412 audio with the local moderator clients 401 audio then encodes the result for compression of the data in preparation for transport across the VPN network 461. The application software audio encoder 520a delivers both the PSTN client's audio and the local moderator client's audio to remote audio video clients 418.

The local moderator client 401 receives audio from the PSTN client 412, and thus the voice over IP player mixer 569 mixes audio previously decoded by the voice over IP decoder 524 with the audio from the remote client's 418 for presentation to the local speaker 454. All the remote audio video clients 418 hear the audio from the PSTN client 412. The PSTN client 412 transports audio through the PSTN 433 to Internet-based voice over IP server 409. The voice over IP server transcodes the audio data into a format suitable for transport onto the VoIP application boundary 566. Figure 6 also

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depicts how audio data from the remote audio video clients 418 is prepared for transport across a VPN network 461. This audio data is input to the application's local decoders for audio decompression 525 prior to the mixing process. The remote audio video clients 418 audio is mixed with the local moderator client audio 401 in preparation for compression by the VoIP encoder 522. This audio data is then placed in the virtual private network tunnel for transport to the voice over IP server 409 and onto the gateway for audio presentation to the PSTN, terminating at the PSTN client 412.

Figure 6 outlines multiple application software boundaries used to mix audio between local and remote clients in hybrid data networks as indicated by the multiple protocol boundaries 562, 564, 566. Thus, the embodiment allows enhancements to the ability for audio video conferencing with multiple clients and the added value of dialing out to a remote telephone user located somewhere within the global dial-up network 450 (shown in Figure 3). Prior art techniques, such as that known in the ITU H.323 recommendations, have the compressor 522 and decompressors 524 located within the VoIP server running the H.323 network system as indicated in Figure 2 (audio codec 211). This poses a problem for low bit-rate networks especially when video and audio are already part of the transport data. The present embodiment uses highly compressed audio that is compressed and decompressed at the client computer. Thus, the voice over IP server can be located anywhere within the Internet 435 without concern about the limited bandwidth of the first and last mile. In addition, only a single server is required for multiple conferences. The prior art systems, as shown in Figure 1, place at least one or more voice over IP server behind the firewall and corporate router for transcoding information to the H.323 network. This requires additional cost when a separate server is needed in each location to run the H.323 standard. The present embodiment does not require a separate server at each site, but instead requires that the desktop computer or terminal compress the data prior to transport.

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Claims:

We claim:

1-11. (Cancelled)

12. (New) A multi-participant conference system comprising:

a public switched telephone network (PSTN) client configured to communicate audio data;

at least one remote client connected to the Internet configured to receive audio-video data;

a first participant client configured to receive audio-video data, wherein the first participant client includes,

a voice over IP encoder that compresses audio data transported to the PSTN client,

a voice over IP decoder that decodes audio data from the PSTN client,

a first audio mixer that mixes the decoded audio data from the PSTN client with the audio-video data from the first participant into a first mixed audio-video data stream, wherein the first mixed audio-video data stream is transmitted to the at least one remote client connected to the Internet;

a second audio mixer that mixes the audio-video data stream from the first participant with the audio-video data stream from the at least one remote client connected to the Internet into a second mixed audio, wherein the second mixed audio is compressed by the voice over IP encoder, which is then transmitted to the PSTN client.

13. (New) The system of claim 12 further comprising a third audio mixer that mixes the audio data from the PSTN client with the audio-video data stream from the at least one remote client into a third mixed audio, wherein the third mixed audio stream and audio-video data stream is transmitted to the first participant.

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14. (New) The system of claim 12 wherein data between the first participant and the PSTN client is transported through a virtual private network tunnel.

15. (New) The system of claim 12 wherein data between the moderator and the remote client is transported through a virtual private network tunnel.

16. (New) The system of claim 12 further comprising a first message communicated to each of a plurality of multicast appliances over the Internet, wherein the first message comprises a group address which identifies participants.

17. (New) The system of claim 16 further comprising each of the multicast appliances configured to receive the first message.

18. (New) The system of claim 17 further comprising a plurality of virtual private networks across the Internet that are established between the multicast appliances.

19. (New) The system of claim 18 wherein the PSTN client is configured to communicate with a PSTN gateway that communicates with a VoIP server, which is communicatively coupled to the plurality of virtual private networks.

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20. (New) A system for supporting a multi-participant conference call comprising:

a first mixer configured to mix a Public Switched Telephone Network (PSTN) client audio data stream with a moderator audio-video data stream into a first mixed data stream;

a first transport output configured to transmit the first mixed data stream to at least one remote client configured to receive the first mixed data stream, the at least one remote client connected to the Internet and configured to generate a remote client audio-video data stream;

a second mixer configured to mix the moderator audio-video data stream with the remote client audio-video data stream into a second mixed data stream; and

a second transport output configured to transmit a mixed audio data stream, corresponding to the second mixed data stream, to the PSTN client.

21. (New) The system of claim 20 further comprising a third mixer configured to mix the audio data from the PSTN client with the audio-video data stream from the remote client into a third mixed data stream and communicating the third mixed data stream to the moderator.

22. (New) The system of claim 20 further comprising a VoIP decoder configured to receive IP packets containing the audio data stream generated by the PSTN client, and further configured to decode the IP packets containing the audio data from the PSTN client.

23. (New) The system of claim 20 further comprising at least one audio decompressor configured to decode IP packets containing the audio-video data stream generated by the remote client.

24. (New) The system of claim 20 wherein the PSTN client audio data stream and the moderator audio-video data stream are configured to be transported across a virtual private network tunnel.

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25. (New) The system of claim 20 wherein the moderator audio-video data stream and the remote client audio-video data stream are configured to be transported across a virtual private network tunnel.

26. (New) The system of claim 25 further comprising an encoder configured to receive the first mixed data stream and encode the first mixed voice data before transmitting the first mixed data stream to the remote client.

27. (New) The system of claim 24 further comprising a VoIP encoder configured to encode the second mixed data stream and encode the second mixed voice data before transmitting the second mixed data stream to the PSTN client.

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28. (New) A method for supporting a multi-participant conference call, the method comprising:

receiving a PSTN audio data stream from a public switched telephone network (PSTN) client;

receiving a moderator audio-video data stream from a moderator;

receiving a remote client audio-video data stream from at least one remote client connected to the Internet;

mixing the PSTN audio data stream with the moderator audio-video data stream into a first mixed data stream;

transmitting the first mixed data stream to the remote client;

mixing the moderator audio-video data stream with the remote client audio-video data stream into a second mixed data stream;

transmitting a mixed audio data stream, corresponding to the second mixed data stream, to the PSTN client.

29. (New) The method of claim 28 further comprising mixing the PSTN audio data stream with the remote client audio-video data stream into a third mixed data stream.

30. (New) The method of claim 28 wherein receiving the PSTN audio data stream from the PSTN client at a moderator client includes receiving IP packets and decoding the IP packets containing the PSTN audio data stream.

31. (New) The method of claim 28 wherein receiving the remote client audio-video data at a moderator computer client includes decoding the IP packets containing the audio-video data generated by the remote client.

32. (New) The method of claim 28 further comprising transporting through a virtual private network the PSTN client audio stream and the moderator audio-video data stream.

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33. (New) The method of claim 28 further comprising transporting the moderator audio-video data stream and the remote client audio-video data stream through a virtual private network.

34. (New) The method of claim 33 further comprising receiving the first mixed data stream and encoding the first mixed voice data before transmitting the first mixed data stream to the remote client.

35. (New) The method of claim 22 further comprising encoding the second mixed data stream and encoding the second mixed voice data before transmitting the second mixed data stream to the PSTN client.

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Abstract of the Disclosure

A multi-participant conference system and method is described. The multi-participant system includes a PSTN client, at least one remote client and a first participant client. The PSTN client communicates audio data and the remote clients communicate audio-video data. The first participant client includes a voice over IP (VoIP) encoder, a VoIP decoder, a first audio mixer, and a second audio mixer. The VoIP encoder compresses audio data transported to the PSTN client. The VoIP decoder then decodes audio data from the PSTN client. The first audio mixer mixes the decoded audio data from the PSTN client with the audio-video data from the first participant into a first mixed audio-video data stream transmitted to the remote client. The second audio mixer mixes the audio-video data stream from the first participant with the audio-video data stream from each remote client into a second mixed audio transmitted to the PSTN client.

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Electronic Acknowledgement Receipt

EFS ID:	14202028
Application Number:	13674233
International Application Number:	
Confirmation Number:	5197
Title of Invention:	AUDIO-VIDEO MULTI-PARTICIPANT CONFERENCE SYSTEM USING PSTN AND INTERNET NETWORKS
First Named Inventor/Applicant Name:	Thomas Dye
Customer Number:	48008
Filer:	Michael A. Kerr/Julie Dawes
Filer Authorized By:	Michael A. Kerr
Attorney Docket Number:	MEET 12.003
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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Transmittal of New Application	utl_transmittal.pdf	141393 0b7d8ca45b15eef17e59458b039486304d828104	no	2

Warnings:	
Information:	

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2	Application Data Sheet	app_data_sheet.pdf	1396825 449d6e85149be1185e504c7385032dae9dcf95c4	no	6
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Information:					
3	Oath or Declaration filed	declaration.pdf	367371 e9b39cfce773bf82d278c3e3ae200ac318a67e5e	no	3
Warnings:					
Information:					
4	Power of Attorney	poa.pdf	69300 a7032b36d96bf1e69e4beb4bbfb4255c713fcc79	no	1
Warnings:					
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5	Drawings-only black and white line drawings	figs.pdf	179769 b6553adb9fd1812cba1a0798533a57fdb53a78fc	no	6
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6		spec_original.pdf	96673 9cfd45e0164d969083a9430f5d38776157b5a224	yes	22

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	Claims	17	21
	Abstract	22	22

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	Multipart Description/PDF files in .zip description		
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	Claims	19	29

	Abstract		30	30	
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	Specification	1	15
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