

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

ZOOM COMMUNICATIONS, INC.,

Petitioner

v.

RICOH COMPANY, LTD.

Patent Owner

IPR2026-00453

U.S. Patent No. 10,931,917

DECLARATION OF DR. KEVIN C. ALMEROOTH

REGARDING U.S. PATENT NO. 10,931,917

TABLE OF CONTENTS

	Page
I. INTRODUCTION	1
A. Engagement	1
B. Background and Qualifications	1
C. Compensation and Prior Testimony	7
D. Information Considered.....	7
II. LEGAL STANDARDS FOR PATENTABILITY	8
III. TECHNOLOGY BACKGROUND.....	11
A. Video Conferencing Between Authenticated Terminals via Relay Servers Was Well-Known.....	11
B. Sharing Content and Display Data During Video Conferences Was Well-Known.....	14
C. Connecting External Input Devices to Conference Terminals Without Requiring Separate Authentication Was Well-Known.....	16
D. Transmitting Multiple Types of Data Over an Established Communication Session Was Well-Known.....	17
E. Transmitting Programs to Connected Peripheral Devices Upon Connection, with Conditional Installation, Was Well-Known	19
IV. THE '917 PATENT	21
A. Overview	21
B. Prosecution History	23
V. LEVEL OF ORDINARY SKILL IN THE ART	25
VI. CLAIM CONSTRUCTION	26
VII. OVERVIEW OF CHALLENGE.....	26
VIII. THE ASSERTED GROUNDS OF INVALIDITY	27
A. Ground 1: Toya in view of Tucker Renders Obvious Claims 1-3, 7-10, 14-15	27
1. Motivation to Combine	27

TABLE OF CONTENTS (continued)

	Page
2. Preambles	32
a) [1.pre] “A first transmission terminal comprising: processing circuitry configured to”	32
b) [8.pre] “A method, implemented by a first transmission terminal, comprising:”	35
c) [15.pre] “A non-transitory computer readable medium that stores a program that when executed by a first transmission terminal causes the first transmission terminal to perform a method comprising:”	36
3. [1.a]/[8.a]/[15.a] “obtain first video data captured by a camera,”	38
4. [1.b]/[8.b]/[15.b] “log into a management system by transmitting a login request to the management system,”	40
5. [1.c]/[8.c]/[15.c] “establish a communication session for transmitting the first video data to a second transmission terminal that has logged into the management system,”	43
6. [1.d]/[8.d]/[15.d] “transmit the first video data using the established communication session”	44
7. [1.e]/[8.e]/[15.e] “when an external input apparatus that has not logged into the management system is connected with the first transmission terminal during the first video data being displayed on a display screen of the second transmission terminal, receive, from the external input apparatus, second video data obtained in the external input apparatus, and”	46
8. [1.f]/[8.f]/[15.f] “in response to receiving the second video data, transmit the first video data and the second video data for sharing with the second transmission terminal using the established communication session.”	52

TABLE OF CONTENTS (continued)

	Page
9. Claim 2/9 “The first transmission terminal according to claim 1, wherein the processing circuitry is configured to transmit the first video data and the second video data via a relay apparatus.”	53
10. [3.a]/[10.a] “The first transmission terminal according to claim 2, wherein the relay apparatus is selected from a plurality of relay apparatuses, and”	57
11. [3.b]/[10.b] “the processing circuitry receives, from the management system, terminal identification information for identifying another transmission terminal that has requested a start of communication from among a plurality of transmission terminals.”	59
12. [7.a]/[14.a] “The first transmission terminal according to claim 1, wherein the processing circuitry is configured to receive, from the management system, information of destination candidates associated with the first transmission terminal,”	63
13. [7.b]/[14.b] “receive a selection from among the received information of the destination candidates, and”	65
14. [7.c]/[14.c] “establish the communication session with the second transmission terminal corresponding to information of the thus selected destination candidate.”	66
 B. Ground 2: Toya in view of Tucker and Further in View of Chang Render Obvious Claims 4-6 and 11-13.....	 67
1. Motivation to Combine	70
2. [4.a]/[11.a] “The first transmission terminal according to claim 1, wherein the processing circuitry receives, from the external input apparatus, a request for permission to execute a program that is for obtaining data in the external input apparatus, and”	74

TABLE OF CONTENTS (continued)

	Page
3. [4.b]/[11.b] “in response to permission of the request, the program is executed in the external input apparatus, and thus, the processing circuitry receives, from the external input apparatus, the second video data obtained in the external input apparatus.”	78
4. Claim 5/12 “The first transmission terminal according to claim 4, wherein the processing circuitry is configured to transmit the program to the external input apparatus.”	80
5. Claim 6/13 “The first transmission terminal according to claim 5, wherein if the program is not installed in the external input apparatus when the first transmission terminal is connected with the external input apparatus, the processing circuitry transmits the program to the external input apparatus.	82
C. Ground 3: Toya in view of RFC 3261 Renders Obvious Claims 1-3, 8-10, and 15.....	84
1. RFC 3261	84
2. Motivation to Combine	87
3. [1.b]/[8.b]/[15.b] “log into a management system by transmitting a login request to the management system,”	91
D. Ground 4: Toya in view of RFC 3261 and Further in View of Chang Render Obvious Claims 4-6 and 11-13	93
1. Motivation to Combine	95
2. [4.a]/[11.a] “The first transmission terminal according to claim 1, wherein the processing circuitry receives, from the external input apparatus, a request for permission to execute a program that is for obtaining data in the external input apparatus, and”	100

TABLE OF CONTENTS
(continued)

	Page
3. [4.b]/[11.b] “in response to permission of the request, the program is executed in the external input apparatus, and thus, the method includes receiving, from the external input apparatus, the second video data obtained in the external input apparatus.”	100
4. Claim 5/12 “The first transmission terminal according to claim 4, wherein the processing circuitry is configured to transmit the program to the external input apparatus.”	100
5. Claim 6/13 “The first transmission terminal according to claim 5, wherein if the program is not installed in the external input apparatus when the first transmission terminal is connected with the external input apparatus, the processing circuitry transmits the program to the external input apparatus.”	100
IX. CONCLUSION.....	100

PETITIONER’S EXHIBIT LIST

No.	Reference	Referred To As
1001	U.S. Patent No. 10,931,917	'917 Patent
1002	Prosecution History of U.S. Patent No. 10,931,917	'917 Patent File History
1003	Declaration of Dr. Kevin Almeroth	Almeroth Decl.
1004	U.S. Patent No. 8,305,422	Toya
1005	U.S. Patent Application Publication No. 2010/0066805	Tucker
1006	RFC 3261 - SIP: Session Initiation Protocol	RFC 3261
1007	U.S. Patent No. 8,316,138	Chang
1008	U.S. Patent No. 7,373,379	Comstock
1009	U.S. Patent No. 8,264,520	Oya
1010	U.S. Patent No. 7,035,899	Marchon
1011	U.S. Patent No. 6,760,749	Dunlap
1012	U.S. Patent Application Publication No. 2012/0133727	Bolduc
1013	U.S. Patent No. 7,668,986	Lowe
1014	U.S. Patent No. 8,190,785	Hill
1015	U.S. Patent No. 8,260,978	Thompson
1016	SMART Technologies ULC's International Publication No. WO 2010/105335	Banerjee
1017	NISP Nation_NISP Standard-RFC 3261.pdf	NISP Nation
1018	Internet Engineering Task Force (IETF) IANA Registry – Updating 3261	IANA Registry – Updating 3261
1019	G. Banks, M. Cova, V. Felmetzger, K. Almeroth, R. Kemmerer and G. Vigna, " SNOOZE: toward a Stateful NetwOrk prOtocol fuzZEer ," <i>Information Security Conference (ISC)</i> , Samos Island, GREECE, September 2006.	Banks
1020	U.S. Pat. Publ. No. 2004/0062204A1	Bearden

LISTING OF CHALLENGED CLAIMS

Claim	Limitation
[1.pre]	A first transmission terminal comprising: processing circuitry configured to
[1.a]	obtain first video data captured by a camera,
[1.b]	log into a management system by transmitting a login request to the management system,
[1.c]	establish a communication session for transmitting the first video data to a second transmission terminal that has logged into the management system,
[1.d]	transmit the first video data using the established communication session
[1.e]	when an external input apparatus that has not logged into the management system is connected with the first transmission terminal during the first video data being displayed on a display screen of the second transmission terminal, receive, from the external input apparatus, second video data obtained in the external input apparatus, and
[1.f]	in response to receiving the second video data, transmit the first video data and the second video data for sharing with the second transmission terminal using the established communication session.
[2]	The first transmission terminal according to claim 1, wherein the processing circuitry is configured to transmit the first video data and the second video data via a relay apparatus.
[3.a]	The first transmission terminal according to claim 2, wherein the relay apparatus is selected from a plurality of relay apparatuses, and
[3.b]	the processing circuitry receives, from the management system, terminal identification information for identifying another transmission terminal that has requested a start of communication from among a plurality of transmission terminals.
[4.a]	The first transmission terminal according to claim 1, wherein the processing circuitry receives, from the external input apparatus, a request for permission to execute a program that is for obtaining data in the external input apparatus, and
[4.b]	in response to permission of the request, the program is executed in the external input apparatus, and thus, the processing circuitry receives, from the external input apparatus, the second video data obtained in the external input apparatus.

Claim	Limitation
[5]	The first transmission terminal according to claim 4, wherein the processing circuitry is configured to transmit the program to the external input apparatus.
[6]	The first transmission terminal according to claim 5, wherein if the program is not installed in the external input apparatus when the first transmission terminal is connected with the external input apparatus, the processing circuitry transmits the program to the external input apparatus.
[7.a]	The first transmission terminal according to claim 1, wherein the processing circuitry is configured to receive, from the management system, information of destination candidates associated with the first transmission terminal,
[7.b]	receive a selection from among the received information of the destination candidates, and
[7.c]	establish the communication session with the second transmission terminal corresponding to information of the thus selected destination candidate.
[8.pre]	A method, implemented by a first transmission terminal, comprising:
[8.a]	obtaining first video data captured by a camera,
[8.b]	logging into a management system by transmitting a login request to the management system,
[8.c]	establishing a communication session for transmitting the first video data to a second transmission terminal that has logged into the management system,
[8.d]	transmitting the first video data using the established communication session,
[8.e]	when an external input apparatus that has not logged into the management system is connected with the first transmission terminal during the first video data being displayed on a display screen of the second transmission terminal, receiving, from the external input apparatus, second video data obtained in the external input apparatus, and
[8.f]	in response to receiving the second video data, transmitting the first video data and the second video data for sharing with the second transmission terminal using the established communication session.
[9]	The method according to claim 8, further comprising transmitting the first video data and the second video data via a relay apparatus.

Claim	Limitation
[10.a]	The method according to claim 9, wherein the relay apparatus is selected from a plurality of relay apparatuses, and
[10.b]	the method includes receiving, from the management system, terminal identification information for identifying another transmission terminal that has requested a start of communication from among a plurality of transmission terminals
[11.a]	The method according to claim 8, further comprising: receiving, from the external input apparatus, a request for permission to execute a program that is for obtaining data in the external input apparatus, and
[11.b]	in response to permission of the request, the program is executed in the external input apparatus, and thus, the method includes receiving, from the external input apparatus, the second video data obtained in the external input apparatus.
[12]	The method to claim 11, further comprising transmitting the program to the external input apparatus.
[13]	The transmission terminal according to claim 12, further comprising: if the program is not installed in the external input apparatus when the transmission terminal is connected with the external input apparatus, transmitting the program to the external input apparatus.
[14.a]	The method according to claim 8, further comprising: receiving, from the management system, information of destination candidates associated with the first transmission terminal;
[14.b]	receiving a selection from among the received information of the destination candidates; and
[14.c]	establishing the communication session with the second transmission terminal corresponding to information of the thus selected destination candidate.
[15.pre]	A non-transitory computer readable medium that stores a program that when executed by a first transmission terminal causes the first transmission terminal to perform a method comprising:
[15.a]	obtaining first video data captured by a camera,
[15.b]	logging into a management system by transmitting a login request to the management system,

Claim	Limitation
[15.c]	establishing a communication session for transmitting the first video data to a second transmission terminal that has logged into the management system,
[15.d]	transmitting the first video data using the established communication session,
[15.e]	when an external input apparatus that has not logged into the management system is connected with the first transmission terminal during the first video data being displayed on a display screen of the second transmission terminal, receiving, from the external input apparatus, second video data obtained in the external input apparatus, and
[15.f]	in response to receiving the second video data, transmitting the first video data and the second video data for sharing with the second transmission terminal using the established communication session.

I. INTRODUCTION

A. Engagement

1. I, Dr. Kevin C. Almeroth, have been retained by counsel for Zoom Communications, Inc. (“Petitioner”) to provide my expert opinions regarding U.S. Patent No. 10,931,917 (“the ’917 Patent”), which is assigned to Ricoh Company, Ltd. (“Patent Owner”). I have been asked to evaluate the validity of claims 1-15 of the ’917 Patent in light of the prior art. I understand that my opinions will be submitted in support of a Petition for Inter Partes Review before the United States Patent and Trademark Office, Patent Trial and Appeal Board. This declaration sets forth my opinions and the bases for those opinions.

B. Background and Qualifications

2. My complete qualifications and professional experience are described in my curriculum vitae, a copy of which is provided as Appendix A. The following is a summary of my relevant qualifications and professional experience.

3. I am currently Professor Emeritus in the Department of Computer Science at the University of California, Santa Barbara (UCSB). I have been a faculty member at UCSB since July 1997. At UCSB, I held faculty appointments and was a founding member of the Computer Engineering Program, the Media Arts and Technology Program, and the Technology Management Program. I served as Associate Director of the Center for Information Technology and Society from 1999 to 2012. My administrative roles have included Vice Chair of Computer Science

from July 2000 through November 2005 and Associate Dean of the College of Engineering from March 2007 through August 2009.

4. I hold three degrees from the Georgia Institute of Technology. I received a B.S. degree in Information and Computer Science with high honors in June 1992, with minors in Economics, Technical Communication, and American Literature. My undergraduate work included courses typical of electrical engineering, including digital logic, signal processing, and telecommunications theory. I received an M.S. degree in Computer Science in June 1994, with a specialization in Networking and Systems. I received a Ph.D. degree in Computer Science in June 1997. My doctoral dissertation was titled “Networking and System Support for the Efficient, Scalable Delivery of Services in Interactive Multimedia Systems,” and I completed a minor in Telecommunications Public Policy.

5. For more than 30 years, my research has focused on the delivery of multimedia content and data between computing devices. This encompasses network architectures, large-scale content delivery systems, scalable delivery of content to hundreds or thousands of users simultaneously, and smaller-scale content exchange between computers and portable devices. My research has emphasized efficient content exchange across networks, scalable content delivery, mobile computing, satellite networking, delivery to mobile devices, and wireless data delivery.

6. Beginning in 1992, my research focused on interactive functions for near video-on-demand systems, including VCR-style functions such as pause, rewind, and fast-forward, and aggregation of requests for movies using one audio/video stream broadcast to multiple receivers. I have researched communicating multimedia content, including video, between computers across networks including the Internet, including streaming multimedia content and multicast protocols for efficient delivery to multiple endpoints simultaneously.

7. Starting in 1997, I worked on integrating Internet streaming media with web interactivity through a system called the Interactive Multimedia Jukebox (IMJ), where users selected content via a web page and content was scheduled and delivered through multicast channels. The IMJ combined web interactivity with Internet streaming to create a jukebox-like service supporting Video-on-Demand when capacity allowed and scalable service to many users. This work is relevant to the subject matter of the '917 Patent because it involved the integration of interactive user interface controls with real-time multimedia delivery across networked systems.

8. Since 1997, I have also researched wireless devices and sensors, lightweight devices, small form-factor and resource-constrained devices, wireless networking, ad hoc networks, mesh networks, and wireless protocols. My wireless networking work spans the protocol stack from applications through data link and physical layers. My research includes application development for mobile platforms,

opportunistic contact among mobile devices, wireless infrastructure support, challenged network environments, network monitoring, IEEE 802.11 networks, channel bonding, location information, handoffs, and location and movement prediction.

9. Since 2000, I have worked on network security, firewalls, intrusion detection, malware detection, and a Department of Defense/Army Research Office high-speed intrusion detection project. I have also investigated content delivery in online social networks, caching and cache placement strategies, reputation management systems, peer-to-peer communication architectures, and recommendations for downloadable applications.

10. One of my early research interests was in using technology in the classroom to aid in instruction. An initial concern was that too much technology, or technology used incorrectly could be a distraction. Therefore, starting in the late 1990s, I undertook research to first figure out what technology could be used in the classroom and then continued on with research to understand its effectiveness. This work included the design, deployment, and study of digital classroom systems, including work to build infrastructure for a next-generation digital classroom. It also led to a broader set of projects and publications involving classroom activity monitoring, network access controls, plagiarism detection, clicker-based interaction

in large lecture courses, and tools for measuring student engagement and learning in computer-equipped classrooms.

11. I have been involved in the Internet Engineering Task Force (IETF), including content-delivery and multicast-related working groups: AVT, MBONED, SSM, IDMR, RMT, and PIM. I served on the Multicast Directorate and chaired the Internet2 Multicast Working Group for seven years. I co-founded Santa Barbara Labs, which developed emulation systems for the U.S. Air Force's next-generation internetwork, including systems for IPv6, multicast, quality of service, satellite communication, security, video conferencing, and video-on-demand.

12. I have consulted with or collaborated with IBM, Hitachi Telecom, Turner Broadcasting System, Bell South, Digital Fountain, RealNetworks, Intel Research, Cisco Systems, and Lockheed Martin. I have held leadership roles in academic journals and conferences, including ACM NOSSDAV, ICNP, CHANTS, IEEE Global Internet Symposium, IEEE/ACM Transactions on Networking, IEEE Transactions on Mobile Computing, IEEE Network, ACM Computers in Entertainment, and ACM Computer Communications Review. I am a Fellow of IEEE and a member of ACM.

13. I have taught courses covering Internet and network communication, physical and data link layers, cable systems, telephone lines, wireless communication, high-speed LANs, data communication, multimedia encoding,

mobile application design, and infrastructures including cable, ISDN, Ethernet, ATM, fiber, and DSL. I received the UCSB Academic Senate Distinguished Teaching Award in 2006-2007, multiple Computer Science Outstanding Faculty Member awards, and the UCSB Spotlight on Excellence Award. Additional details of my education and work experience, awards and honors, and publications that may be relevant to the opinions I have formed are set forth in my CV, attached hereto as Appendix A.

14. Based on my education and experience, I am familiar with the state of the art before May 6, 2010 in networked multimedia systems, video conferencing, graphical interfaces for networked collaboration, interactive multimedia systems, content sharing, client/server and peer-to-peer content delivery, and software systems for displaying and controlling multimedia content across networked devices. The '917 Patent concerns a transmission management apparatus for video conferencing that stores terminal identification names and attendance states, updates those states as terminals join a video communication, acquires identification-name information for attending terminals, transmits that information to a requesting terminal, enables display of an identification name list of attending sites during the video communication, and supports simultaneous display of video images from attending terminals—subjects that fall squarely within my expertise. My education, research, and professional experience provide me with a thorough understanding of

the technology at issue in this proceeding, and I am well qualified to opine on the level of ordinary skill in the art and the prior art relevant to the '917 Patent.

C. Compensation and Prior Testimony

15. I am being compensated at my standard hourly rate for my study and testimony in this matter. My compensation is not contingent on the outcome of this proceeding or the specifics of my testimony. I have previously provided expert testimony in matters involving patents related to computer systems, networking, multimedia systems, and related technologies, including depositions and trial testimony in federal court. A complete list of cases in which I have testified as an expert within the past four years is set forth in my CV, attached as Appendix A.

D. Information Considered

16. My opinions are based on my years of education, research, and experience, as well as my investigation and study of relevant materials. In forming my opinions, I have considered the materials I identify in this declaration and those listed in the Exhibit List at the start of this declaration.

17. I may rely upon these materials or additional materials to respond to arguments raised by the Patent Owner. I may also consider additional documents and information in forming any necessary opinions—including documents that may not yet have been provided to me.

18. My analysis of the materials produced in this matter is ongoing and I will continue to review any new materials as they are provided. This declaration represents only those opinions I have formed to date.

II. LEGAL STANDARDS FOR PATENTABILITY

19. In expressing my opinions and considering the subject matter of the claims of the '917 Patent, I am relying upon certain basic legal principles that have been explained to me. I understand that in an inter partes review, the petitioner bears the burden of proving unpatentability by a preponderance of the evidence. A preponderance of the evidence means that a proposition is more likely true than not true. I have applied this standard in forming my opinions in this Declaration.

20. I understand that claims subject to inter partes review are given their ordinary and customary meaning as understood by one of ordinary skill in the art in view of the patent specification and its prosecution history.

21. I understand that a claim is unpatentable as obvious under 35 U.S.C. §103 if the differences between the claimed invention and the prior art are such that the subject matter as a whole would have been obvious to a person of ordinary skill in the art at the time the invention was made. The factual inquiries underlying the obviousness determination include: (1) the scope and content of the prior art; (2) the differences between the prior art and the claims at issue; (3) the level of ordinary skill in the pertinent art; and (4) objective indicia of nonobviousness, such as

commercial success, long-felt but unsolved needs, failure of others, and unexpected results.

22. I understand that the obviousness analysis cannot be confined by a rigid requirement of a teaching, suggestion, or motivation to combine prior art references. Any motivation known to a person of ordinary skill in the art—including common sense, the nature of the problem to be solved, or market demand—is sufficient to explain why prior art references would have been combined. The analysis must be expansive and flexible, taking into account the interrelated teachings of multiple patents, the effects of demands known to the design community or present in the marketplace, and the background knowledge possessed by a person of ordinary skill in the art. Prior art is not limited to solving the same problem addressed by the patentee; any need or problem known in the field of endeavor at the time of invention and addressed by the patent can provide a reason for combining prior art elements.

23. I understand that the combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results. If a technique has been used to improve one device, and a person of ordinary skill would recognize that it would improve similar devices in the same way, using that technique is obvious unless its actual application is beyond that person's skill. When there is a design need or market pressure to solve a problem and there are a finite number of identified, predictable solutions, a person of ordinary skill has good

reason to pursue the known options within his or her technical grasp. If this leads to the anticipated success, it is likely the product not of innovation but of ordinary skill and common sense.

24. I understand that a reference does not “teach away” from a combination simply because it suggests another embodiment is preferred. Teaching away requires a clear statement that the combination should not be attempted or will not work. I further understand that obviousness does not require bodily incorporation of features of one reference into another; the test is what the combined teachings of the prior art would have suggested to a person of ordinary skill. A person of ordinary skill is also a person of ordinary creativity, not an automaton.

25. I understand that obviousness must be assessed from the perspective of a person of ordinary skill in the art at the time of the invention, without the benefit of hindsight derived from the patent itself. Objective factors such as commercial success, long-felt but unsolved needs, failure of others, copying, licensing, and unexpected results may be considered as secondary indicia bearing on the question of obviousness.

26. I have applied these legal standards in my evaluation of the claims of the '917 Patent as set forth in this Declaration.

III. TECHNOLOGY BACKGROUND

27. The '917 Patent relates to a transmission terminal that logs into a management system, establishes a video conference session with a second terminal, and—when an external input apparatus that has not logged into the management system is connected—forwards the external apparatus's display data alongside the terminal's own camera video to the second terminal over the already-established session. See EX1001, claims 1, 8, 15. Each aspect of this technology was known years before the earliest possible priority date of May 6, 2010.

A. Video Conferencing Between Authenticated Terminals via Relay Servers Was Well-Known

28. Relay-based conferencing architectures—in which an intermediary server routes media streams between endpoints—were a common model prior to the '917 Patent. Polycom's U.S. Patent No. 7,373,379 (Comstock) taught the use of MCUs for “switching and multiplexing video, audio, and data streams in a multimedia conference.” EX1008, 4:60-5:9, FIGS. 1-2. Tucker et al. (U.S. Patent Application Publication No. 2010/0066805) likewise taught a server-mediated video conference system handling authentication, invitation management, and data relay. EX1005.

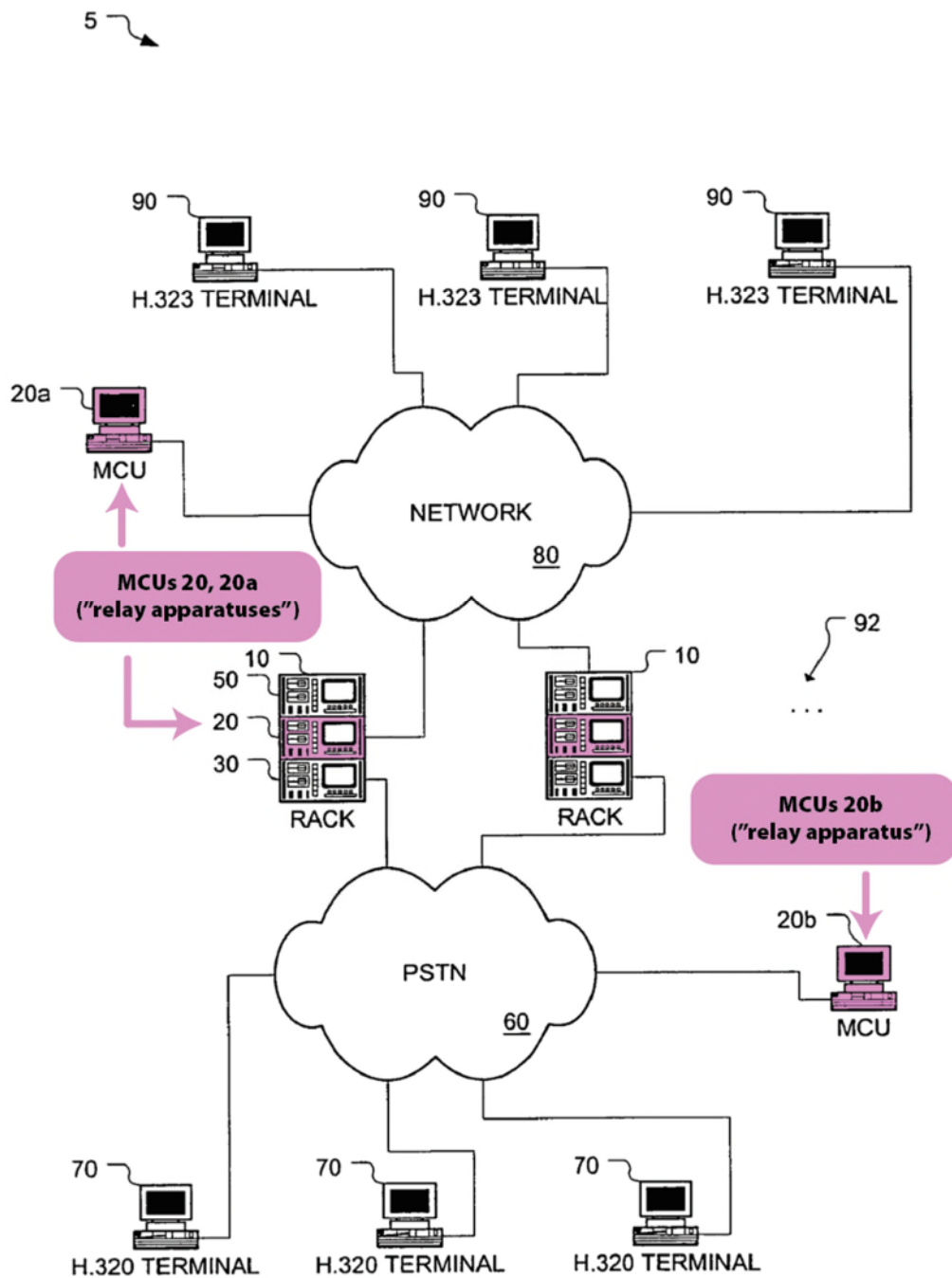
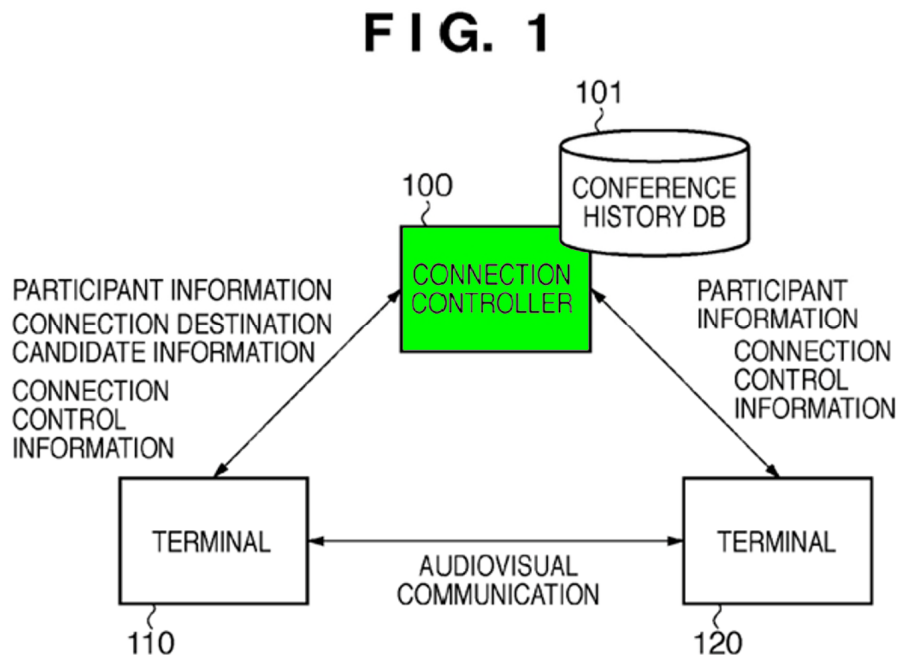


FIG. 1

EX1008, FIG1.

29. In my experience, requiring terminals to authenticate with a management system before joining a conference was equally well-known. Canon's U.S. Patent No. 8,264,520 (Oya) describes a connection controller that manages terminal authentication, connection candidates, and session establishment. EX1009, Abstract; FIGS. 1-6, 1:8-28, 1:66-2:2, 3:41-4:26. Marchon et al.'s U.S. Patent No. 7,035,899 similarly requires user authentication before establishing a meeting session, with the server validating credentials and generating access tokens. EX1010, Abstract, 9:12-10:15, FIG. 9. A POSITA would have understood that authenticating terminals through a management system before permitting conference participation was well-known.



EX1009, FIG1.

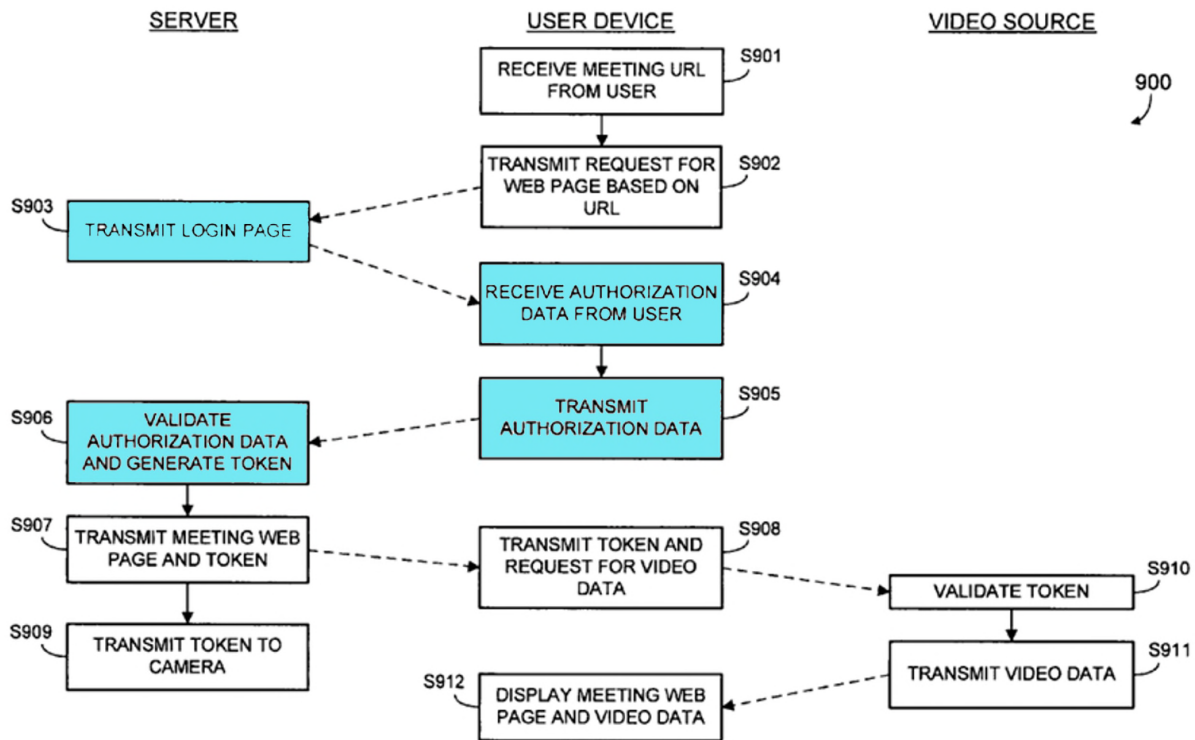


FIG. 9

EX1010, FIG9.

B. Sharing Content and Display Data During Video Conferences Was Well-Known

30. The ‘917 Patent acknowledges that sharing “presentation content” during video conferences was known, citing U.S. Pat. No. 6,760,749 (Dunlap) (EX1011), which “discusses a technology whereby the display data of a material . . . is transmitted together with the audio and video data to a distributing apparatus [relay apparatus] during a telephone conference via a network.” EX1001, 1:61-2:3.

31. Sharp’s U.S. Patent No. 8,305,422 (Toya) teaches a conference terminal that obtains content data from outside sources and automatically transmits

it to the conferencing counterpart once a call session is established—without requiring the user to specify the device. EX1004, Abstract, 18:24-41, 20:54-21:37. Comstock further teaches explicitly assigning “content” and “people” roles to media streams, with separate source switches handling inputs from computers and document cameras alongside live camera video. EX1008, 5:20-8:31, FIG2. In my opinion, content sharing during conferences was thus ubiquitous in the prior art.

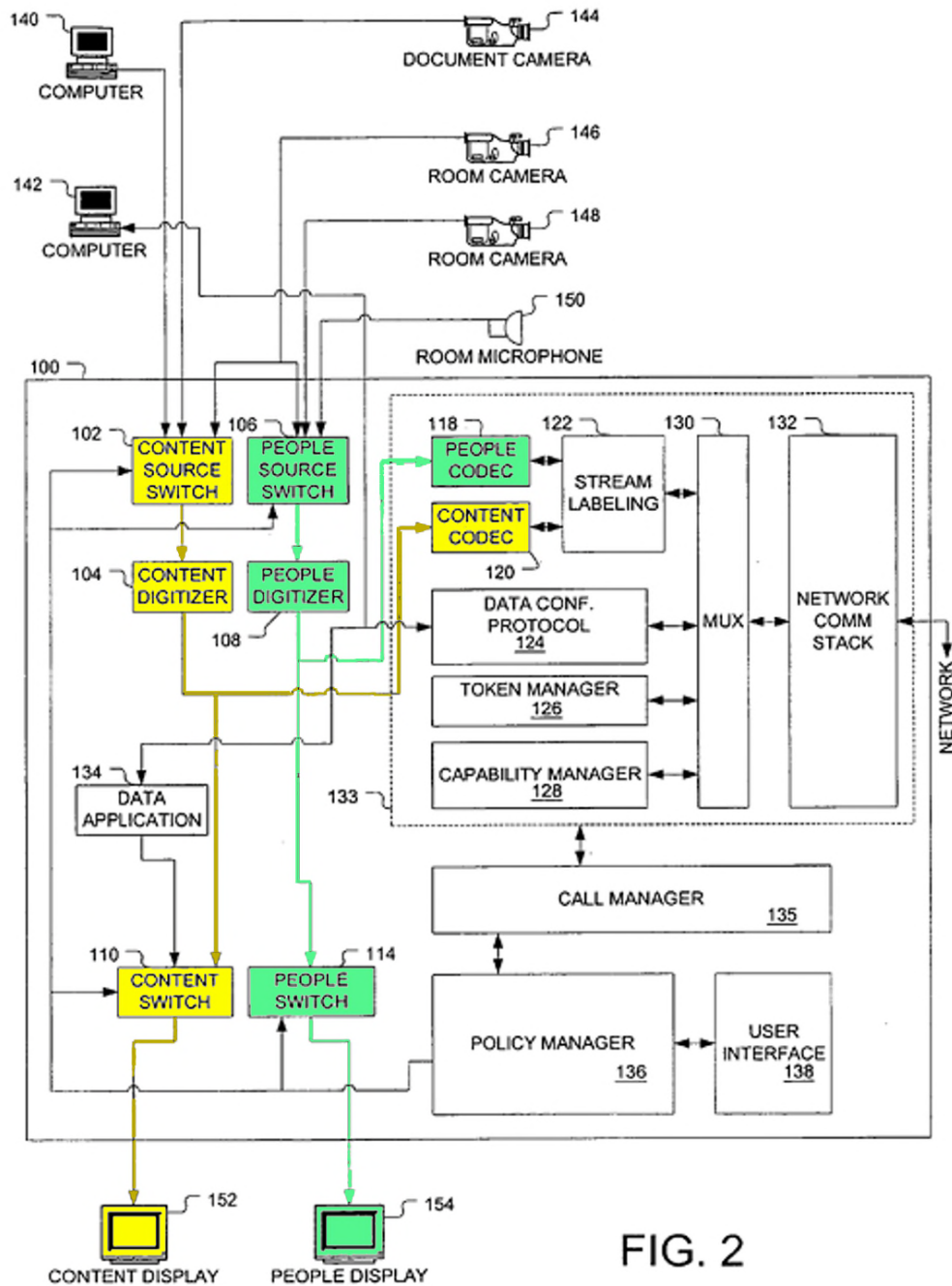


FIG. 2

EX1008, FIG2.

C. Connecting External Input Devices to Conference Terminals Without Requiring Separate Authentication Was Well-Known

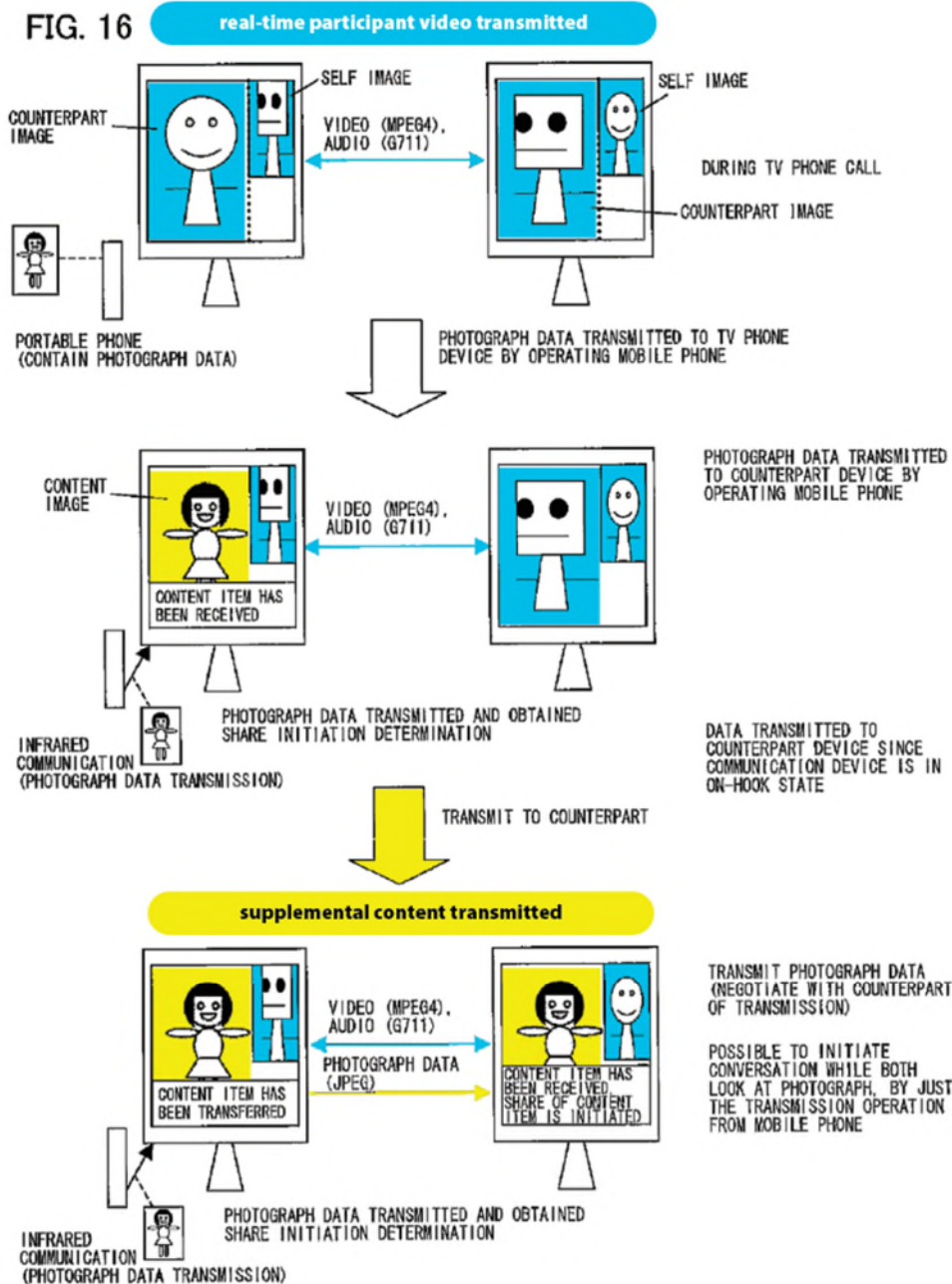
32. Based on my experience, this gateway pattern of forwarding data through the same relay apparatus carrying the video conference traffic was well-

known at the time of the '917 Patent. Toya receives content from external sources via Bluetooth, infrared, Ethernet, and SD card interfaces and forwards it to the conferencing counterpart—without requiring the external source to authenticate with or connect to any management system. EX1004, 18:42-21:20. In Comstock, computers and document cameras connect directly to the terminal's content source switch, and their output is digitized, encoded, and transmitted to remote endpoints without those devices independently registering with the conferencing network. EX1008, 5:20-6:50, FIG. 2. A POSITA would have recognized that using a conference terminal as a passthrough for an unmanaged peripheral's data was the natural, predictable approach.

D. Transmitting Multiple Types of Data Over an Established Communication Session Was Well-Known

33. Moreover, in my experience, combining camera video and shared content within a single session was well understood. Comstock's system simultaneously handles "people" and "content" streams, combining them through a single multiplexer and network communication stack. EX1008, FIG. 2, 5:20-8:31. Toya transmits both real-time participant video and supplemental content data over the same established call session. EX1004, FIGS. 14-16, 29:28-31:12. U.S. Patent Application Publication No. 2012/0133727 (Bolduc) describes a presenter device that captures both camera video and screen content, sends both to a streaming server, and the server rebroadcasts them to attendees. EX1012, Abstract, FIG. 1, FIGS. 4A-

4B. In my opinion, multiplexing camera video and shared content over a conferencing session was well known.



EX1004, FIG16.

E. Transmitting Programs to Connected Peripheral Devices Upon Connection, with Conditional Installation, Was Well-Known

34. Based on my experience in the field of networked device communication, the specific interaction pattern—in which a host device receives a request from a connected peripheral, grants permission, transmits a program to the peripheral if not already installed, and receives data captured by the program executing on the peripheral—was a thoroughly documented and widely deployed technique in the connected-device ecosystem years before the '917 Patent's priority date.

35. The USB Plug-and-Play architecture, which was standardized and ubiquitous well before 2010, established a paradigm for host-peripheral program exchange. U.S. Patent No. 7,668,986 (Lowe) describes a peripheral device that, upon connection to a host, initially presents itself as a mass storage device to permit the host to access and install driver software stored in the peripheral's memory, and then transitions to a second mode enabling full device functionality once the drivers are installed. EX1013, Abstract; FIGS. 1-2. Lowe teaches that the peripheral device stores its own drivers internally and that the host checks whether an appropriate driver already exists before performing installation—the same conditional-installation logic recited in claim 6.

36. SMART Technologies ULC's U.S. Patent No. 8,190,785 (Hill) discloses a "plug-and-play" peripheral device comprising a cable with embedded

storage that stores driver software. EX1014, Abstract. When the peripheral is connected to a host computer, the host detects the peripheral, determines whether appropriate driver software is already installed, and if not, retrieves and installs the driver from the peripheral's embedded storage to enable the host to access the peripheral's data-capture functionality. EX1014, Abstract, FIG. 1, 1:8-2:11, 3:55-4:46. In my opinion, the pattern of checking for existing software before transmitting and installing a program from a host-connected device was well-known by 2006.

37. Marvell's U.S. Patent No. 8,260,978 (Thompson) describes a host device that detects a peripheral device, determines whether a driver is already installed, and if not, executes the auto-installation program retrieved from the peripheral to install the necessary software enabling the host to communicate with the peripheral. EX1015, Abstract, FIGS. 1-4, 2:66-4:45. This teaches that the conditional-installation check—the host evaluates whether existing software on the host already supports the peripheral before initiating installation—was well known.

38. SMART Technologies ULC's International Publication No. WO 2010/105335 (Banerjee) describes a plug-and-play device comprising storage that stores "code that is automatically executed by the . . . computing device when said plug-and-play device is connected thereto," with the code "when executed initiating a screen display data exchange" between computing devices. EX1016, [0009], [0003]. Thus, transmitting a program from a device to a connected host (or vice

versa) upon connection, with conditional installation, was a standard plug-and-play design pattern for enabling screen data exchange between devices.

39. These references collectively establish that by 2008—well before the '917 Patent's priority date—the claimed interaction pattern was well-known in the art of connected-device software deployment. Specifically, the prior art demonstrates that it was known for a host device to: (a) detect when a peripheral is connected and receive a request or notification that initiates a software interaction; (b) determine whether the necessary program is already installed on the peripheral or host; (c) transmit the program to the device that lacks it if it is not already present; and (d) upon successful installation and permission, execute the program to acquire data from the device.

IV. THE '917 PATENT

A. Overview

40. The Invention of the '917 Patent relates to (1) a first transmission terminal logging into a management system and establishing a communication session for a video conference with a second transmission terminal that has also logged into the management system, (2) receiving display data from an external input apparatus (such as a laptop computer) that has not logged into the management system when that apparatus is connected to the first transmission terminal during the video conference, and (3) forwarding the received display data—along with the first

terminal's own video data—to the second transmission terminal using the already-established communication session. See EX1001, claims 1, 8, 15.

41. The elements of this disclosure were known in the art. The '917 Patent's specification states that conducting video conferences by transmitting video and audio data between plural transmission terminals over a communication network was already common, and that it was separately known to transmit “presentation content” alongside audio and video data to conference participants. See EX1001, 1:40-2:3. The alleged distinguishing feature identified in the '917 Patent is that the external input apparatus need not itself log into the transmission managing system because the first terminal—already authenticated and in session—acts as a conduit for the external apparatus's display data, relaying it through the same relay apparatus that carries the video conference traffic. See EX1001, 2:15-21, 28:60-29:10.

42. Thus, the '917 Patent describes the step of forwarding screen-share data from an unmanaged device through a terminal that is already participating in a video conference session—a concept that combines the well-known functions of receiving data from a connected peripheral and transmitting that data over a pre-existing communication path. See EX1001, 28:60-29:10. The substance of the claims adds nothing beyond what a person of ordinary skill would have understood as the application of known data-forwarding techniques in the video conferencing context.

B. Prosecution History

43. The application that issued as the '917 Patent (Application No. 16/589,700) was filed on October 1, 2019, with a single independent claim. EX1002, Filing Receipt.

44. The Office issued a first non-final office action on March 5, 2020, rejecting claim 1 under 35 U.S.C. §103 as being unpatentable over Saito et al. (U.S. Pub. No. 2005/0060547) in view of Ikeda et al. (U.S. Patent No. 8,400,530). EX1002, 167-171. The Examiner also rejected claim 1 on the ground of nonstatutory double patenting as being unpatentable over claims 1–8 of U.S. Patent No. 9,787,944 and over claims 1–8 of U.S. Patent No. 10,178,349. EX1002, 171-173.

45. In response, on June 5, 2020, Applicant amended claim 1 and added new claims 2–15 (including new independent claims 8 and 15). EX1002, 186-191. The amendments added limitations requiring that the first transmission terminal “log into a management system by transmitting a login request to the management system,” “establish a communication session for transmitting the first video data to a second transmission terminal that has logged into the management system,” and receive second video data from “an external input apparatus that has not logged into the management system.” EX1002, 186. Applicant argued that the amended claims patentably distinguished over Saito and Ikeda because neither reference taught these features. EX1002, 192-194.

46. The Examiner issued a final office action on August 6, 2020, finding claims 1–15 allowable over the prior art of record but maintaining a rejection on the ground of nonstatutory double patenting as being unpatentable over claims 1–13 of U.S. Patent No. 10,477,147. EX1002, 201-205.

47. On September 21, 2020, Applicant submitted a terminal disclaimer to overcome the double patenting rejection. EX1002, 216-217.

48. On October 21, 2020, the Examiner issued a Notice of Allowance for claims 1–15, accepting the terminal disclaimer and finding the claims allowable. EX1002, 233-243. In the Examiner’s Statement of Reasons for Allowance, the Examiner noted that updated searches identified several references—including Kato et al. (US 2019/0107988), Kagawa (US 2020/0273464), Shiro et al. (US 2018/0041553), Homma et al. (US 2018/0027030), Horiuchi et al. (US 2017/0264450), and Umehara et al. (US 2016/0150023)—but found none that taught all features of the amended independent claims. EX1002, 233-234, 239-240.

49. On January 7, 2021, Applicant filed an amendment after allowance under 37 C.F.R. §1.312 to clarify claim language and correct terminology. EX1002, 252-258. The Examiner entered the amendment on January 14, 2021. EX1002, 269-270.

50. As demonstrated below, the added claim limitations used to distinguish the claims from Saito and Ikeda—requiring login to a management system,

establishing a session with a second terminal that has logged in, and receiving data from an external apparatus that has not logged in—were well-known, as were the Challenged Claims as a whole. The Examiner never had the opportunity to evaluate the Challenged Claims in light of the Toya, Tucker, Chang, and RFC 3261 references and their combinations presented herein.

V. LEVEL OF ORDINARY SKILL IN THE ART

51. A person of ordinary skill in the art (“POSITA”) relevant to the ’917 Patent as of May 6, 2010 would have had at least: (1) a bachelor’s degree in electrical engineering, computer science, computer engineering, or equivalent coursework, with at least two years of work experience in video conferencing systems, networked multimedia communication systems, or remote conference system architectures; or (2) a master’s degree in electrical engineering, computer science, computer engineering, or equivalent coursework, with coursework or research focused on video conferencing systems, networked terminal management, real-time audio/video transmission, or client-server communication architectures. An individual with additional education could have less practical experience, and vice versa. I meet or exceed this definition of a person of ordinary skill in the art at all times relevant to this proceeding.

VI. CLAIM CONSTRUCTION

52. It is my opinion that no constructions are necessary for determining whether the prior art meets the limitations of the challenged claims.

VII. OVERVIEW OF CHALLENGE

53. It is my opinion that claims 1-15 are unpatentable, as set forth below. As set forth in this declaration, I present 4 grounds of invalidity: (1) Ground 1, demonstrating that Toya (EX1004) in view of Tucker (EX1005) renders obvious claims 1-3, 7-10, and 14-15 under 35 U.S.C. §103, (2) Ground 2, demonstrating that Toya (EX1004) in view of Tucker (EX1005) in further view of Chang (EX1007) renders obvious claims 4-6 and 11-13 under 35 U.S.C. §103, (3) Ground 3, demonstrating that Toya (EX1004) in view of RFC 3261 (EX1006) renders obvious claims 1-3, 8-10, and 15 under 35 U.S.C. §103, and (4) Ground 4, demonstrating that Toya (EX1004) in view of RFC 3261 (EX1006) in further view of Chang (EX1007) renders obvious claims 4-6 and 11-13 under 35 U.S.C. §103.

54. I understand that the challenge is based on the references discussed below, each of which is prior art under pre-AIA 35 U.S.C. §102. None of these references were considered or cited during prosecution of the '917 Patent.

VIII. THE ASSERTED GROUNDS OF INVALIDITY

A. Ground 1: Toya in view of Tucker Renders Obvious Claims 1-3, 7-10, 14-15

55. In my opinion, Toya in view of Tucker renders obvious every limitation of claims 1-3, 7-10, 14-15. Based on my review, Toya provides the foundational video conferencing architecture in which a communication device establishes a call session with another device, captures and transmits video data, receives content data from an external source, and forwards that content to the other device over the established session. Toya does not provide details on the mechanism by which terminals are authorized for use of the system. A POSITA would have understood that in a real-world system, for example, a commercial version of Toya, some form of authorization and authentication would be necessary. Tucker supplies the details of how terminals log into a centralized management system by transmitting a login request before establishing the communication session by disclosing a server-mediated video conferencing system in which a remote user is authenticated through a website before the video conference is initiated, including accessing a user database to verify the user's authorization and establishing the session only upon successful verification.

1. Motivation to Combine

56. A POSITA would have been motivated to incorporate Tucker's server-based user authentication into Toya's SIP-based video conferencing and content-

sharing system for several independently sufficient reasons. I am not aware of any secondary considerations that would overcome the obviousness of the ground.

57. **Same Field of Endeavor:** In my opinion, Toya and Tucker are in the same field of endeavor: both are directed to video conferencing systems that establish sessions between remote participants and transmit video data over a communication network. Toya discloses a “video communication device” that “function[s] as a television conference system terminal device” and establishes “a call session with another video communication device serving as a counterpart device, thereby realizing reception and transmission of video data and audio data therebetween.” EX1004, 16:51-64. Tucker likewise discloses a system and method “for implementing a video conference through a television forwarding device” or set-top box in which a remote user and a local user exchange video conference signals. EX1005, ¶¶[0003], [0059], Abstract. Both references address how to manage the initiation and conduct of video conferences between networked endpoints. A POSITA designing a video conferencing system with content-sharing capabilities would have naturally looked to both references.

58. **Tucker Solves a Problem That Toya’s System Faces:** Toya’s system faces a security and access-control necessity about which Toya does not focus: how to ensure that only authorized users can initiate or participate in video conference sessions. Toya discloses that its video communication device establishes call

sessions using SIP signaling, but Toya does not address the details of a mechanism for verifying the identity or authorization of the terminals before permitting the session to proceed. EX1004, 16:65-17:126. Without an authentication mechanism, any device with network access could potentially initiate a call session with Toya's video communication device, raising concerns about unauthorized access and misuse. Tucker addresses this necessity.

59. Tucker teaches “authenticating a remote user through a website” before permitting the video conference to be implemented, including “accessing a user database to determine that the remote user is authorized to communicate with the television forwarding device” or set-top box and “verifying an identifier received from the remote user.” EX1005, claims 1, 13, [0003], [0021]-[0023], [0053]-[0054],[0059]-[0061], FIG4. A POSITA would have been motivated to incorporate Tucker's pre-session authentication into Toya's conferencing system to restrict conference participation to authorized users and prevent unauthorized access—a recognized security objective in networked communication systems.

60. **Tucker Ensures Only Authorized Users Communicate:** A POSITA would have been well aware, and Tucker confirms, the need for authentication before initiating a video conference. Tucker teaches that the system includes “a database in communication with the server, the database configured to verify that the remote user is authorized to communicate with the television forwarding device.”

EX1005, claim 15, [0023]. Tucker further teaches encrypting and decrypting the video conference using digital rights management keys, confirming that controlling access to conferencing sessions was a central design objective. EX1005, claim 16, [0022]-[0024]. This same concern applies to Toya's system: without authentication, Toya's content-sharing functionality—which automatically forwards externally obtained content data to the conferencing counterpart—could be exploited by unauthorized users. A POSITA would have recognized that incorporating Tucker's authentication step into Toya's system would address this concern, ensuring that content is shared only with verified, authorized participants.

61. **Predictable Combination of Known Elements:** The combination of Toya and Tucker is the predictable use of known prior art elements according to known methods to yield predictable results. Toya teaches a video conferencing terminal that establishes SIP-based call sessions, transmits camera video to a counterpart device, receives content data from external sources, and forwards that content to the counterpart over the established session. EX1004, 16:51-17:43, 18:24-49, 20:23-32. Tucker teaches a centralized server that authenticates users by verifying credentials against a user database before permitting a video conference to proceed. EX1005, claims 1, 13, 15, [0022]-[0024]. Incorporating Tucker's pre-session authentication step into Toya's system yields the entirely predictable result: before Toya's video communication device establishes a SIP call session with a

counterpart device, both devices first authenticate with a centralized server, and the session proceeds only upon successful verification. The underlying video conferencing, content acquisition, and content forwarding functions disclosed by Toya remain unchanged; the only modification is the addition of an authentication prerequisite before session establishment.

62. Using a Known Technique to Improve a Similar Device in the Same Way: In my opinion, the combination is further supported because it is made using a known technique (Tucker's server-based user authentication via username/password verification against a user database) to improve a similar device (Toya's SIP-based video conferencing terminal with content-sharing capabilities) in the same way (restricting conference participation to authenticated users before permitting session establishment).

63. A POSITA would have had a reasonable expectation of success because Toya's system already uses network-based signaling protocols (SIP) to establish call sessions, and adding a pre-session authentication exchange with a centralized server—as taught by Tucker—would have been a straightforward modification requiring the addition of a credential-verification step prior to the SIP INVITE message.

64. Based on my experience, SIP-based systems were known to support integration with authentication servers and registrars, and a POSITA would have

understood that pairing Toya's SIP signaling with Tucker's server-based authentication was a routine engineering task within ordinary skill.

65. **The External Input Apparatus Remains Unauthenticated:** Importantly, in my opinion, the combination preserves Toya's architecture in which the external content source (e.g., a mobile phone connected via a wired or wireless connection) does not participate in the conferencing session and does not authenticate with the management server. In the combined system, only the video communication devices (transmission terminals) that participate in the call session authenticate with Tucker's server; the external device that supplies content data to the authenticated terminal through a local interface is not required to log in.

66. A POSITA would have understood that this is the precise configuration recited in the '917 Patent's claims, which require that the external input apparatus "has not logged into the management system." EX1001, claim 1. In my opinion, the combination naturally and predictably arrives at the claimed architecture without any non-obvious modification.

2. Preambles

a) [1.pre] "A first transmission terminal comprising: processing circuitry configured to"

67. Toya discloses this element. Toya describes a "video communication device 1" that functions as "a television conference system terminal device." EX1004, 16:42-57. The video communication device 1 includes a CPU 20, ROM

21, and RAM 22, which collectively constitute processing circuitry that executes a program to control the device's communication, content acquisition, and content transmission functions. EX1004, 16:35-57, 21:64-22:32; FIGS. 1, 3. The CPU 20 functions as the communication control section 2, the communication processing section 3, the communication input section 4, and the communication output section 5, as well as the content receiving section 6, the content storage section 7, and the content transmission section 8. EX1004, 16:42-17:10; 22:3-10; FIGS. 1, 3. A POSITA would have understood that Toya's **video communication device 1**, with **its CPU-based processing architecture**, constitutes a "first transmission terminal comprising processing circuitry."

FIG. 3

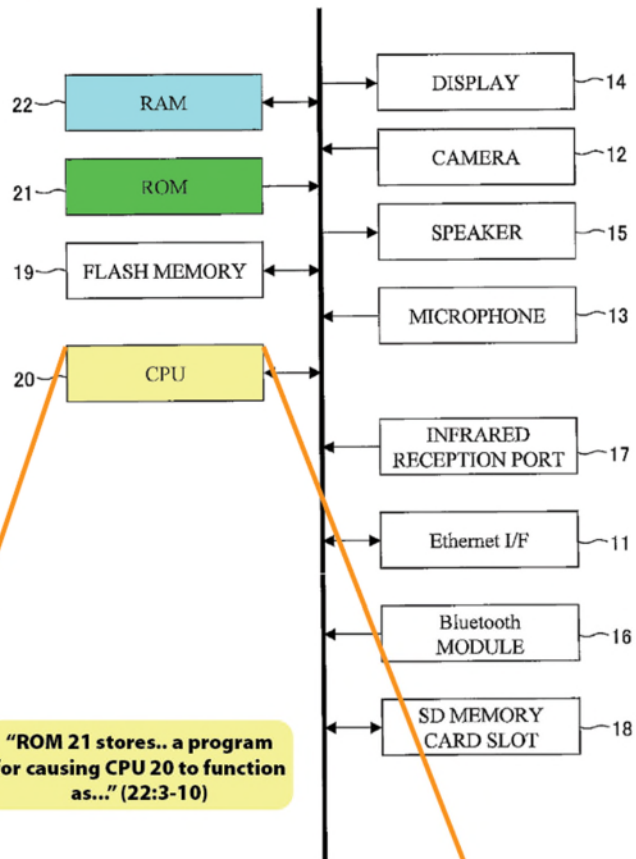
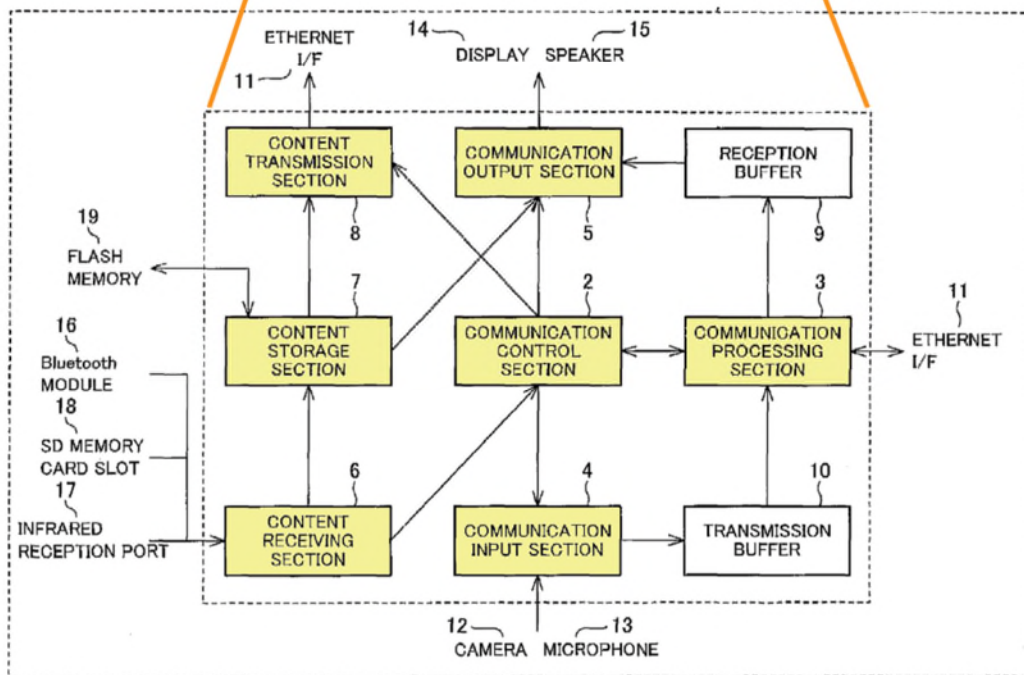


FIG. 1



EX1004, FIG13.

b) [8.pre] “A method, implemented by a first transmission terminal, comprising:”

68. Toya discloses performing the method of claim 8. Toya’s video communication device 1, when executing the software stored in its ROM 21 and controlled by its CPU 20, performs the functional operations of establishing a call session via SIP signaling, capturing and transmitting video data through its camera 12 and communication processing section 3, receiving content data from an external device through its content receiving section 6, and transmitting the received content data to the counterpart device through its content transmission section 8. EX1004, 16:35-17:26, 17:58-18:41, 20:6-32, 21:64-22:10, FIGS. 9, 14-16. A POSITA would have understood that any processor-based system that performs functional operations through software execution necessarily performs the steps of a method. The execution of video conferencing software by Toya’s CPU 20 to control call session establishment, video capture and transmission, content acquisition from external devices, and content forwarding to the counterpart device constitutes performance of a method.

69. Tucker likewise discloses performing a method. Tucker’s claims “[a] method for implementing a video conference through a television forwarding device, the method comprising: authenticating a remote user through a website; receiving a selection of a user for the remote user to communicate with through the video

conference; sending an invitation to the television forwarding device . . . and implementing the video conference between the remote user and the user in response to the user accepting the invitation.” EX1005, claim 1, [0003]. Tucker’s authentication process—in which a user submits credentials through a website and the server accesses a user database to verify authorization—is performed as method steps by the server and the user’s communications device. EX1005, claims 1, 13, [0022]-[0023], [0061].

70. In the combination, Toya’s CPU 20 executes the method steps of obtaining first video data from the camera, establishing a call session with a counterpart device, transmitting the video data over the session, receiving content data from an external device, and transmitting both the video data and the content data to the counterpart device—while Tucker’s server performs the method step of authenticating the terminals before the session is established. In my opinion, the combination of Toya and Tucker renders obvious every method step recited in claim 8 for the same reasons discussed with respect to the corresponding limitations of claim 1.

- c) **[15.pre] “A non-transitory computer readable medium that stores a program that when executed by a first transmission terminal causes the first transmission terminal to perform a method comprising:”**

71. Toya discloses a non-transitory computer readable medium storing computer-executable instructions. Toya describes that its video communication

device 1 includes a ROM 21 and a flash memory 19, both of which store programs and data for controlling the device's operations. EX1004, 21:64-22:32, FIGS. 1, 3. Toya further discloses that the video communication device 1 includes a CPU 20 that executes the programs stored in the ROM 21 and flash memory 19, causing the device to perform the conferencing, content acquisition, and content transmission functions described above. EX1004, 21:64-22:32, FIGS. 1, 3. The ROM 21 and flash memory 19—which are non-volatile storage media retaining the program instructions even when the device is powered off—constitute “non-transitory computer readable medium[s]” within the meaning of claim 15.

72. Toya also discloses that its invention may be embodied in a computer-readable storage medium. Toya claims “a non-transitory computer-readable storage medium, storing therein a program for causing a computer to function as the means of the communication device.” EX1004, claim 17. This further confirms that Toya contemplated embodying its conferencing and content-sharing functionality as stored program instructions on a non-transitory medium.

73. Tucker likewise discloses stored program instructions. Tucker's server stores program logic that implements the authentication, invitation, and video conference management functions, and the television forwarding device or set-top box includes “video conference logic” operable to control video conferencing operations. EX1005, ¶¶[0004]-[0005], [0065]. In Tucker's embodiments, this

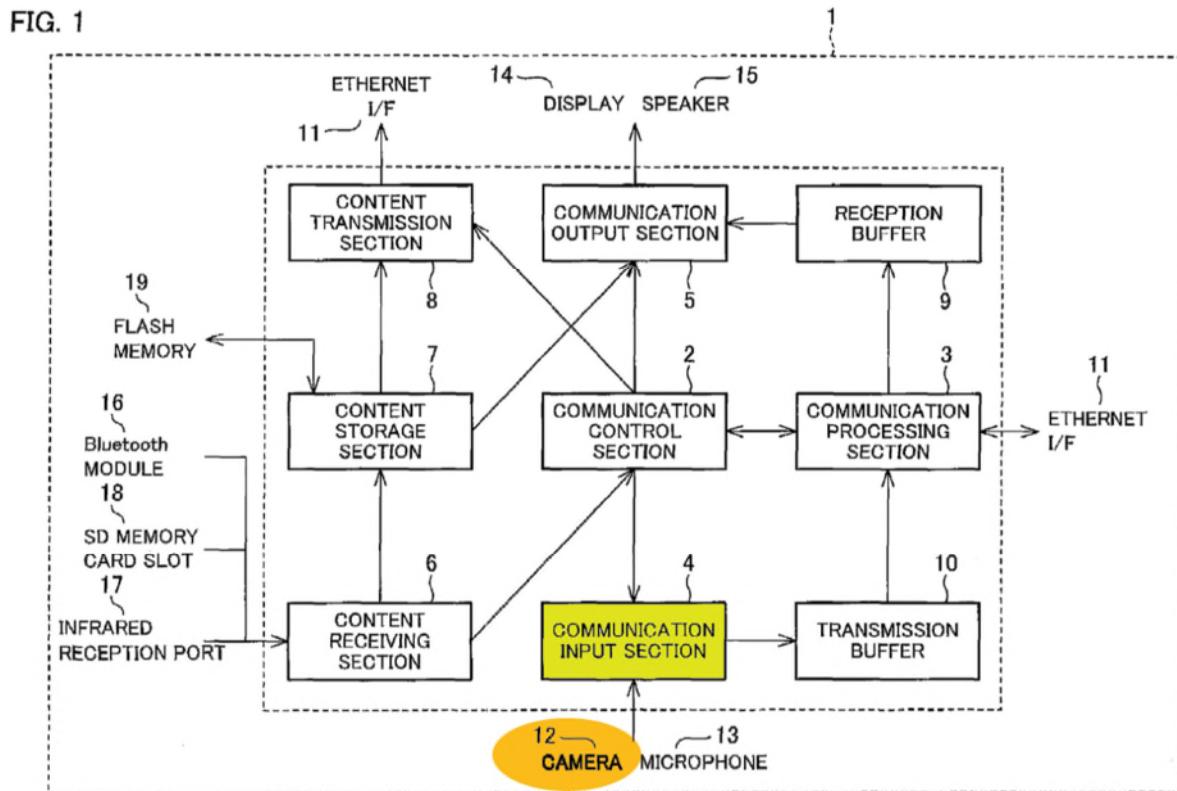
server (e.g., communications management system 112 or 404) handles routing and management of video communications between communications devices, as well as authentication of users. EX1005, ¶¶ [0019], [0022]. In the combination, the authentication step taught by Tucker would be implemented as stored instructions executed by Toya's CPU 20, alongside the existing conferencing and content-sharing instructions already stored in Toya's ROM 21 and flash memory 19.

74. The stored instructions in Toya's non-transitory medium, as modified by Tucker's authentication teachings, when executed by Toya's CPU 20, cause the video communication device 1 to perform the same operations described in the claim 1 analysis: obtaining video data from the camera, logging into the management system, establishing a communication session with an authenticated counterpart, transmitting video data, receiving content data from an external device that has not logged into the management system, and transmitting both the video data and the content data for sharing with the counterpart using the established session. The combination of Toya and Tucker thus renders obvious every limitation of claim 15 for the same reasons discussed with respect to the corresponding limitations of claim 1.

3. [1.a]/[8.a]/[15.a] “obtain first video data captured by a camera,”

75. It is my opinion that Toya discloses “obtain first video data captured by a camera.”

76. Toya's video communication device 1 includes a communication input section 4 comprising a camera 12 and a microphone 13. EX1004, 18:3-11; FIG1. The **camera 12** captures video data of the local user, and the communication input section 4 provides this captured video data for transmission to a counterpart device during a television conference call session. EX1004, 17:11-26. A POSITA would have understood that the captured video data from the camera constitutes the claimed “first video data captured by a camera.”



EX1004, FIG1.

77. Therefore, in my opinion, Toya discloses “obtain first video data captured by a camera.”

4. [1.b]/[8.b]/[15.b] “log into a management system by transmitting a login request to the management system,”

78. It is my opinion that Toya does not explicitly disclose this element by transmitting a login request. Tucker discloses “log into a management system by transmitting a login request to the management system.”

79. Tucker teaches a video conferencing system in which a user must be “authenticated through a website” before initiating or participating in a video conference. EX1005, ¶[0003], Abstract claim 1, 5. Tucker’s authentication process involves “accessing a user database to determine that the remote user is authorized to communicate with the television forwarding device” and “verifying an identifier received from the remote user.” EX1005, claim 13, [0022]-[0023], [0053]-[0054], [0059]-[0061]. As illustrated in Tucker’s FIG. 6, the user submits a username and password through a graphical user interface to initiate the video conference, and the system verifies those credentials before permitting the session to proceed. EX1005, FIG6, FIG7, ¶¶[0054], [0060]-[0065], [0071]-[0072], [0077]. **The submission of a username and password to the server for verification constitutes “transmitting a login request to the management system,” and the server that hosts the website, stores the user database, and performs the authentication constitutes the claimed “management system.”** Tucker further discloses that this server functionality may be embodied as communications management system 112 or 404,

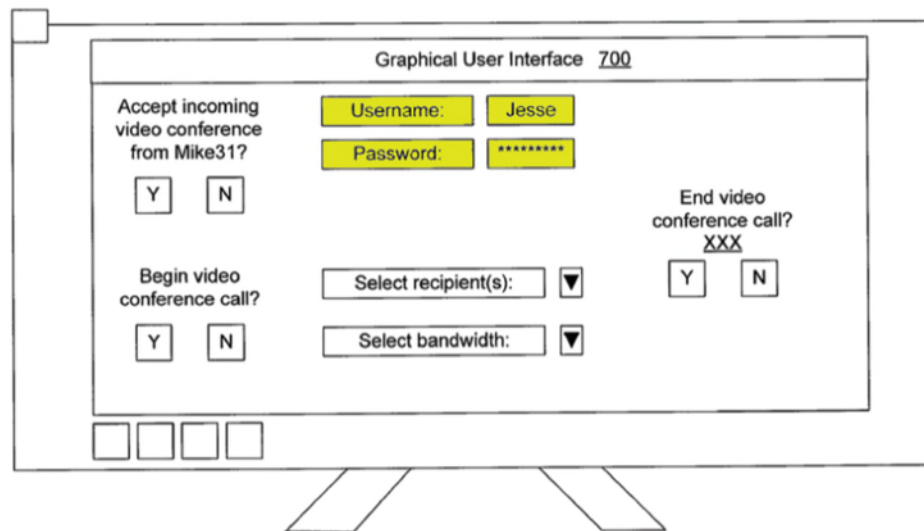
which may include any number of servers to authenticate remote users. EX1005, ¶¶ [0019], [0022].

FIG. 6

FIG. 6 illustrates a user interface for initiating a video conference, divided into four steps:

- Step 1: Initiate Video Conference (602)**
 - Username: CTucker
 - Password: [Redacted]
 - ☒ Configure User Preferences
- Step 2: Select Participant(s) (600)**
 - Network Address Book 608
 - Work
 - ☒ Home
 - Mom and dad
 - Guest House
- Step 3: Select Resolution (606)**
 - Highest 704x480(4CIF)
 - Medium High 704x240(2CIF)
 - Medium Low 352x240(CIF)
 - Low 176x120(QCIF)
- Step 4: Start/Stop (608)**
 - Initiate Video Conference
 - End video conference

FIG. 7



EX1005, FIGS6, 7.

80. In the combination, Toya's video communication device 1 would be modified to authenticate with a centralized server (as taught by Tucker, (e.g., 112 or 404)) before establishing a call session with a counterpart device. A POSITA would have understood this to be a predictable addition of a well-known pre-session authentication step to Toya's existing SIP-based conferencing architecture.

81. Therefore, in my opinion, Tucker discloses "log into a management system by transmitting a login request to the management system."

5. [1.c]/[8.c]/[15.c] **“establish a communication session for transmitting the first video data to a second transmission terminal that has logged into the management system,”**

82. It is my opinion that the combination of Toya and Tucker discloses “establish a communication session for transmitting the first video data to a second transmission terminal that has logged into the management system.”

83. Toya discloses that “the communication control section 2 controls the communication processing section 3, the communication input section 4, and the communication output section 5, and establishes a call session with another video communication device serving as a counterpart device, thereby realizing reception and transmission of video data and audio data therebetween.” EX1004, 16:58-64. The establishment of the call session is “realized by controlling ‘call control signaling’ between the video communication device 1 and the counterpart device which carry out communication call with use of SIP.” EX1004, 16:65-17:2. The counterpart device is itself a video communication device of the same type, capable of performing the same functions. EX1004, FIG9. **A POSITA would have understood that the call session established between the two devices constitutes the claimed “communication session for transmitting the first video data to a second transmission terminal.”**

84. Tucker supplies the requirement that the second terminal “has logged into the management system.” In Tucker’s system, both participants must be

authenticated before the video conference is implemented. EX1005, ¶[0003], [0022]-[0023], [0053]-[0054], claims 1, 13-15. The server (e.g., Tucker's communications management system 112 or 404) verifies that both the remote user and the local user are authorized to communicate before permitting the session. EX1005, ¶[0004], [0022]-[0023], [0053], [0061], claim 15. In my opinion, in the combination, both Toya's first and second video communication devices would authenticate with the management server before the SIP call session is established, satisfying this limitation.

85. Therefore, in my opinion, the combination of Toya and Tucker discloses “establish a communication session for transmitting the first video data to a second transmission terminal that has logged into the management system.”

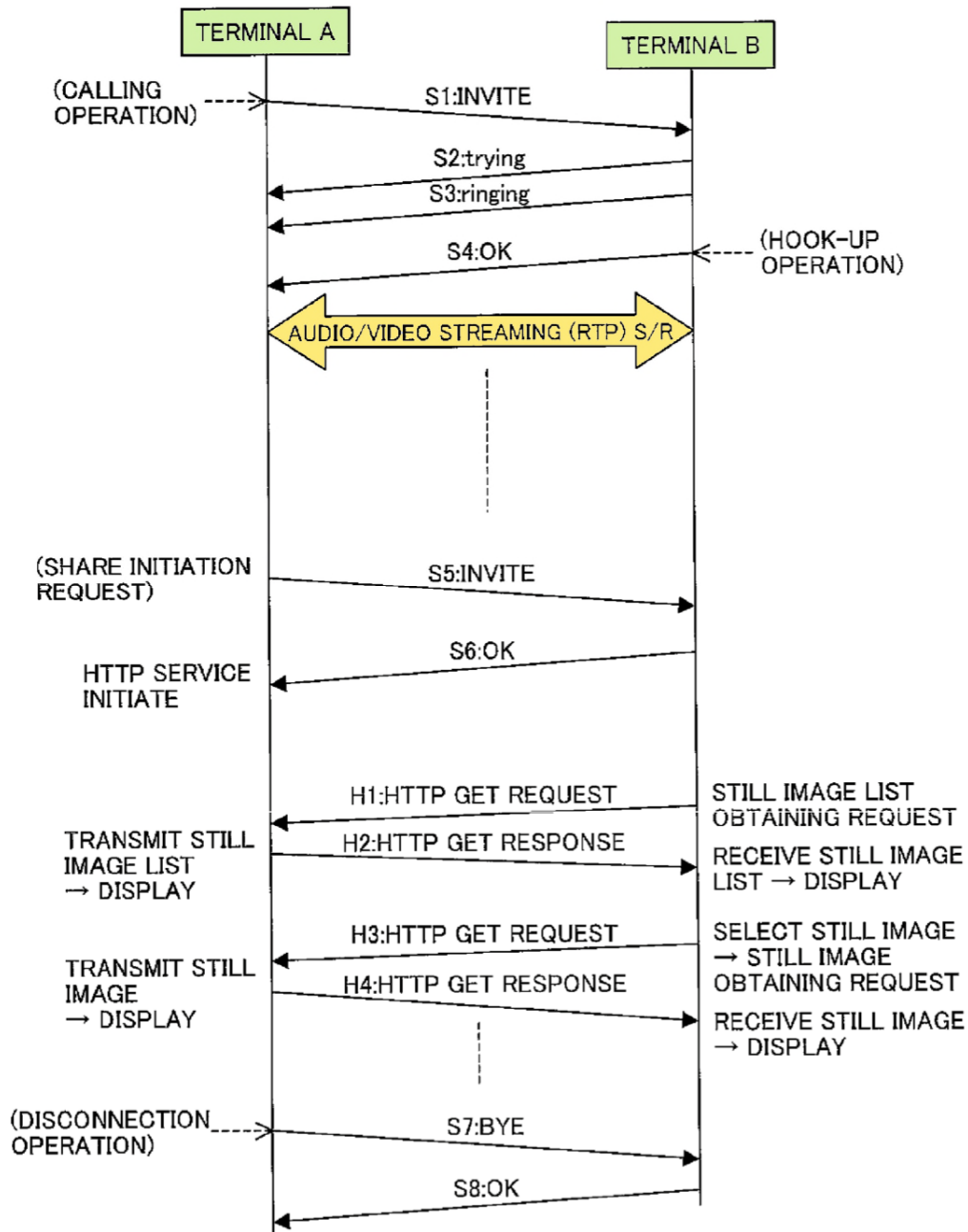
6. [1.d]/[8.d]/[15.d] “transmit the first video data using the established communication session”

86. It is my opinion that Toya discloses “transmit the first video data using the established communication session.”

87. Once the call session is established, Toya's video communication device 1 transmits video data captured by the camera 12 and audio data captured by the microphone 13 to the counterpart device via the communication processing section 3. EX1004, 16:51-18:11, 26:39-43; FIGS. 1, 9 (showing bidirectional audio/video streaming transmission between terminal A and terminal B during the call session). The transmission of this camera-captured video data over the SIP-

based call session constitutes “transmit[ting] the first video data using the established communication session.”

FIG. 9



EX1004, FIG9.

88. Therefore, in my opinion, Toya discloses “transmit the first video data using the established communication session.”

7. **[1.e]/[8.e]/[15.e] “when an external input apparatus that has not logged into the management system is connected with the first transmission terminal during the first video data being displayed on a display screen of the second transmission terminal, receive, from the external input apparatus, second video data obtained in the external input apparatus, and”**

89. It is my opinion that the combination of Toya and Tucker discloses “when an external input apparatus that has not logged into the management system is connected with the first transmission terminal during the first video data being displayed on a display screen of the second transmission terminal, receive, from the external input apparatus, second video data obtained in the external input apparatus.”

90. Toya discloses that the video communication device 1 includes a content receiving section 6 that is “arranged so as to obtain content data from the outside of the video communication device 1.” EX1004, 18:24-41. The video communication device 1 includes “a plurality of interfaces for receiving data from the outside,” including “an infrared reception port 17 and a Bluetooth (registered trademark) module 16 as communication devices for receiving data from an external device,” as well as “an SD memory card reader 18 as a reproduction device for reading out data from the storage medium” and an “**Ethernet I/F 11.**” EX1004, 18:32-59. FIG. 8, examples 2 and 5 demonstrate the wired connections between the

external input apparatus and the first transmission terminal. “Example 2 is a content data set received at an HTTP protocol from a port 8080 via the Ethernet I/F 11.” EX1004, 26:2-3. And, “example 5 shows the setting for sharing an MPEG4 data stream received at a port 4000 via the Ethernet I/F 11.” EX1004, 26:10-11.

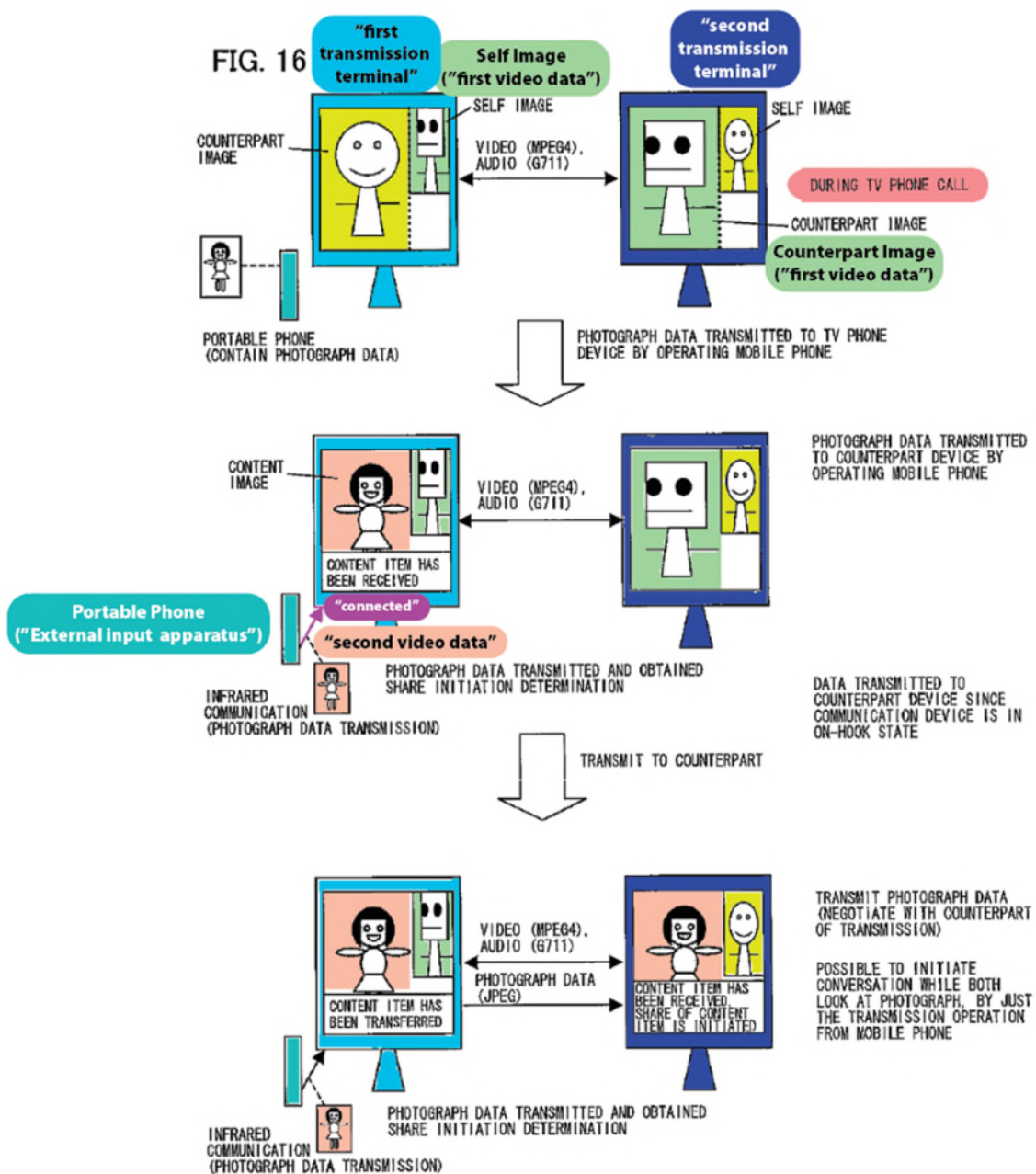
FIG. 8

<u>SET FORMAT</u>
DEVICE: PROTOCOL : PORT : DATA TYPE
EXAMPLE 1: INFRARED COMMUNICATION
Ir:IrSimple::jpg Ir:IrSimple::png
EXAMPLE OF SET DATA WHICH SHARE jpg OR png DATA FILE BY USING COMMUNICATION METHOD IN IrSimple Ir (INFRARED COMMUNICATION) DEVICE
EXAMPLE 2: IP NETWORK COMMUNICATION
Ether:HTTP:8080:jpg
EXAMPLE OF SETTING SHARING WHEN RECEIVING jpg FILE IN HTTP PROTOCOL AT PORT 8080 USING EtherNetwork DEVICE
EXAMPLE 3: SD CARD
SD:::/share/*:jpg
EXAMPLE OF SETTING SHARING jpg FILE IN SD CARD INSERTED TO SD CARD SLOT (IF THERE IS ONE)
EXAMPLE 4: Bluetooth COMMUNICATION
BT:::jpg
EXAMPLE OF SETTING OBTAINING OF jpg FILE BY Bluetooth AT INITIATION OF SHARING
EXAMPLE 5: IP NETWORK COMMUNICATION (STREAMING)
Ether:RTP/AVP:4000: MP4V-ES/90000
EXAMPLE OF SETTING INITIATION OF SHARING WHEN MPEG4 STREAMING IS RECEIVED AT PORT 4000 USING EtherNetwork DEVICE

EX1004, FIG8.

91. External devices such as a mobile phone transmit content data (including photograph data and video data) to the video communication device 1 via these interfaces. EX1004, FIGS. 14-16, 24:50-56, 29:34-31:12. A POSITA would have understood that the content data obtained from these external sources constitutes the claimed “second video data obtained in the external input apparatus.”

92. Toya further discloses that the content data is received from the external device *during an ongoing call session* in which the video communication device 1 is already transmitting video data to the counterpart device and the counterpart device is displaying the video conference on its display. EX1004, FIGS. 14-16 (showing content sharing occurring during an active television phone call). The external device (e.g., the mobile phone) has not established its own call session with the counterpart device and is not a participant in the conferencing system; it merely sends data to the video communication device 1 through a local interface. EX1004, 18:32-49, 24:50-56, 29:34-31:12, FIGS. 14-16.



EX1004, FIGS 14, 16.

93. The combination with Tucker is consistent with the requirement that the external input apparatus "has not logged into the management system." In the

combination, the management system authenticates only the video communication devices (transmission terminals) that participate in the conference, not the external devices (such as mobile phones or SD cards) that supply content data to those terminals through local interfaces. A POSITA would have understood that Toya's external mobile phone or other content source—which connects locally to the video communication device via Bluetooth, infrared, SD card or Ethernet I/F—would not separately authenticate with Tucker's management server, because the external device does not participate in the conferencing session; it merely supplies data to the authenticated terminal. Moreover, Toya already provides security relating to its external device connection, which does not include logging in. EX1004, 27:52-28:2. Thus, a POSITA would understand that the combination of Tucker with Toya would not require (and Toya teaches against) the external device logging into the management system.

94. Therefore, in my opinion, the combination of Toya and Tucker discloses “when an external input apparatus that has not logged into the management system is connected with the first transmission terminal during the first video data being displayed on a display screen of the second transmission terminal, receive, from the external input apparatus, second video data obtained in the external input apparatus.”

8. **[1.f]/[8.f]/[15.f] “in response to receiving the second video data, transmit the first video data and the second video data for sharing with the second transmission terminal using the established communication session.”**

95. It is my opinion that Toya discloses “in response to receiving the second video data, transmit the first video data and the second video data for sharing with the second transmission terminal using the established communication session.”

96. Toya discloses that when the content receiving section 6 obtains content data from an external device, the content transmission section 8 “specif[ies] another communication device as a communication device, to which the obtained content data should be transmitted, if connection with said another communication device is established when the content receiving section (6) obtains the content data.” EX1004, Abstract. The content transmission section 8 transmits the obtained content data to the counterpart device over the established call session. EX1004, 18:24-31, 19:28-43, 20:23-41. During this process, the video communication device 1 continues to transmit its own camera video data and audio data to the counterpart device. EX1004, FIGS. 14-16 (showing “VIDEO (MPEG4), AUDIO (G.711)” continuing alongside “PHOTOGRAPH DATA (JPEG)” transmission). As illustrated in Toya’s FIG. 16, the counterpart device displays both the conference video and the shared content data simultaneously, with the “SELF IMAGE,” “COUNTERPART IMAGE,” and “CONTENT IMAGE” all appearing on the display. EX1004, FIG. 16.

97. Thus, in response to receiving the content data from the external device, Toya's video communication device transmits both the first video data (camera video) and the second video data (content from the external device) for sharing with the counterpart device using the established call session. In my opinion, this satisfies the claim requirement of transmitting "the first video data and the second video data for sharing with the second transmission terminal using the established communication session."

98. Therefore, in my opinion, Toya discloses "in response to receiving the second video data, transmit the first video data and the second video data for sharing with the second transmission terminal using the established communication session."

9. Claim 2/9 "The first transmission terminal according to claim 1, wherein the processing circuitry is configured to transmit the first video data and the second video data via a relay apparatus."

99. It is my opinion that the combination of Toya and Tucker renders obvious "the processing circuitry is configured to transmit the first video data and the second video data via a relay apparatus."

100. Claim 2 depends from claim 1 and further requires that "the processing circuitry is configured to transmit the first video data and the second video data via a relay apparatus."

101. Toya discloses the use of SIP and Internet protocol networking, which inherently involves the relaying of information from device to device across the network, for example via IP switches, hubs, and routers. The SIP headers disclosed in Toya expressly acknowledge this by specifying “max-forwards” parameters, which specify the maximum number of hops (i.e., relays) that the message is permitted to take between source and destination. EX1004, FIGS. 10, 13, 17.

FIG. 13

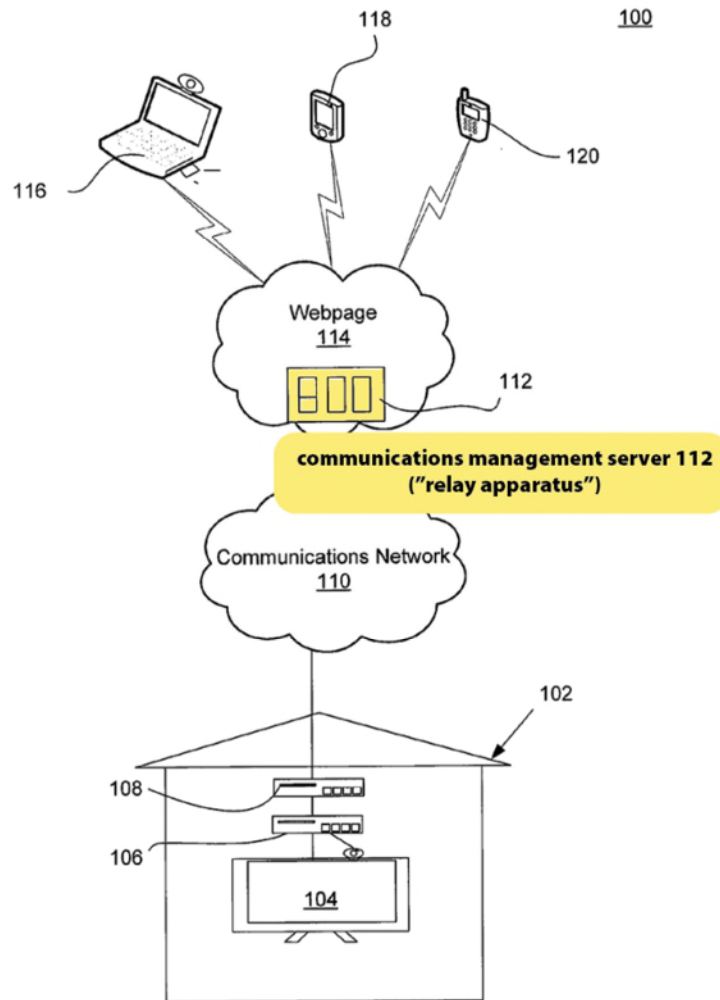
```
INVITE sip:vc2@vc.sharp.co.jp SIP/2.0
Via: SIP/2.0/UDP 172.16.0.163:5060;branch=z9hG4bK1066896417
From: "Mari" <sip:vc1@vc.sharp.co.jp>;tag=897334059-1-0
To: <sip:vc2@vc.sharp.co.jp>;
Call-ID: 1365018947@172.16.0.163
CSeq: 2 INVITE
Contact: <sip:vc1@172.16.0.163:5060>
supported: timer
Session-Expires: 180;refresher=uac
max-forwards: 70
Content-Type: application/sdp
Content-Length: ...

v=0
o=- 0 0 IN IP4 172.16.0.163
s=-
c=IN IP4 172.16.0.163
t=0 0
m=audio 4050 RTP/AVP 0
a=rtpmap:0 PCMU/8000
m=video 4060 RTP/AVP 98
a=rtpmap:98 MP4V-ES/90000
m=application 4070 RTP/AVP 99
a=rtpmap:99 MP4V-ES/90000
a=X-application: sharpVideoStreamShare } 103
```

EX1004, FIG 13.

102. To the extent that Toya's forwarding hops do not involve relay apparatuses, Tucker discloses transmitting video conference data through an intermediary server or relay apparatus. Tucker teaches a system comprising "a server configured to provide a website accessible by a remote user through a network connection" and a set-top box or "a television forwarding device in communication with the server." EX1005, claim 14, [0004], [0019], [0059], FIG1. Tucker's server mediates the video conference between the remote user's communications device or set-top box, functioning as a relay for the conference signals. EX1005, ¶¶[0003]-[0005], [0019]-[0023], [0059], claims 14-16. The server, which may be communications management server 112 or 404, routes media content and video communications between one or more communications devices. EX1005, ¶¶[0019], [0065].

FIG. 1



EX1005, FIG 1.

103. In the combination, Toya's video communication device would transmit both the camera video data and the externally obtained content data through Tucker's intermediary server (relay apparatus) rather than directly to the counterpart device. A POSITA would have been motivated to route the data through a relay apparatus for the same reasons discussed in the motivation to combine—centralized

management, authentication, and security—and because relay-based architectures were the predominant model for enterprise video conferencing. In my opinion, this combination is the predictable use of a known technique (server-mediated data relay) to improve a similar device (Toya’s conferencing terminal) in the same way (routing video and content data through a centralized relay for management and security purposes).

104. Therefore, in my opinion, the combination of Toya and Tucker renders obvious “the processing circuitry is configured to transmit the first video data and the second video data via a relay apparatus.”

10. [3.a]/[10.a] “The first transmission terminal according to claim 2, wherein the relay apparatus is selected from a plurality of relay apparatuses, and”

105. It is my opinion that the Tucker discloses this element and the combination of Toya and Tucker renders it obvious “the relay apparatus is selected from a plurality of relay apparatuses.”

106. Tucker teaches a system architecture in which a server mediates video conference sessions between remote users and television forwarding devices/set-top boxes. EX1005, ¶¶[0003]-[0005], [0019]-[0023], claims 14-16. The communications management system 112 embodiment of Tucker’s server “may include any number of servers, routers, switches, or advanced intelligent devices.” EX1005, ¶[0019] Given that the communications management system 112 may

include any number of servers, a POSITA would understand that it is necessary that one be selected. Similarly, Tucker discloses that “the communications management system 404 may buffer, process, or **route** the communications signals, packets, or data to facilitate the communications.” A POSITA would have understood that “routing” involves selecting intermediate stops through which data, such as packets, are relayed.

107. Moreover, in enterprise video conferencing systems, it was well-known to deploy multiple relay servers across different geographic locations and to select the optimal relay based on network conditions such as latency, proximity, and available bandwidth.

108. Additionally, Toya’s IP/SIP-based forwarding mechanisms, which Toya acknowledges by including “max-forwards” in SIP headers, involves selecting between intermediate proxy servers or routing nodes for relaying data.

109. A POSITA implementing Tucker’s centralized server architecture with Toya’s conferencing system would have found it obvious to select a relay apparatus from among multiple available relays based on network proximity and performance metrics. Based on my experience, this was a known optimization in relay-based conferencing systems, and selecting among plural relays to minimize latency and maximize quality was standard practice before the ’917 Patent’s priority date. In my opinion, the combination is the predictable use of known prior art elements

(Tucker's server-mediated relay architecture; known relay selection techniques based on network metrics) according to known methods to yield predictable results (selecting the optimal relay apparatus for a video conference session from among multiple available relays).

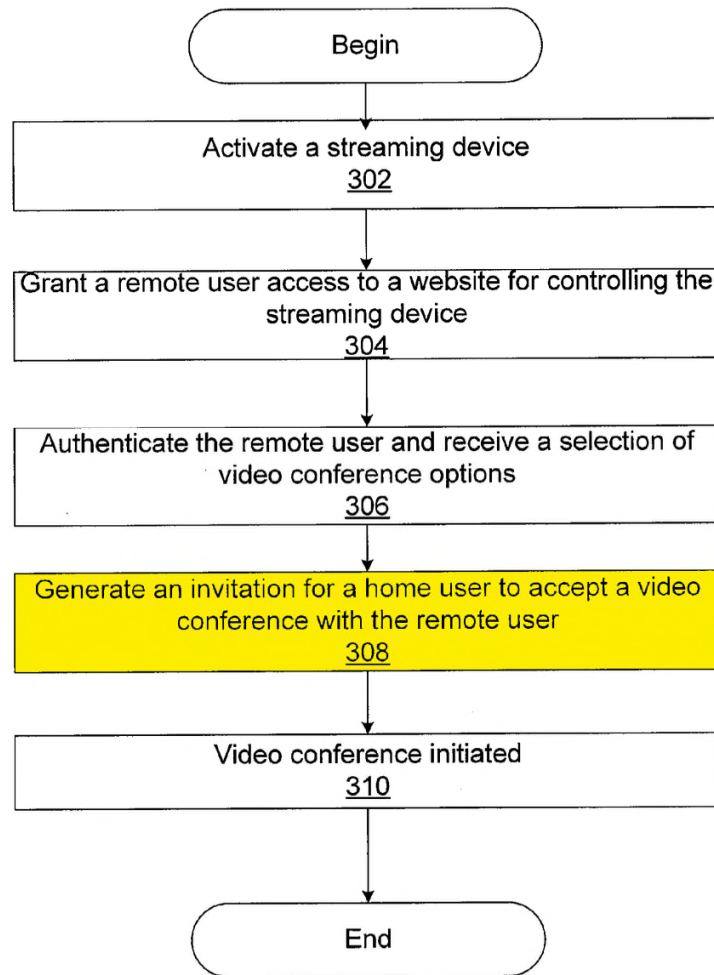
110. Therefore, in my opinion, the combination of Toya and Tucker discloses "the relay apparatus is selected from a plurality of relay apparatuses."

11. [3.b]/[10.b] "the processing circuitry receives, from the management system, terminal identification information for identifying another transmission terminal that has requested a start of communication from among a plurality of transmission terminals."

111. It is my opinion that Tucker discloses "the processing circuitry receives, from the management system, terminal identification information for identifying another transmission terminal that has requested a start of communication from among a plurality of transmission terminals."

112. Tucker teaches that when a remote user selects to initiate a video conference with a local user, the system sends an invitation to the television forwarding device or set-top box to notify the local user that a remote user has requested communication. EX1005, ¶¶[0003]-[0005],[0016],[0059],[0064]-[0065] claim 1, FIG3.

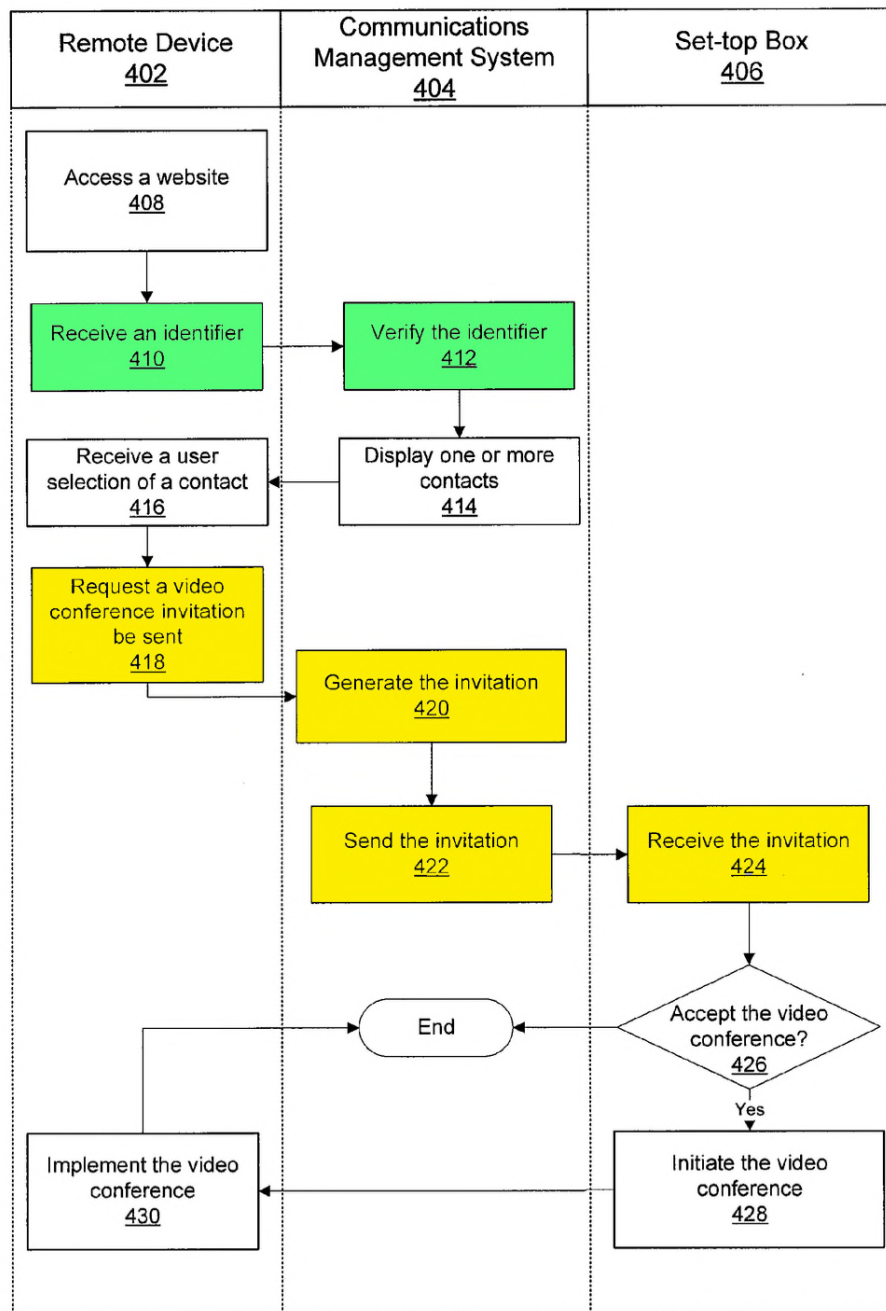
FIG. 3



EX1005, FIG 3.

113. The server identifies which remote user has requested the start of communication and conveys that information to the television forwarding device or set-top box (the receiving terminal), enabling the local user to know who is requesting the conference and to accept or decline. EX1005, ¶¶[0003]-[0004], [0022]-[0023], claims 1, 14, FIG. 4.

FIG. 4



EX1005, FIG 4.

114. The invitation sent from the server to the television forwarding device or set-top box—which identifies the requesting remote user—constitutes “terminal

identification information for identifying another transmission terminal that has requested a start of communication.” The server, for example communications management system 112 or 404, which manages multiple authorized users in its database, constitutes the “management system” that provides this information “from among a plurality of transmission terminals.”

115. In the combination, Tucker’s management server—which maintains a database of multiple authorized terminals and mediates session initiation by sending invitations identifying the requesting user—provides terminal identification information to the receiving terminal, enabling it to identify which of the plurality of managed terminals has requested a start of communication. A POSITA would have understood that informing a receiving terminal of the identity of a requesting terminal was a known feature of managed, multi-terminal video conferencing systems. This is further confirmed by the fact that Tucker’s system already performs this function when it sends an invitation identifying the remote user to the television forwarding device. In my opinion, the combination satisfies this limitation.

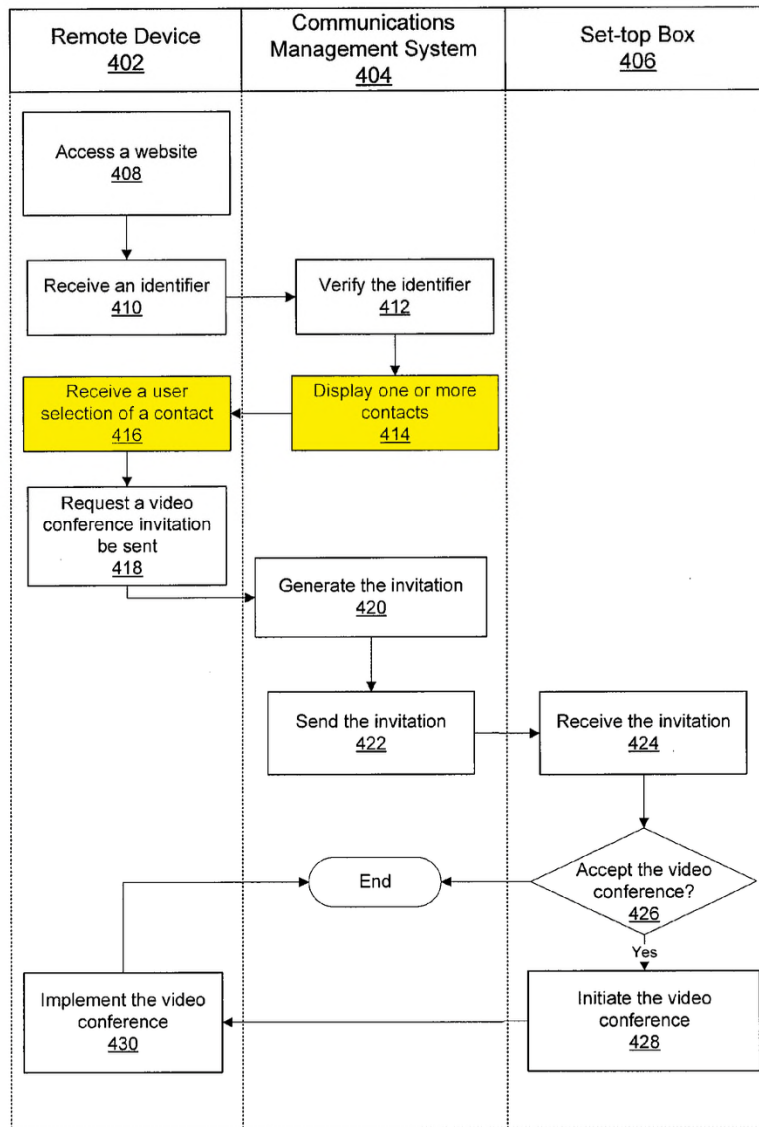
116. Therefore, in my opinion, Tucker discloses “the processing circuitry receives, from the management system, terminal identification information for identifying another transmission terminal that has requested a start of communication from among a plurality of transmission terminals.”

12. [7.a]/[14.a] **“The first transmission terminal according to claim 1, wherein the processing circuitry is configured to receive, from the management system, information of destination candidates associated with the first transmission terminal,”**

117. It is my opinion that Tucker discloses “the processing circuitry is configured to receive, from the management system, information of destination candidates associated with the first transmission terminal.”

118. Tucker teaches that the server provides the user with a list of available contacts for video conferencing. EX1005, ¶[0003]-[0004], [0022]-[0023], [0061], claim 1. Specifically, Tucker discloses that “the selection of the user is made using a network address book that lists a plurality of contacts, wherein the plurality of contacts are received based on user input through the set-top box.” EX1005, claim 3, [0023], [0054], [0062]. The server maintains a database of authorized users and provides the requesting user with information about which contacts are available for communication. EX1005, claims 3, 14-15, [0023], [0054], [0061]-[0062]. The network address book listing a plurality of contacts constitutes “information of destination candidates associated with the first transmission terminal,” and the server that stores and provides this information constitutes the “management system.” For example, communications management system 404 displays a list of contacts from which the user of the remote device can select. EX1005, FIG4.

FIG. 4



EX1005, FIG 4.

119. In the combination, after Toya's video communication device authenticates with Tucker's management server, the server provides a list of destination candidates—i.e., other authenticated terminals available for communication—to the first terminal. A POSITA would have understood that

receiving a list of available conferencing destinations from a centralized server was a predictable feature of managed video conferencing systems.

120. Therefore, in my opinion, Tucker discloses “the processing circuitry is configured to receive, from the management system, information of destination candidates associated with the first transmission terminal.”

13. [7.b]/[14.b] “receive a selection from among the received information of the destination candidates, and”

121. It is my opinion that Tucker discloses “receive a selection from among the received information of the destination candidates.”

122. Tucker teaches that after the contacts are presented to the user, the system “receiv[es] a selection of a user for the remote user to communicate with through the video conference.” EX1005, ¶[0003]-[0004], [0054], [0063]-[0065], claim 1. As illustrated in Tucker’s FIG6, the user interface presents a “Select Participant(s)” step in which the user chooses from among available contacts such as “Home,” “Mom and dad,” and “Guest House.” EX1005, FIG6, ¶¶[0071]-[0074]. The user’s selection of a desired contact from among the listed destination candidates constitutes “receiv[ing] a selection from among the received information of the destination candidates.”

123. In the combination, after Tucker’s management server provides the list of destination candidates to Toya’s video communication device, the user selects one of those candidates through the device’s user interface. A POSITA would have

understood that presenting a list of available destinations and receiving a user selection was a standard step in initiating a managed video conference session.

124. Therefore, in my opinion, Tucker discloses “receive a selection from among the received information of the destination candidates.”

14. [7.c]/[14.c] “establish the communication session with the second transmission terminal corresponding to information of the thus selected destination candidate.”

125. It is my opinion that the combination of Toya and Tucker discloses “establish the communication session with the second transmission terminal corresponding to information of the thus selected destination candidate.”

126. Tucker teaches that, in response to the user’s selection, the system establishes the video conference with the selected contact. Specifically, Tucker discloses sending an invitation to the television forwarding device or set-top box, and implementing the video conference between the remote user and the user in response to the user accepting the invitation. EX1005, ¶[0003], [0046], claim 1. The video conference session is thus established with the specific terminal corresponding to the user’s selection from among the destination candidates.

127. Toya provides the underlying session-establishment mechanism. EX1004, 16:51-17:10, FIG9. Toya discloses that after the user selects a counterpart device, the communication control section 2 establishes “a call session with another video communication device serving as a counterpart device” using SIP signaling.

EX1004, 16:58-17:6. In the combination, after Toya’s video communication device receives the list of destination candidates from Tucker’s management server and the user selects one of those candidates, Toya’s SIP-based session establishment mechanism initiates a call session with the selected counterpart device—the “second transmission terminal corresponding to information of the thus selected destination candidate.” A POSITA would have understood that establishing a conferencing session with a user-selected destination was the expected outcome of combining Toya’s SIP-based session establishment with Tucker’s server-mediated participant selection.

128. Therefore, in my opinion, the combination of Toya and Tucker discloses “establish the communication session with the second transmission terminal corresponding to information of the thus selected destination candidate.”

B. Ground 2: Toya in view of Tucker and Further in View of Chang Render Obvious Claims 4-6 and 11-13

129. The permission-request, program-transmission, and conditional-installation steps of claims 4–6 are the application of software deployment techniques that a POSITA would have found obvious when implementing Toya’s content-sharing architecture.

130. To the extent a POSITA wanted additional details beyond Toya in view of Tucker about the permission-request, program-transmission, and conditional-

installation mechanisms (as recited in claims 4–6), Chang discloses these elements.

131. Chang discloses a plug-and-show USB portable disk that, when connected to a presenter’s laptop during a conference, automatically delivers screen-capture software (“green software”) from the conferencing hub system to the laptop, causes the software to execute on the laptop to capture presentation frame data, and forwards the captured data through the laptop to the wireless gateway for display to conference participants—all without requiring pre-installation on the laptop. EX1007, Abstract, 4:55-5:21, FIGS. 2, 4. In this architecture, the wireless gateway and its associated USB portable disk constitute the conferencing hub (analogous to the “first transmission terminal” that is logged into the conference), and the presenter’s laptop constitutes the “external input apparatus” that has not logged into the conferencing management system. A POSITA would have understood that the USB disk is functionally a component of the hub—it is the physical mechanism by which the hub delivers its screen-sharing program to external participant laptops, just as the ’917 Patent’s transmission terminal stores and transmits its display data acquiring unit to the external input apparatus.

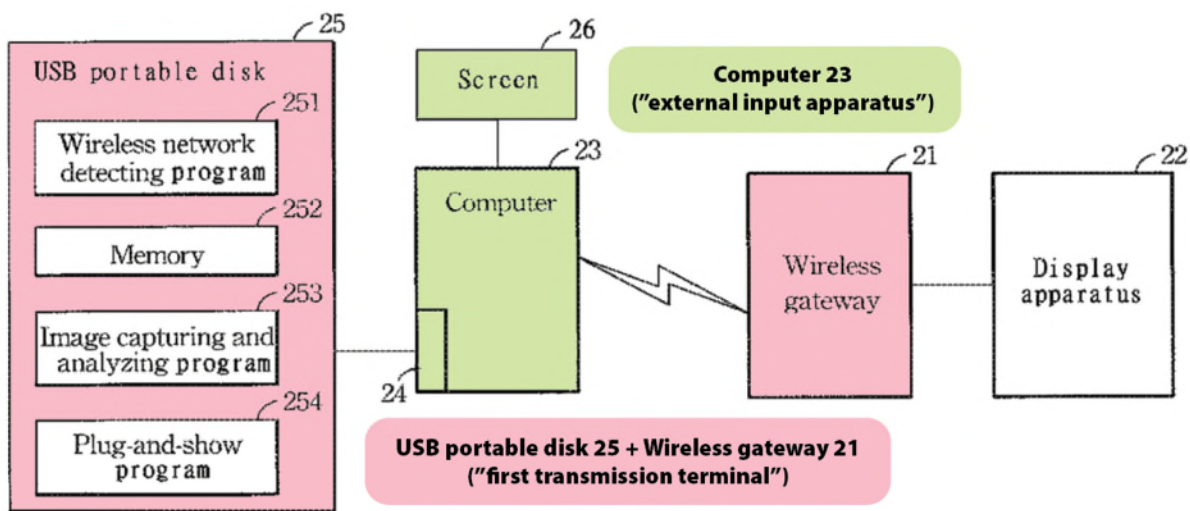
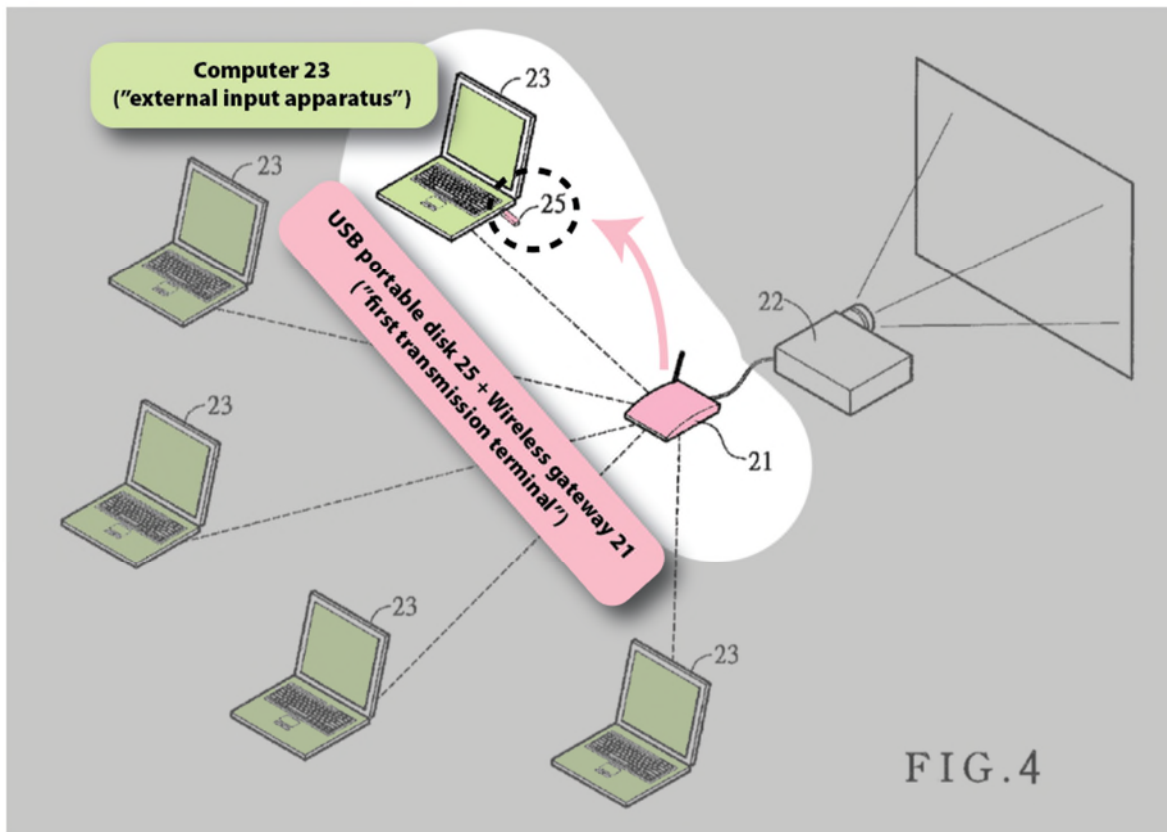


Fig. 2

EX1007, FIGS 2, 4.

132. In my opinion, Chang’s disclosures map directly to each limitation of claims 4–6. For claim 4, Chang teaches that when the USB portable disk engages with the laptop’s USB port, the auto-run plug-and-show program triggers a request for the laptop to permit execution of the image capturing and analyzing program (claim 4.a), and upon permission the program executes on the laptop to capture display data that is forwarded to the wireless gateway (claim 4.b). For claim 5, Chang teaches that the conferencing hub system transmits the screen-capture program to the laptop via the USB portable disk upon connection. For claim 6, Chang’s green-software architecture satisfies the conditional-installation requirement: because the program is never permanently installed on the laptop—it is loaded fresh upon each connection and removed upon disconnection—the system transmits the program each time the connection is made, because the program is not installed on the external device when the connection occurs. EX1007, 5:1-7;

133. In my opinion, a POSITA would have been motivated to combine Chang with Toya and Tucker for the reasons below. I am not aware of any secondary considerations that would overcome the obviousness of the ground.

1. Motivation to Combine

134. **Same Field of Endeavor:** In my opinion, Chang, Toya, and Tucker are all directed to systems for sharing presentation content or video data during conferences or meetings. Chang specifically addresses wireless presentation

systems in which “plural representatives with their own computers may present to show their presentation files pre-stored in their own computers” during a “presentation conference.” EX1007, 1:43-54. This is the same conference content-sharing scenario addressed by Toya and the ’917 Patent. A POSITA designing a video conferencing terminal with content-sharing capabilities from external devices would have naturally looked to Chang’s plug-and-show architecture.

135. Chang Solves a Problem That Toya and Tucker Do Not Address: The Toya/Tucker combination provides the foundational video conferencing and content-sharing architecture but does not focus on how the external device transmits image or video data to the terminal. For example, Toya is silent on how a mobile phone would transmit the image/video if it does not have software installed for performing such transmission, or how such software might be seamlessly and conveniently installed. Chang provides disclosure on how such functionality might be implemented. Chang identifies the need—“a specific drive program for the wireless projector is needed to be installed into the computer prepared for a corresponding wireless projector”—and provides the solution: a plug-and-show USB disk that automatically provides and executes green software on the external computer upon connection, without requiring pre-installation. EX1007, 1:32-2:56, Abstract. A POSITA would have been motivated to incorporate Chang’s plug-and-show program-delivery mechanism into the Toya/Tucker combination to

enable sharing of screens, videos, or images from any external device without requiring the external device to already have any necessary content-sharing software installed.

136. **Chang’s Express Motivation:** Chang identifies the motivation for its approach: eliminating the need for pre-installation of drive programs on each presenter’s computer, avoiding “time needed for the installation as well as the restart process” that “may ruin his/her presentation or at least cost the conference flow,” and enabling presentation “any time after the plug-and-show USB portable disk is plugged into the computer.” EX1007, 1:57-2:16, 3:51-65. These same motivations apply directly to Toya’s content-sharing system: a video conferencing terminal that can automatically provide necessary software to any connected external laptop—without requiring pre-installation—delivers the same plug-and-show convenience in the video conferencing context.

137. **Predictable Combination of Known Elements:** In my opinion, the combination of Toya, Tucker, and Chang is the predictable use of known prior art elements according to known methods to yield predictable results. Toya teaches a video conferencing terminal that receives content from external devices and forwards it over an established session. EX1004, 17:58-18:49, 19:28-50, 20:23-32. Tucker teaches centralized authentication for session establishment. EX1005, [0003]-[0005], [0022]-[0023], claims 1, 13-15. Chang teaches delivering an image

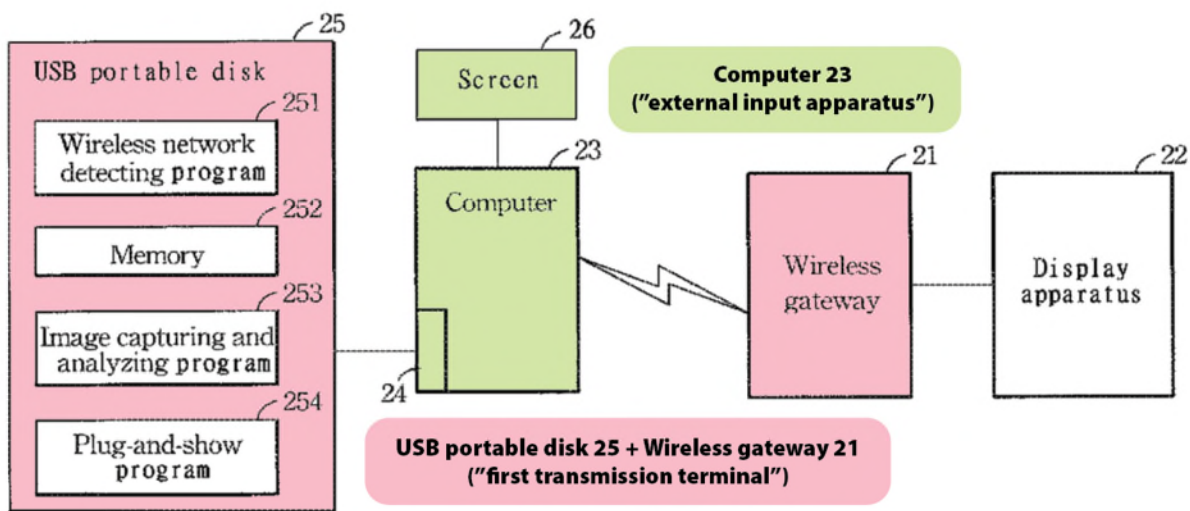
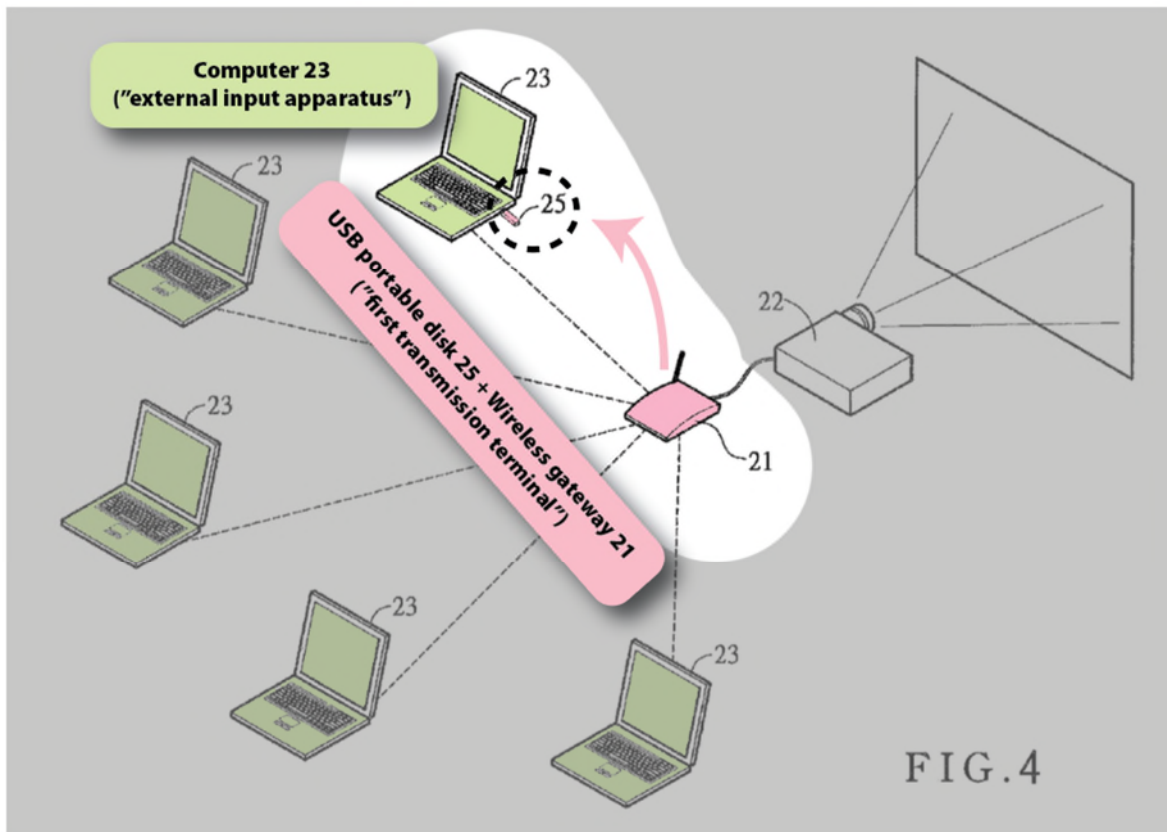
transfer program from a conferencing hub (via USB disk) to an external computer upon connection, with the program automatically executing to capture and forward display data to the conferencing system—all without pre-installation. EX1007, Abstract, 4:55-5:21. Incorporating Chang's plug-and-show program-delivery mechanism into the Toya/Tucker combination yields a predictable result: when an external laptop connects to the video conferencing terminal, the terminal provides a screen-capture program to the laptop, the laptop requests permission to execute the program, the program captures the laptop's display data, and the captured image data is forwarded to the conferencing counterpart over the established session.

138. **Reasonable Expectation of Success.** A POSITA would have had a reasonable expectation of success because Chang's plug-and-show architecture operates at the same physical interface (USB connection between an external computer and a conferencing hub) as the '917 Patent's external input apparatus connection. The modification requires no changes to Toya's video conferencing session architecture or Tucker's authentication mechanism—it adds Chang's program-delivery and auto-execution mechanism at the point where the external device physically connects to the terminal.

2. **[4.a]/[11.a] “The first transmission terminal according to claim 1, wherein the processing circuitry receives, from the external input apparatus, a request for permission to execute a program that is for obtaining data in the external input apparatus, and”**

139. It is my opinion that Chang discloses “the processing circuitry receives, from the external input apparatus, a request for permission to execute a program that is for obtaining data in the external input apparatus.”

140. In Chang’s system, the USB portable disk 25 stores a plug-and-show program 254 that is an auto-run program. EX1007, 5:1-7. When the USB portable disk 25 engages with the USB transmission port 24 of the computer 23, “the computer 23 will automatically execute any instruction from the plug-and-show program 254.” EX1007, 5:1-7. In Chang, the wireless gateway 21 (together with the USB portable disk 25, which is part of or associated with the gateway/hub system) is the “first transmission terminal,” and the computer 23 (the presenter’s laptop) is the “external input apparatus.” The USB portable disk 25 is the physical mechanism by which the first transmission terminal provides its program to the external input apparatus—it is functionally part of the conferencing hub infrastructure, as a POSITA would have understood that the dongle/USB disk is the hub’s accessory for enabling screen sharing from external laptops.



EX1007, FIGS 2, 4.

141. When the computer 23 detects the engagement of the USB portable disk, the auto-run function triggers the plug-and-show program, which constitutes a request—initiated by the USB disk (associated with the terminal/hub)—for the computer to permit execution of the image capturing and analyzing program 253. EX1007, 5:1-8. Under USB auto-run protocols, the host computer’s operating system receives the auto-run request and determines whether to permit execution—Windows auto-run prompts, for example, ask the user to confirm execution of software from removable media. A POSITA would have understood that this auto-run engagement constitutes a “request for permission to execute a program that is for obtaining data in the external input apparatus.”

142. Moreover, Chang’s USB portable disk 25 stores the plug-and-show program 254, the image capturing and analyzing program 253, and the wireless network detecting program 251. EX1007, 4:49-5:21. When the USB is inserted into the computer (the claimed external input apparatus), the wireless network detecting program is launched, to establish a connection to Chang’s wireless gateway (the claimed transmission terminal). EX1007, 2:58-65. A POSITA would have understood that if the computer is not permitted by the wireless network to connect, the other programs, which capture then transmit images wirelessly to the wireless gateway, should not be executed, as such transmission would be impossible.

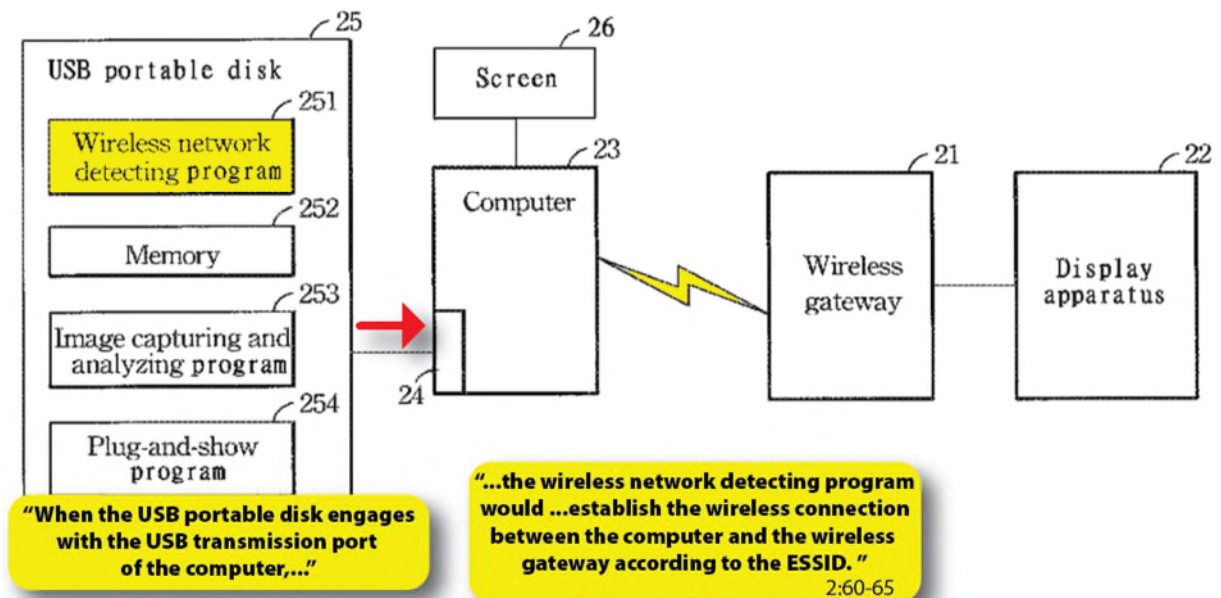


Fig. 2

EX1007, FIG 2.

143. Toya provides motivation for this sort of permission-based system, noting the importance of preventing content from unexpected sources from being transmitted over the network. EX1004, 5:14-28.

144. A POSITA would have found it obvious to implement a permission-request mechanism in which the external input apparatus asks the conferencing terminal for authorization before executing a data-capture program. This pattern ensures that (1) the terminal user retains control over what data is captured and shared during the conference—a straightforward security and usability consideration that was well-known in the design of connected-device architectures, and (2) image capture and transmission software does not execute when such transmission is impossible, which would waste computing resources.

145. Therefore, in my opinion, Chang discloses “the processing circuitry receives, from the external input apparatus, a request for permission to execute a program that is for obtaining data in the external input apparatus.”

3. **[4.b]/[11.b] “in response to permission of the request, the program is executed in the external input apparatus, and thus, the processing circuitry receives, from the external input apparatus, the second video data obtained in the external input apparatus.”**

146. It is my opinion that Chang discloses “in response to permission of the request, the program is executed in the external input apparatus, and thus, the processing circuitry receives, from the external input apparatus, the second video data obtained in the external input apparatus.”

147. Upon the computer 23 permitting execution, the plug-and-show program 254 causes the computer 23 to execute the image capturing and analyzing program 253, which captures and analyzes the presentation frame data transmitted from the computer to the screen and generates and forwards an analysis result of the presentation frame data to the wireless gateway through the computer. EX1007, 2:66-3:3, 5:10-21. The image capturing and analyzing program 253 executes *on the computer 23* (the external input apparatus) and captures presentation frame data (the “second video data”) from the computer’s display output. EX1007, 2:66-3:17. The captured data is then forwarded from the computer 23 to the wireless gateway 21 (and ultimately to the display apparatus 22 for the conference). EX1007, 2:66-3:17, 4:39-5:8.

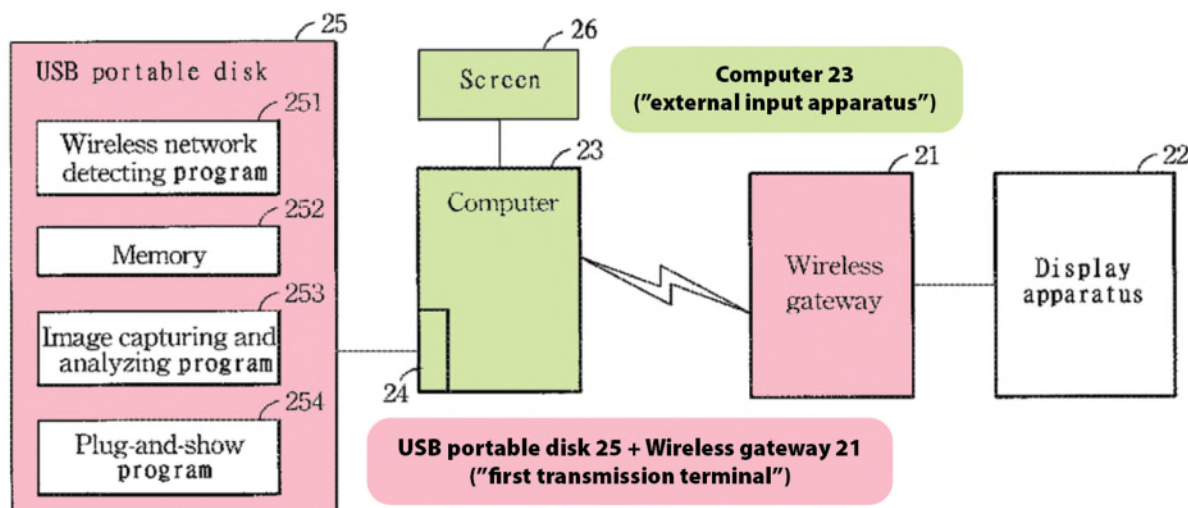


Fig. 2

EX1007, FIG2.

148. In the combination with Toya and Tucker, the wireless gateway 21 (the first transmission terminal, which is logged into the conferencing system) receives the captured display data from the computer 23 (the external input apparatus that has not logged into the management system) and forwards it to the remote conference participants. A POSITA would have understood that this maps to claim 4.b: in response to permission, the program executes in the external input apparatus to obtain data, and the processing circuitry of the first terminal receives the obtained data from the external apparatus.

149. A POSITA would have understood that conditioning the execution of a data-acquisition program on receiving permission from the host terminal was a routine and predictable design choice. This pattern provides the terminal user with

an opportunity to authorize or decline the data capture before it occurs, which was a well-known approach to managing device interactions in conferencing and collaboration systems.

150. Therefore, in my opinion, Chang discloses “in response to permission of the request, the program is executed in the external input apparatus, and thus, the processing circuitry receives, from the external input apparatus, the second video data obtained in the external input apparatus.”

4. Claim 5/12 “The first transmission terminal according to claim 4, wherein the processing circuitry is configured to transmit the program to the external input apparatus.”

151. It is my opinion that Chang discloses “the processing circuitry is configured to transmit the program to the external input apparatus.”

152. Chang’s USB portable disk 25 stores the plug-and-show program 254, the image capturing and analyzing program 253, and the wireless network detecting program 251. EX1007, 4:49-5:21. When the USB portable disk 25 is inserted into the computer 23’s USB transmission port 24, these programs are provided from the USB disk to the computer for execution. EX1007, 5:1-8. The USB portable disk 25, as an accessory of the wireless gateway/conferencing hub system, constitutes the mechanism by which the first transmission terminal transmits its programs to the external input apparatus.

153. A POSITA would have understood that the USB portable disk is functionally equivalent to a component of the conferencing hub—it is the physical carrier that the hub system uses to deliver its screen-capture software to the external laptop. Commercial wireless presentation systems such as those manufactured by Awind (the assignee of Chang), Barco (ClickShare), and Crestron have long used USB dongles as the mechanism by which the conferencing hub transmits its screen-sharing program to participant laptops. A POSITA would have recognized that whether the program is stored on a USB dongle physically associated with the hub or in internal storage of the terminal itself, the result is the same: the first terminal transmits a program to the external device.

154. Moreover, transmitting a program from a host device to a connected peripheral for execution on the peripheral was a well-known software deployment technique, and a POSITA would have found it obvious to transmit a data-acquisition program from Toya's video communication device to the connected external device in order to enable content capture and sharing.

155. Therefore, in my opinion, Chang discloses “the processing circuitry is configured to transmit the program to the external input apparatus.”

5. **Claim 6/13 “The first transmission terminal according to claim 5, wherein if the program is not installed in the external input apparatus when the first transmission terminal is connected with the external input apparatus, the processing circuitry transmits the program to the external input apparatus.”**

156. It is my opinion that Chang discloses “if the program is not installed in the external input apparatus when the first transmission terminal is connected with the external input apparatus, the processing circuitry transmits the program to the external input apparatus.”

157. Chang’s programs are “green software”—software “that can be executed directly in the computer without any pre-installation.” EX1007, 4:55-67. Chang explains that “[t]he green software can be stored in the USB portable disk 25, and thus can be run immediately as soon as the USB portable disk 25 is engaged with the USB transmission port 24 of the computer 23. While the USB portable disk 25 disengages with the computer 23, the green software can be removed from the computer 23 automatically.” EX1007, 4:56-62.

158. This green-software architecture discloses the conditional-installation logic of claim 6: because the program is never permanently installed on the external computer—it is loaded fresh each time the USB disk is connected and removed when disconnected—the system provides the program to the computer each time the connection is made, because the program is *not installed* on the computer when the connection occurs. Chang identifies this as an advantage over the prior art, which

“need[ed] to install a proper drive program immediately at the conference site” and which “different manufacturers provide different drive programs for their products.” EX1007, 1:55-2:16. Chang’s solution—transmitting the program from the USB disk (associated with the hub) to the computer only upon connection, because it is never permanently installed—discloses the conditional-installation requirement of claim 6.

159. Moreover, a POSITA would have understood that implementing an explicit check before transmitting the program is a predictable optimization of Chang’s approach: if the green software happens to already be present on the computer (e.g., from a prior connection that was not properly cleaned up), there is no need to re-transmit it. Adding such a check to Chang’s system would have been a software engineering step.

160. Moreover, this claimed conditional-installation pattern—checking whether software is already present before transmitting it—was a well-known technique in software deployment, and a POSITA implementing a content-sharing system would have found it obvious to check for the presence of the required program on the external device before transmitting it, in order to avoid redundant installations and reduce network overhead.

161. Therefore, in my opinion, Chang discloses “if the program is not installed in the external input apparatus when the first transmission terminal is

connected with the external input apparatus, the processing circuitry transmits the program to the external input apparatus.”

C. Ground 3: Toya in view of RFC 3261 Renders Obvious Claims 1-3, 8-10, and 15

162. In my opinion, Toya in view of RFC 3261 renders obvious every limitation of claims 1-3, 8-10, and 15. Based on my review, Toya provides the foundational video conferencing architecture in which a communication device establishes a call session with a counterpart device, captures and transmits video data, receives content data from an external source, and forwards that content to the counterpart over the established session. Toya discloses that this can be accomplished using Session Initiation Protocol (SIP). EX1004, 16:65-17:6. Toya does not, however, explicitly disclose that the terminals log into a centralized management system by transmitting a login request before establishing the communication session. RFC 3261 discloses a server-mediated video conferencing system in which terminals must log into a managing registrar system prior to videoconferencing. EX1006, §22, §26.1.1. All other limitations of claims 1-3, 7-10, and 14-15 are disclosed by Toya as explained above in Ground 1.

1. RFC 3261

163. RFC 3261 was published by the Internet Engineering Task Force (IETF) in June 2002, approximately eight years before the '917 Patent's earliest

priority date of May 6, 2010, and qualifies as prior art at least under 35 U.S.C. § 102(b) (pre-AIA).

164. The document lists June 2002 as its publication date, and provides that “Distribution of this memo is unlimited.” EX1006, p.1. The IETF Datatracker—the official publication index maintained by the Internet Engineering Task Force—lists RFC 3261 with a date of June 2002. EX1006. The document header on each page of the RFC itself bears the legend “RFC 3261 SIP: Session Initiation Protocol June 2002,” which serves as an internal publication-date indicator analogous to a copyright notice. EX1006, p.2 (header). The document also provides a “Copyright Notice” reciting “Copyright (C) The Internet Society (2002).” EX1006, p.1. The NISP Nation standards registry independently catalogs RFC 3261 with a publication date code of “2002-06”. EX1017. Together, these corroborating sources leave no ambiguity regarding the date on which RFC 3261 became a publicly available printed publication for purposes of § 102(b). These characteristics are consistent with RFCs for which I was a co-author, RFCs 3170, 3171, and 3611 published in September 2001, August 2001, and November 2003, respectively.

165. Additionally, subsequent IETF documents that update or reference RFC 3261 uniformly cite it with a June 2002 date. For instance, the bibliographic entry in draft-ietf-sipcore-priority (later published as RFC 6878) states: “Rosenberg, J., Schulzrinne, H., Camarillo, G., Johnston, A., Peterson, J., Sparks, R., Handley,

M., and E. Schooler, ‘SIP: Session Initiation Protocol’, RFC 3261, June 2002.” EX1018, (<https://datatracker.ietf.org/doc/html/rfc6878>, at Section 4.1. I also cited to RFC 3261 in my own work, published in 2006¹. This consistent bibliographic practice across the IETF corpus is itself evidence that the document was publicly accessible as of that date, because the citing authors necessarily had access to RFC 3261 in order to reference it.

166. RFC 3261 is also discussed in U.S. Pat. Publ. No. 2004/0062204A1 (EX1020), based on an application filed Sep. 30, 2002, where it is described as being published at <http://www.ietf.org/rfc/rfc3261.txt> in June 2002.

167. Moreover, I attended SIP working group meetings, along with other audio/video related working groups, in the years prior to the standardization of SIP as RFC 3261. Many of the IETF meetings from 1995 to 2005 I attended as part of the volunteer team that provided video conferencing support for remote participants via the Multicast Backbone (MBone). I am familiar with the technical content of the SIP standard and the inter-workings of the IETF.

168. Further, I personally accessed RFC 3261 from publicly available sources shortly after its June 2002 publication and on numerous occasions thereafter. The RFC Editor has maintained RFC 3261 on its publicly accessible website

¹ G. Banks, M. Cova, V. Felmetzger, K. Almeroth, R. Kemmerer and G. Vigna, "[SNOOZE: toward a Stateful NetwOrk prOtocol fuzZEr](#)," *Information Security Conference (ISC)*, Samos Island, GREECE, September 2006; EX1019

(<https://www.rfc-editor.org>) and at the IETF's own web repository (<https://www.ietf.org/rfc/rfc3261.txt>) since the document's initial publication. EX1006. While in the United States, I downloaded RFC 3261 multiple times from the RFC Editor website and the IETF website, both of which are freely accessible to any member of the public without any subscription, paywall, or access restriction. The IETF's longstanding open-access policy ensures that all published RFCs are available to the global public at no cost. I further confirm personal knowledge that RFC 3261 was extensively discussed, distributed, and relied upon within the networking and telecommunications community beginning in 2002, including at IETF working group meetings and industry conferences. Accordingly, RFC 3261 was publicly accessible years before the May 6, 2010 earliest priority date of the '917 Patent.

2. Motivation to Combine

169. A POSITA would have been motivated to incorporate RFC 3261's authentication mechanisms into Toya's SIP-based video conferencing and content-sharing system for several independently sufficient reasons. I am not aware of any secondary considerations that would overcome the obviousness of the ground.

170. **Toya's Express Concern with Security and Use of SIP:** Toya expressly discloses that it is desirable to decrease the possibility that an unexpected

communication device can access the content data. EX1004, 21:10-20. Toya further discloses that the use of SIP protocols for communications. EX1004, 27:52-28:2.

171. Given Toya's extensive disclosures involving using SIP and its express disclosure of the desirability of ensuring that only authorized devices can access content data, a POSITA would have been motivated to combine Toya with SIP for authentication as disclosed in RFC 3261, which defines the Session Initiation Protocol standard.

172. **Same Field of Endeavor:** In my opinion, Toya and RFC 3261 are in the same field of endeavor: both are directed to conferencing systems that establish sessions between remote participants and transmit multimedia data over a communication network. Toya discloses a "video communication device" that "function[s] as a television conference system terminal device" and establishes "a call session with another video communication device serving as a counterpart device, thereby realizing reception and transmission of video data and audio data therebetween." EX1004, 16:51-64. RFC 3261 likewise discloses a standard for "creating, modifying and terminating sessions with one or more participants," including "multimedia conferences." EX1006, Abstract, p. 1. Both references address how to manage the initiation and conduct of conferences between networked endpoints. A POSITA designing a video conferencing system with content-sharing capabilities would have naturally looked to both references.

173. **RFC 3261 Solves a Problem That Toya's System Faces:** In my opinion, Toya's system faces a security and access-control problem that Toya does not focus on: how to ensure that only authorized users can initiate or participate in video conference sessions. Toya discloses that its video communication device establishes call sessions using SIP signaling, but Toya does not focus on mechanisms for verifying the identity or authorization of the terminals before permitting the session to proceed. EX1004, 16:51-17:10. Without an authentication mechanism, any device with network access could potentially initiate a call session with Toya's video communication device, raising concerns about unauthorized access and misuse.

174. RFC 3261 directly solves this problem. RFC 3261 discloses a "registrar" which is a server that handles registration of authenticated entities which may participate in videoconferences. The registrar is a server that handles "REGISTER" requests, which associate a user with a particular terminal. EX1006, §6, 10.2. RFC 3261 also notes the threat of "registration hijacking," and suggests that a service "control access to its resources by authenticating requests that it receives" because devices "have an interest in ascertaining the identities of originators of requests." EX1006, §26.1.1. As RFC 3261 states, there is "the need for security services that enable SIP entities to authenticate the originators of requests." EX1006 § 26.1.1.

175. RFC 3261 states that a registrar “SHOULD authenticate the UAC.” EX1006, §10.3. RFC 3261 discloses a challenge-based mechanism for authentication that resolves the issue, identified in Toya, that an unauthorized party might otherwise access content data. EX1006, §22. Specifically, RFC 3261 discloses a login framework where, in response to an initial request from a client, the responding server may issue a challenge, requiring the user’s terminal to provide information proving identity. EX1006, §22.

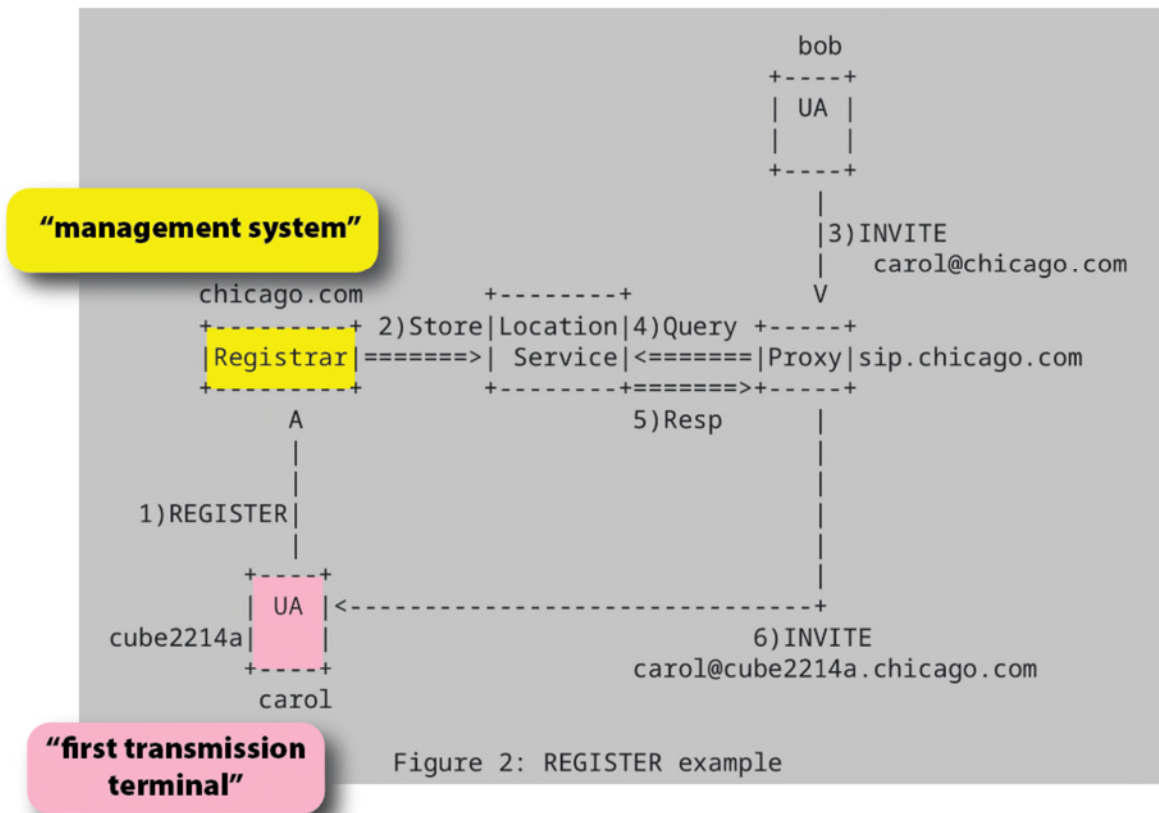
176. **Predictable Combination of Known Elements:** In my opinion, the combination of Toya and RFC 3261 is the predictable use of known prior art elements according to known methods to yield predictable results. Toya teaches a video conferencing terminal that establishes SIP-based call sessions, transmits camera video to a counterpart device, receives content data from external sources, and forwards that content to the counterpart over the established session. Toya further discloses specific details of the use of SIP protocols, such as the “INVITE” message. EX1004, FIGS. 10, 13. RFC 3261 discloses the specifications for the SIP protocol, including the INVITE message as well as authentication procedures and the use of registrars to manage conference participant registration. Incorporating registrars and authentication into Toya involves the inclusion of additional SIP features, not addressed by Toya, into Toya’s existing scheme. The authentication

and registrar features disclosed by RFC 3261 are designed to work in conjunction with the INVITE and other SIP protocol features relied upon and disclosed by Toya.

3. [1.b]/[8.b]/[15.b] “log into a management system by transmitting a login request to the management system,”

177. It is my opinion that Toya does not explicitly disclose logging into a management system by transmitting a login request, and RFC 3261 discloses “log into a management system by transmitting a login request to the management system.”

178. RFC 3261 discloses a video conferencing system in which a user registers with a registration server, which is a management apparatus, before participating in conferences. EX1006, Abstract; §24.1. RFC 3261 teaches a “registrar” which is a server that handles registration of users who may participate in videoconferences, and, more specifically handles users’ “REGISTER” requests. EX1006, §10.3. RFC 3261 also explains that “authentication [is] usually required for registration” (EX1006, §24.1) because there is “the need for security services that enable SIP entities to authenticate the originators of requests.” EX1006, §26.1.1.



EX1006, FIG2.

179. RFC 3261 teaches that the user at a “UA” (first transmission terminal) submits a login request by providing “credentials” in response to an authentication challenge. EX1006, §26.2.3. EX1006, §§8.1.3.5, 21.4.2, 22.1-22.3. In response to the challenge, the challenged device must provide appropriate credentials to the registrar. EX1006, §22.1. By sending a REGISTER message with the authorization request header, the client is transmitting a login request to the registration server.

180. Therefore, in my opinion, RFC 3261 discloses “log into a management system by transmitting a login request to the management system.”

D. Ground 4: Toya in view of RFC 3261 and Further in View of Chang Render Obvious Claims 4-6 and 11-13

181. For the same reasons as explained above in Ground 2, to the extent a POSITA wanted additional details beyond Toya in view of RFC 3261 about the permission-request, program-transmission, and conditional-installation mechanisms as recited in claims 4–6 and 11-13, Chang discloses these elements. Based on my review, Toya’s video communication device 1 establishes call sessions with counterpart devices using SIP signaling as defined in RFC3261, transmits camera video data over the established session, receives content data from external devices through local interfaces (Bluetooth, infrared, SD card, Ethernet), and forwards that content to the counterpart device for shared viewing during the video conference. RFC 3261 supplies the detailed SIP-based session establishment protocol—including INVITE, authentication, and session management—that underpins Toya’s conferencing architecture, rendering obvious the management-system login and session-establishment requirements of claim 1. To the extent neither Toya nor RFC 3261 explicitly discloses the mechanism by which the terminal provides a screen-capture program to the external device for automatic execution upon connection, Chang discloses this with its plug-and-show USB portable disk that automatically delivers green software from the conferencing hub system to a presenter’s laptop upon USB connection, causes the software to execute on the laptop to capture presentation frame data, and forwards the captured data to the wireless gateway for

display to remote conference participants—all without requiring pre-installation. EX1007, Abstract, 4:49-5:21;

182. Chang's disclosures map directly to each limitation of claims 4–6 and 11–13 for the same reasons applicable to the Toya/Tucker/Chang combination. *See supra* §VIII.B.2-5. For claim 4, Chang teaches that when the USB portable disk engages with the laptop, the auto-run plug-and-show program initiates a request for the laptop to permit execution of the image capturing and analyzing program (claim 4.a), and upon permission the program executes on the laptop to capture display data that is forwarded to the wireless gateway (claim 4.b). *See supra* §VIII.B.2-3. For claim 5, Chang teaches that the hub system transmits the screen-capture program to the laptop via the USB portable disk upon connection. *See supra* §VIII.B.4. For claim 6, Chang's green-software architecture satisfies the conditional-installation requirement because the program is never permanently installed on the laptop—it is loaded fresh upon each connection and removed upon disconnection—so the system necessarily transmits the program each time the connection occurs, precisely because the program is not present on the external device at the time of connection. *See supra* §VIII.B.5.

183. In my opinion, a POSITA would have been motivated to combine Chang with Toya and RFC 3261 for the reasons below.

1. Motivation to Combine

184. A POSITA would have been motivated to incorporate Chang's plug-and-show program-delivery mechanism into the Toya/RFC 3261 combination for the reasons below. I am not aware of any secondary considerations that would overcome the obviousness of the ground.

185. **Same Field of Endeavor:** In my opinion, Chang, Toya, and RFC 3261 are all directed to systems for sharing image or video content during conferences or meetings. Chang specifically addresses wireless presentation systems in which "plural representatives with their own computers may present to show their presentation files pre-stored in their own computers" during a "presentation conference." EX1007, 1:43-54. This is the same conference content-sharing scenario addressed by Toya, which discloses a video communication device that receives content data from external devices and transmits it to a counterpart device during a television conference session established using SIP protocols. EX1004, 16:51-17:26. RFC 3261 provides the underlying SIP protocol specifications—including session establishment, authentication, and registrar functions—that govern how conferencing sessions are initiated and secured. EX1006, Abstract, §22, §26.1.1. A POSITA designing a SIP-based video conferencing terminal with content-sharing capabilities from external devices would have naturally looked to

Chang's plug-and-show architecture to solve the problem of how to enable external laptops to share screen data without pre-installing software.

186. **Chang Solves a Problem That Toya and RFC 3261 Do Not Address:** In my opinion, the Toya/RFC 3261 combination provides the foundational video conferencing architecture—including SIP-based session establishment, authentication via registrars, and content sharing from external devices through local interfaces—but does not explicitly address the software executed by an external device to enable sharing of content data, or how that software is made available to the external device. Toya discloses that its video communication device receives content data from external sources (via Bluetooth, infrared, and Ethernet interfaces), but does not describe how the external device obtains the software necessary to share images or video. EX1004, 18:32-19:7. RFC 3261 addresses SIP signaling, authentication, and session management, but is silent on host-to-peripheral program deployment. EX1006, Abstract, p. 1, §22, §26.1.1.

187. Chang addresses this problem. Chang identifies the prior art deficiency—"a specific drive program for the wireless projector is needed to be installed into the computer prepared for a corresponding wireless projector"—and explains that requiring pre-installation causes presenters to "need to install a proper drive program immediately at the conference site," which "may ruin his/her presentation or at least cost the conference flow." EX1007, 1:32-65. Chang's

solution is a USB portable disk that stores green software (requiring no pre-installation) and, upon physical connection to the presenter's laptop, automatically delivers and executes a screen-capture program that captures presentation frame data and forwards it to the conferencing gateway for display to all participants. EX1007, Abstract, 4:39-5:8. A POSITA would have been motivated to incorporate Chang's plug-and-show program-delivery mechanism into the combination to enable seamless sharing of media content from any external device connected to the conferencing terminal—without requiring that device to pre-install content-sharing software or to independently authenticate with the SIP registrar

188. **Chang's Express Motivation:** Chang expressly identifies the motivation for its approach: eliminating the need for pre-installation of drive programs on each presenter's computer, avoiding time needed for the installation as well as the restart process that "may ruin his/her presentation," and enabling presentation "any time after the plug-and-show USB portable disk is plugged into the computer." EX1007, 1:32-2:9, 3:51-65. Chang further explains that "no new installation is required to each of the computers" and that "the presentation can be initiated any time after the plug-and-show USB portable disk 25 is plugged into the computer 23." EX1007, 3:51-65. These same motivations apply directly to Toya's content-sharing system: a SIP-based video conferencing terminal that can automatically provide screen-capture software to any connected external laptop—

without requiring pre-installation or separate authentication—delivers the same plug-and-show convenience in the video conferencing context, while RFC 3261’s authentication mechanisms ensure that only the conferencing terminal (not the external laptop) must authenticate with the management system before establishing the session.

189. **Predictable Combination of Known Elements:** In my opinion, the combination of Toya, RFC 3261, and Chang is the predictable use of known prior art elements according to known methods to yield predictable results. Toya teaches a video conferencing terminal that receives content from external devices and forwards it over an established SIP-based session. EX1004, 16:49-17:26, 17:57-18:49, 19:28-20:32. RFC 3261 teaches SIP authentication via registrars and challenge-based mechanisms, ensuring that only authorized terminals participate in conference sessions. EX1006, §22, §26.1.1. Chang teaches delivering a screen-capture program from a conferencing hub (via a USB portable disk) to an external computer upon connection, with the program automatically executing on the external computer to capture and forward display data to the conferencing system—all without pre-installation. EX1007, Abstract, 4:49-5:8. Incorporating Chang’s plug-and-show program-delivery mechanism into the Toya/RFC 3261 combination yields a predictable result: when an external laptop connects to the SIP-authenticated video conferencing terminal, the terminal provides a screen-capture program to the

laptop (via a USB dongle or equivalent physical mechanism), the laptop permits execution of the program, the program captures the laptop's display data, and the captured data is forwarded to the conferencing counterpart over the SIP-established session—with the external laptop never needing to independently register with or authenticate to the SIP registrar.

190. **Reasonable Expectation of Success:** A POSITA would have had a reasonable expectation of success because Chang's plug-and-show architecture operates at the physical device-connection interface (USB engagement between an external computer and a conferencing hub), which is independent of the SIP signaling and authentication layer taught by Toya and RFC 3261. The modification requires no changes to the SIP session establishment, registrar authentication, or relay architecture—it adds Chang's program-delivery and auto-execution mechanism at the point where the external device physically connects to the terminal. The combination of SIP-based conferencing (Toya/RFC 3261) with USB-based plug-and-show content sharing (Chang) would have been an integration of two independently functioning subsystems operating at different layers of the system architecture.

2. **[4.a]/[11.a] “The first transmission terminal according to claim 1, wherein the processing circuitry receives, from the external input apparatus, a request for permission to execute a program that is for obtaining data in the external input apparatus, and”**

191. Chang discloses this element for the same reasons discussed in Section VIII.B.2, which is incorporated by reference.

3. **[4.b]/[11.b] “in response to permission of the request, the program is executed in the external input apparatus, and thus, the method includes receiving, from the external input apparatus, the second video data obtained in the external input apparatus.”**

192. Chang discloses this element for the same reasons discussed in Section VIII.B.3, which is incorporated by reference.

4. **Claim 5/12 “The first transmission terminal according to claim 4, wherein the processing circuitry is configured to transmit the program to the external input apparatus.”**

193. Chang discloses this element for the same reasons discussed in Section VIII.B.4, which is incorporated by reference.

5. **Claim 6/13 “The first transmission terminal according to claim 5, wherein if the program is not installed in the external input apparatus when the first transmission terminal is connected with the external input apparatus, the processing circuitry transmits the program to the external input apparatus.”**

194. Chang discloses this element for the same reasons discussed in Section VIII.B.5, which is incorporated by reference.

IX. CONCLUSION

195. It is my opinion that the Challenged Claims are rendered obvious for the reasons I have set forth.

* * *

196. I declare under penalty of perjury that the foregoing is true and correct. I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

Executed on: August 11, 2026


Dr. Kevin C. Almeroth

Appendix A

Kevin C. Almeroth

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Education

- Ph.D.** June 1997 *Georgia Institute of Technology* Computer Science
Dissertation Title: Networking and System Support for the Efficient, Scalable Delivery of Services in Interactive Multimedia Systems
Minor: Telecommunications Public Policy
- M.S.** June 1994 *Georgia Institute of Technology* Computer Science
Specialization: Networking and Systems
- B.S.** June 1992 *Georgia Institute of Technology* Information and Computer Science
(high honors) *Minors:* Economics, Technical Communication, American Literature

Employment History

Professor Emeritus	Department of Computer Science University of California Santa Barbara, CA	Nov 2020 -- present
Professor	Department of Computer Science University of California Santa Barbara, CA	Jul 2005 -- Oct 2020
Associate Dean	College of Engineering University of California Santa Barbara, CA	Mar 2007 -- Aug 2009
Vice Chair	Department of Computer Science University of California Santa Barbara, CA	Jul 2000 -- Nov 2005

Associate Professor	Department of Computer Science University of California Santa Barbara, CA	Jul 2001 -- Jun 2005
Assistant Professor	Department of Computer Science University of California Santa Barbara, CA	Jul 1997 -- Jun 2001
Graduate Researcher	Broadband Telecommunications Center Georgia Center for Adv Telecom Tech Atlanta, GA	Sep 1996--Jun 1997
Graduate Intern	IBM T.J. Watson Research Labs Hawthorne, NY	Jun 1995--Sep 1995
Support Specialist	Office of Information Technology Georgia Institute of Technology Atlanta, GA	Sep 1995--Jun 1997
Research Assistant	College of Computing Georgia Institute of Technology Atlanta, GA	Jan 1994--Mar 1994
Graduate Intern	Hitachi Telecommunications Norcross, GA	Jun 1992--Sep 1992
Undergraduate Intern	IBM Research Triangle Park, NC	Jun 1989--Sep 1989 Jun 1990--Sep 1990 Mar 1991--Sep 1991

Industry Technical Advising

Board of Directors	The New Media Studio Santa Barbara, CA	Nov 2006 -- present
Co-Founder & Chairman of the Board	Santa Barbara Labs, LLC Santa Barbara, CA	Sep 2007 -- Dec 2009
Board of Advisors	Techknowledge Point Santa Barbara, CA	May 2001 -- Dec 2007
Technical Advisory Board	Occam Networks, Inc. Santa Barbara, CA	May 2000 -- Dec 2010
Board of Advisors	Airplay Inc. San Francisco, CA	Jun 2005 -- Aug 2009
Consultant	Lockheed Martin Corporation San Jose, CA	Nov 1999 -- Jun 2009

Board of Advisors	Santa Barbara Technology Group Santa Barbara, CA	Sep 2000 -- Dec 2004
Board of Directors	Virtual Bandwidth, Inc. Santa Barbara, CA	Nov 2000 -- Jun 2001
Board of Advisors & Affiliated Scientist	Digital Fountain San Francisco, CA	Jan 2000 -- Dec 2001
Senior Technologist	IP Multicast Initiative, Stardust Forums Campbell, CA	Jun 1998 -- Dec 2000

I. Teaching

A. Courses Taught

CS 176A	Intro to Computer Communication Networks	Fall 1997, Fall 1998, Fall 2002, Fall 2003, Fall 2004, Spring 2005, Spring 2006, Spring 2007, Spring 2008, Fall 2008, Fall 2009, Fall 2010, Fall 2011, Fall 2012, Fall 2013, Fall 2014, Spring 2017, Spring 2018, Spring 2020, Fall 2020
CS 176B	Network Computing	Winter 2000, Winter 2001, Winter 2002, Winter 2012, Winter 2014, Winter 2015, Winter 2018, Winter 2019, Winter 2020
MAT 201B	Media Networks and Services	Fall 1999, Fall 2000, Fall 2001, Fall 2003
CS 276	Distributed Computing and Computer Networks	Winter 1999, Spring 2000, Fall 2002, Fall 2005, Fall 2018
CS 290I	Networking for Multimedia Systems	Winter 1998, Spring 1999, Fall 2004, Winter 2010
CS 595N	Technology and Society	Winter 2005, Fall 2005, Spring 2006, Fall 2006, Spring 2007, Fall 2007, Spring 2008, Fall 2008, Spring 2009
CS 595N	Economic Systems Seminar	Winter 2004, Spring 2004, Winter 2005, Spring 2005
CS 595N	Networking Seminar	Winter 1999, Fall 1999, Winter 2003, Winter 2019
CS 595N	Wireless Networking & Multimedia Seminar	Fall 2000
CS 595I	Systems Design and Implementation Seminar	Fall 1999, Fall 2000, Winter 2001, Spring 2001, Winter 2002, Spring 2002

B. Other Teaching Experience

- *The Evolution of Advanced Networking Services: From the ARPAnet to Internet2*, Instructor, Summer 2001. Short course taught at Escuela de Ciencias Informatica (ECI) sponsored by the Universidad de Buenos Aires.

- *Johns Hopkins Center for Talented Youth*, Instructor, Summer 1994. CTY is a program to teach gifted high school students the fundamentals of computer science.
- *Georgia Institute of Technology*, Graduate Teaching Assistant, Sep 1994--Sep 1996. Worked as a TA for 12 quarters teaching 7 different courses (4 undergraduate and 3 graduate).

C. Ph.D. Students Advised [14 graduated]

14. Daniel Havey
 Research Area: *Throughput and Delay on the Packet Switched Internet*
 Date Graduated: Winter 2015
 First Position: Microsoft
13. Lara Deek (co-advised with E. Belding)
 Research Area: *Resource-Efficient Wireless Systems for Emerging Wireless Networks*
 Date Graduated: Summer 2014
 First Position: Post Doc, UIUC
12. Mike Wittie
 Research Area: *Towards Sustained Scalability of Communication Networks*
 Date Graduated: Summer 2011
 First Position: Assistant Professor, Montana State University
11. Allan Knight
 Research Area: *Supporting Integration of Educational Technologies and Research of Their Effects on Learning*
 Date Graduated: Summer 2009
 First Position: Research Scientist, Citrix Online
10. Hangjin Zhang
 Research Area: *Towards Blended Learning: Educational Technology to Improve and Assess Teaching and Learning*
 Date Graduated: Spring 2009
 First Position: Microsoft
9. Gayatri Swamynathan
 Dissertation Title: *Towards Reliable Reputations for Distributed Applications*
 Date Graduated: Spring 2008
 First Position: Zynga
8. Amit Jardosh (co-advised with E. Belding)
 Dissertation Title: *Adaptive Large-Scale Wireless Networks: Measurements, Protocol Designs, and Simulation Studies*
 Date Graduated: Fall 2007
 First Position: Yahoo!
7. Khaled Harras
 Dissertation Title: *Protocol and Architectural Challenges in Delay and Disruption Tolerant Networks*
 Date Graduated: Summer 2007
 First Position: Assistant Professor, Carnegie Mellon University
6. Krishna Ramachandran (co-advised with E. Belding)
 Dissertation Title: *Design, Deployment, and Management of High-Capacity Wireless Mesh Networks*
 Date Graduated: Winter 2006
 First Position: Research Scientist, Citrix Online

5. Robert Chalmers
Dissertation Title: *Improving Device Mobility with Intelligence at the Network Edge*
Date Graduated: Summer 2004
First Position: President and CEO, Limbo.net
4. Prashant Rajvaidya
Dissertation Title: *Achieving Robust and Secure Deployment of Multicast*
Date Graduated: Spring 2004
First Position: President and CTO, Mosaic Networking
3. Sami Rollins
Dissertation Title: *Overcoming Resource Constraints to Enable Content Exchange Applications in Next-Generation Environments*
Date Graduated: Spring 2003
First Position: Assistant Professor, Mount Holyoke College
2. Srinivasan Jagannathan
Dissertation Title: *Multicast Tree-Based Congestion Control and Topology Management*
Date Graduated: Spring 2003
First Position: Consultant, Kelly & Associates
1. Kamil Sarac
Dissertation Title: *Supporting a Robust Multicast Service in the Global Infrastructure*
Date Graduated: Spring 2002
First Position: Assistant Professor, UT-Dallas

D. M.S. Students Advised (Thesis/Project Option) [19 graduated]

19. Neer Shey
Research Area: *Analyzing Content Distribution Through Opportunistic Contact for Smart Cellular Phones*
Date Graduated: Spring 2010
18. Camilla Fiorese
Research Area: *Analysis of a Pure Rate-Based Congestion Control Algorithm*
Date Graduated: Summer 2009
17. Brian Weiner
Research Area: *Multi-Socket TCP: A Simple Approach to Improve Performance of Real-Time Applications over TCP*
Date Graduated: Fall 2007
16. Avijit Sen Mazumder
Research Area: *Facilitating Robust Multicast Group Management*
Date Graduated: Fall 2005
15. Rishi Matthew
Thesis Title: *Providing Seamless Access to Multimedia Content on Heterogeneous Platforms*
Date Graduated: Summer 2004
14. Camden Ho
Research Area: *Tools and Techniques for Wireless Network Management*
Date Graduated: Spring 2004
13. Amit Jardosh (co-advised with E. Belding)
Research Area: *Realistic Environment Models for Mobile Network Evaluation*
Date Graduated: Spring 2004
12. Nitin Solanki
Research Area: *SongWand: A Wireless Barcode Scanner Using Bluetooth Technology*

- Date Graduated: Winter 2004
11. Vrishali Wagle (co-advised with E. Belding)
Research Area: *An Ontology-Based Service Discovery Mechanism*
Date Graduated: Winter 2004
 10. Uday Mohan
Thesis Title: *Scalable Service Discovery in Mobile Ad hoc Networks*
Date Graduated: Spring 2003
 9. Krishna Ramachandran
Thesis Title: *Ubiquitous Multicast*
Date Graduated: Spring 2003
 8. John Slonaker
Thesis Title: *Inductive Loop Signature Acquisition Techniques*
Date Graduated: Spring 2002
 7. Mohammad Battah
Thesis Title: *Dedicated Short-Range Communications Intelligent Transportation Systems Protocol (DSRC-ITS)*
Date Graduated: Spring 2002
 6. Kevin Vogel
Thesis Title: *Integrating E-Commerce Applications into Existing Business Infrastructures*
Date Graduated: Spring 2001
 5. Sami Rollins
Thesis Title: *Audio Xml: Aural Interaction with XML Documents*
Date Graduated: Winter 2000
 4. Andy Davis
Thesis Title: *Stream Scheduling for Data Servers in a Scalable Interactive TV System*
Date Graduated: Spring 1999
 3. David Makofske
Thesis Title: *MHealth: A Real-Time Graphical Multicast Monitoring Tool*
Date Graduated: Winter 1999
 2. Prashant Rajvaidya
Thesis Title: *MANTRA: Router-Based Monitoring and Analysis of Multicast Traffic*
Date Graduated: Winter 1999
 1. Alex DeCastro (co-advised with Yuan-Fang Wang)
Thesis Title: *Web-Based Collaborative 3D Modeling*
Date Graduated: Winter 1998

E. Teaching Awards

2006-2007 UCSB Academic Senate Distinguished Teaching Award
2004-2005 Computer Science Outstanding Faculty Member
2000-2001 UCSB Spotlight on Excellence Award
1999-2000 Computer Science Outstanding Faculty Member (co-recipient)
1998-1999 Computer Science Outstanding Faculty Member (co-recipient)
1997-1998 Computer Science Outstanding Faculty Member

II. Research

A. Journal Papers, Magazine Articles, Books, and Book Chapters

62. L. Deek, E. Garcia-Villegas, E. Belding, S.J. Lee, and K. Almeroth, "[A Practical Framework for 802.11 MIMO Rate Adaptation](#)," *Computer Networks*, vol. 83, num. 6, pp. 332-348, June 2015.
61. L. Deek, E. Garcia-Villegas, E. Belding, S.J. Lee, and K. Almeroth, "[Intelligent Channel Bonding in 802.11n WLANs](#)," *IEEE Transactions on Mobile Computing*, vol. 13, num. 6, pp. 1242-1255, June 2014.
60. H. Zhang and K. Almeroth, "[Alternatives for Monitoring and Limiting Network Access to Students in Network-Connected Classrooms](#)," *Journal of Interactive Learning Research (JILR)*, vol. 24, num. 3, pp. 237-265, July 2013.
59. M. Tavakolifard and K. Almeroth, "[A Taxonomy to Express Open Challenges in Trust and Reputation Systems](#)," *Journal of Communications*, vol. 7, num. 7, pp. 538-551, July 2012.
58. M. Tavakolifard and K. Almeroth, "[Social Computing: An Intersection of Recommender Systems, Trust/Reputation Systems, and Social Networks](#)," *IEEE Network*, vol. 26, num. 4, pp. 53-58, July/August 2012.
57. M. Tavakolifard, K. Almeroth, and P. Ozturk, "[Subjectivity Handling of Ratings for Trust and Reputation Systems: An Abductive Reasoning Approach](#)," *International Journal of Digital Content Technology and its Applications (JDCTA)*, vol. 5, num. 11, pp. 359-377, November 2011.
56. R. Raghavendra, P. Acharya, E. Belding and K. Almeroth, "[MeshMon: A Multi-Tiered Framework for Wireless Mesh Network Monitoring](#)," *Wireless Communications and Mobile Computing (WCMC) Journal*, vol. 11, num. 8, pp. 1182-1196, August 2011.
55. A. Knight and K. Almeroth, "[Automatic Plagiarism Detection with PAIRwise 2.0](#)," *Journal of Interactive Learning Research (JILR)*, vol. 22, num. 3, pp. 379-400, July 2011.
54. V. Kone, M. Zheleva, M. Wittie, B. Zhao, E. Belding, H. Zheng, and K. Almeroth, "[AirLab: Consistency, Fidelity and Privacy in Wireless Measurements](#)," *ACM Computer Communications Review*, vol. 41, num. 1, pp. 60-65, January 2011.
53. G. Swamynathan, K. Almeroth, and B. Zhao, "[The Design of a Reliable Reputation System](#)," *Electronic Commerce Research Journal*, vol. 10, num. 3-4, pp. 239-270, December 2010.
52. P. Acharya, A. Sharma, E. Belding, K. Almeroth and K. Papagiannaki, "[Rate Adaptation in Congested Wireless Networks through Real-Time Measurements](#)," *IEEE Transactions on Mobile Computing*, vol. 9, num. 11, pp. 1535-1550, November 2010.
51. R. Raghavendra, E. Belding, K. Papagiannaki, and K. Almeroth, "[Unwanted Link Layer Traffic in Large IEEE 802.11 Wireless Networks](#)," *IEEE Transactions on Mobile Computing*, vol. 9, num. 9, pp. 1212-1225, September 2010.
50. H. Zhang and K. Almeroth, "[Moodog: Tracking Student Activity in Online Course Management Systems](#)," *Journal of Interactive Learning Research (JILR)*, vol. 21, num. 3, pp. 407-429, July 2010.
49. R. Chertov and K. Almeroth, "[Qualitative Comparison of Link Shaping Techniques](#)," *International*

48. A. Knight and K. Almeroth, "[Fast Caption Alignment for Automatic Indexing of Audio](#)," International Journal of Multimedia Data Engineering and Management, vol. 1, num. 2, pp. 1-17, April-June 2010.
47. K. Harras and K. Almeroth, "[Scheduling Messengers in Disconnected Clustered Mobile Networks](#)," Ad Hoc & Sensor Wireless Networks, vol. 9, num. 3-4, pp. 275-304, March-April 2010.
46. A. Jardosh, K. Papagiannaki, E. Belding, K. Almeroth, G. Iannaccone, and B. Vinnakota, "[Green WLANs: On-Demand WLAN Infrastructures](#)," ACM Journal on Mobile Networks and Applications (MONET), vol. 14, num. 6, pp. 798-814, December 2009.
45. M. Wittie, K. Harras, K. Almeroth, and E. Belding, "[On the Implications of Routing Metric Staleness in Delay Tolerant Networks](#)," Computer Communications Special Issue on Delay and Disruption Tolerant Networking, vol. 32, num. 16, pp. 1699-1709, October 2009.
44. K. Harras, L. Deek, C. Holman, and K. Almeroth, "[DBS-IC: An Adaptive Data Bundling System for Intermittent Connectivity](#)," Computer Communications Special Issue on Delay and Disruption Tolerant Networking, vol. 32, num. 16, pp. 1687-1698, October 2009.
43. S. Karpinski, E. Belding, K. Almeroth, and J. Gilbert, "[Linear Representations of Network Traffic](#)," ACM Journal on Mobile Networks and Applications (MONET), vol. 14, num. 4, pp. 368-386, August 2009.
42. K. Harras and K. Almeroth, "[Controlled Flooding in Disconnected Sparse Mobile Networks](#)," Wireless Communications and Mobile Computing (WCMC) Journal, vol. 9, num. 1, pp. 21-33, January 2009.
41. R. Mayer, A. Stull, K. DeLeeuw, K. Almeroth, B. Bimber, D. Chun, M. Bulger, J. Campbell, A. Knight, and H. Zhang, "[Clickers in College Classrooms: Fostering Learning with Questioning Methods in Large Lecture Classes](#)," Contemporary Educational Psychology, vol. 34, num. 1, pp. 51-57, January 2009.
40. A. Knight, K. Almeroth, and B. Bimber, "[Design, Implementation and Deployment of PAIRwise](#)," Journal of Interactive Learning Research (JILR), vol. 19, num. 3, pp. 489-508, July 2008.
39. A. Garyfalos and K. Almeroth, "[Coupons: A Multilevel Incentive Scheme for Information Dissemination in Mobile Networks](#)," IEEE Transactions on Mobile Computing, vol. 7, num. 6, pp. 792-804, June 2008.
38. I. Sheriff, K. Ramachandran, E. Belding, and K. Almeroth, "[A Multi-Radio 802.11 Mesh Network Architecture](#)," ACM Journal on Mobile Networks and Applications (MONET), vol. 13, num. 1-2, pp. 132-146, April 2008.
37. M. Bulger, R. Mayer, K. Almeroth, and S. Blau, "[Measuring Learner Engagement in Computer-Equipped College Classrooms](#)," Journal of Educational Multimedia and Hypermedia, vol. 17, num. 2, pp. 129-143, April 2008.
36. G. Swamynathan, B. Zhao, and K. Almeroth, "[Exploring the Feasibility of Proactive Reputations](#)," Concurrency and Computation: Practice and Experience, vol. 20, num. 2, pp. 155-166, February 2008.
35. G. Swamynathan, B. Zhao, K. Almeroth, and H. Zheng, "[Globally Decoupled Reputations for Large Distributed Networks](#)," Advances in Multimedia, vol. 2007, pp. 1-14, 2007.

34. R. Mayer, A. Stull, J. Campbell, K. Almeroth, B. Bimber, D. Chun and A. Knight, "[Overestimation Bias in Self-reported SAT Scores](#)," Educational Psychology Review, vol. 19, num. 4, pp. 443-454, December 2007.
33. P. Namburi, K. Sarac and K. Almeroth, "[Practical Utilities for Monitoring Multicast Service Availability](#)," Computer Communications Special Issue on Monitoring and Measurement of IP Networks, vol. 29, num. 10, pp. 1675-1686, June 2006.
32. R. Chalmers, G. Krishnamurthi and K. Almeroth, "[Enabling Intelligent Handovers in Heterogeneous Wireless Networks](#)," ACM Journal on Mobile Networks and Applications (MONET), vol. 11, num. 2, pp. 215-227, April 2006.
31. H. Lundgren, K. Ramachandran, E. Belding, K. Almeroth, M. Benny, A. Hewatt, A. Touma and A. Jardosh, "[Experience from the Design, Deployment and Usage of the UCSB MeshNet Testbed](#)," IEEE Wireless Communications, vol. 13, num. 2, pp. 18-29, April 2006.
30. R. Mayer, K. Almeroth, B. Bimber, D. Chun, A. Knight and A. Campbell, "[Technology Comes to College: Understanding the Cognitive Consequences of Infusing Technology in College Classrooms](#)," Educational Technology, vol. 46, num. 2, pp. 48-53, March-April 2006.
29. A. Garyfalos and K. Almeroth, "[A Flexible Overlay Architecture for Mobile IPv6 Multicast](#)," Journal on Selected Areas in Communications (JSAC) Special Issue on Wireless Overlay Networks Based on Mobile IPv6, vol. 23, num. 11, pp. 2194-2205, November 2005.
28. K. Sarac and K. Almeroth, "[Monitoring IP Multicast in the Internet: Recent Advances and Ongoing Challenges](#)," IEEE Communications, vol. 43, num. 10, pp. 85-91, October 2005.
27. K. Sarac and K. Almeroth, "[Application Layer Reachability Monitoring for IP Multicast](#)," Computer Networks, vol. 48, num. 2, pp. 195-213, June 2005.
26. A. Jardosh, E. Belding, K. Almeroth and S. Suri, "[Real-world Environment Models for Mobile Network Evaluation](#)," Journal on Selected Areas in Communications Special Issue on Wireless Ad hoc Networks, vol. 23, num. 3, pp. 622-632, March 2005.
25. S. Rollins and K. Almeroth, "[Evaluating Performance Tradeoffs in a One-to-Many Peer Content Distribution Architecture](#)," Journal of Internet Technology, vol. 5, num. 4, pp. 373-387, Fall 2004.
24. K. Sarac and K. Almeroth, "[Tracertree: A Scalable Mechanism to Discover Multicast Tree Topologies in the Network](#)," IEEE/ACM Transactions on Networking, vol. 12, num. 5, pp. 795-808, October 2004.
23. K. Sarac and K. Almeroth, "[A Distributed Approach for Monitoring Multicast Service Availability](#)," Journal of Network and Systems Management, vol. 12, num. 3, pp. 327-348, September 2004.
22. P. Rajvaidya, K. Ramachandran and K. Almeroth, "[Managing and Securing the Global Multicast Infrastructure](#)," Journal of Network and Systems Management, vol. 12, num. 3, pp. 297-326, September 2004.
21. P. Rajvaidya and K. Almeroth, "[Multicast Routing Instabilities](#)," IEEE Internet Computing, vol. 8, num. 5, pp. 42-49, September/October 2004.
20. D. Johnson, R. Patton, B. Bimber, K. Almeroth and G. Michaels, "[Technology and Plagiarism in the University: Brief Report of a Trial in Detecting Cheating](#)," Association for the Advancement of Computing in Education (AACE) Journal, vol. 12, num. 3, pp. 281-299, Summer 2004.

19. R. Chalmers and K. Almeroth, "[A Security Architecture for Mobility-Related Services](#)," Journal of Wireless Personal Communications, vol 29, num. 3, pp. 247-261, June 2004.
18. B. Stiller, K. Almeroth, J. Altmann, L. McKnight, and M. Ott, "[Pricing for Content in the Internet](#)," Computer Communications, vol. 27, num. 6, pp. 522-528, April 2004.
17. S. Rollins and K. Almeroth, "[Lessons Learned Deploying a Digital Classroom](#)," Journal of Interactive Learning Research (JILR), vol. 15, num. 2, pp. 169-185, April 2004.
16. S. Jagannathan and K. Almeroth, "[A Dynamic Pricing Scheme for E-Content at Multiple Levels-of-Service](#)," Computer Communications, vol. 27, num. 4, pp. 374-385, March 2004.
15. K. Almeroth, "[Using Satellite Links in the Delivery of Terrestrial Multicast Traffic](#)," Internetworking and Computing over Satellites, Kluwer Academic Publishers, 2003.
14. R. Chalmers and K. Almeroth, "[On the Topology of Multicast Trees](#)," IEEE/ACM Transactions on Networking, vol. 11, num. 1, pp. 153-165, January 2003.
13. S. Jagannathan, J. Nayak, K. Almeroth, and M. Hofmann, "[On Pricing Algorithms for Batched Content Delivery Systems](#)," Electronic Commerce Research and Applications Journal, vol. 1, num. 3-4, pp. 264-280, Fall 2002.
12. D. Makofske and K. Almeroth, "[Multicast Sockets: Practical Guide for Programmers](#)," *Morgan Kaufmann Publishers*, November 2002.
11. S. Jagannathan and K. Almeroth, "[Price Issues in Delivering E-Content On-Demand](#)," ACM Sigecom Exchanges, vol. 3, num. 2, pp. 18-27, May 2002.
10. D. Makofske and K. Almeroth, "[From Television to Internet Video-on-Demand: Techniques and Tools for VCR-Style Interactivity](#)," Software: Practice and Experience, vol. 31, num. 8, pp. 781-801, July 2001.
9. K. Sarac and K. Almeroth, "[Supporting Multicast Deployment Efforts: A Survey of Tools for Multicast Monitoring](#)," Journal on High Speed Networking, Special Issue on Management of Multimedia Networking, vol. 9, num. 3/4, pp. 191-211, March 2001.
8. K. Almeroth, "[Adaptive, Workload-Dependent Scheduling for Large-Scale Content Delivery Systems](#)," Transactions on Circuits and Systems for Video Technology, *Special Issue on Streaming Video*, vol. 11, num. 3, pp. 426-439, March 2001.
7. D. Makofske and K. Almeroth, "[Real-Time Multicast Tree Visualization and Monitoring](#)," Software: Practice and Experience, vol. 30, num. 9, pp. 1047-1065, July 2000.
6. M. Ammar, K. Almeroth, R. Clark and Z. Fei, "Multicast Delivery of WWW Pages," Electronic Commerce Technology Trends: Challenges and Opportunities, IBM Press, February 2000.
5. K. Almeroth, "[The Evolution of Multicast: From the MBone to Inter-Domain Multicast to Internet2 Deployment](#)," IEEE Network Special Issue on Multicasting, vol. 10, num. 1, pp. 10-20, January/February 2000.
4. K. Almeroth and M. Ammar, "[An Alternative Paradigm for Scalable On-Demand Applications: Evaluating and Deploying the Interactive Multimedia Jukebox](#)," IEEE Transactions on Knowledge and Data Engineering Special Issue on Web Technologies, vol. 11, num. 4, pp 658-672, July/August 1999.

3. K. Almeroth and M. Ammar, "[The Interactive Multimedia Jukebox \(IMJ\): A New Paradigm for the On-Demand Delivery of Audio/Video](#)," *Computer Networks and ISDN Systems*, vol. 30, no. 1, April 1998.
2. K. Almeroth and M. Ammar, "[Multicast Group Behavior in the Internet's Multicast Backbone \(MBone\)](#)," *IEEE Communications*, vol. 35, no. 6, pp. 124-129, June 1997.
1. K. Almeroth and M. Ammar, "[On the Use of Multicast Delivery to Provide a Scalable and Interactive Video-on-Demand Service](#)," *Journal on Selected Areas of Communication (JSAC)*, vol. 14, no. 6, pp. 1110-1122, August 1996.

B. Conference Papers with Proceedings (refereed)

89. D. Havey and K. Almeroth, "[Active Sense Queue Management \(ASQM\)](#)," *IFIP Networking Conference*, Toulouse, FRANCE, May 2015.
88. L. Deek, E. Garcia-Villegas, E. Belding, S.J. Lee, and K. Almeroth, "[Joint Rate and Channel Width Adaptation in 802.11 MIMO Wireless Networks](#)," *IEEE Conference on Sensor, Mesh and Ad Hoc Communications and Networks (SECON)*, New Orleans, LA, USA, June 2013.
87. D. Havey and K. Almeroth, "[Fast Wireless Protocol: A Network Stack Design for Wireless Transmission](#)," *IFIP Networking Conference*, Brooklyn, New York, USA, May 2013.
86. M. Tavakolifard, J. Gulla, K. Almeroth, J. Ingvaldsen, G. Nygreen, and E. Berg, "[Tailored News in the Palm of Your HAND: A Multi-Perspective Transparent Approach to News Recommendation](#)," *Demo Track at the International World Wide Web Conference (WWW)*, Rio de Janeiro, BRAZIL, May 2013.
85. S. Patterson, M. Wittie, K. Almeroth, and B. Bamieh, "[Network Optimization with Dynamic Demands and Link Prices](#)," *Allerton Conference*, Monticello, Illinois, USA, October 2012.
84. D. Havey, R. Chertov, and K. Almeroth, "[Receiver Driven Rate Adaptation](#)," *ACM Multimedia Systems Conference (MMSys)*, Chapel Hill, North Carolina, USA, February 2012.
83. M. Tavakolifard and K. Almeroth, "[Trust 2.0: Who to Believe in the Flood of Online Data?](#)" *International Conference on Computing, Networking and Communications (ICNC)*, Maui, Hawaii, USA, January 2012.
82. L. Deek, E. Garcia-Villegas, E. Belding, S.J. Lee, and K. Almeroth, "[The Impact of Channel Bonding on 802.11n Network Management](#)," *ACM CoNEXT*, Tokyo, JAPAN, December 2011.
81. L. Deek, X. Zhou, K. Almeroth, and H. Zheng, "[To Preempt or Not: Tackling Bid and Time-based Cheating in Online Spectrum Auctions](#)," *IEEE Infocom*, Shanghai, CHINA, April 2011.
80. M. Wittie, V. Pejovic, L. Deek, K. Almeroth, and B. Zhao, "[Exploiting Locality of Interest in Online Social Networks](#)," *ACM CoNEXT*, Philadelphia, Pennsylvania, USA, November 2010.
79. R. Chertov and K. Almeroth, "[Using BGP in a Satellite-Based Challenged Network Environment](#)," *IEEE Conference on Sensor, Mesh and Ad Hoc Communications and Networks (SECON)*, Boston, Massachusetts, USA, June 2010.
78. R. Chertov, D. Havey and K. Almeroth, "[MSET: A Mobility Satellite Emulation Testbed](#)," *IEEE*

77. B. Stone-Gross, A. Moser, C. Kruegel, E. Kirda, and K. Almeroth, "[FIRE: Finding Rogue nEtworks](#)," *Annual Computer Security Applications Conference (ACSAC)*, Honolulu, Hawaii, USA, December 2009.
76. M. Wittie, K. Almeroth, E. Belding, I. Rimal, and V. Hilt, "[Internet Service in Developing Regions Through Network Coding](#)," *IEEE Conference on Sensor, Mesh and Ad Hoc Communications and Networks (SECON)*, Rome, ITALY, June 2009.
75. R. Chertov and K. Almeroth, "[High-Fidelity Link Shaping](#)," *International Conference on Testbeds and Research Infrastructures for the Development of Networks and Communities (TRIDENTCOM)*, Washington DC, USA, April 2009.
74. L. Deek, K. Almeroth, M. Wittie, and K. Harras, "[Exploiting Parallel Networks Using Dynamic Channel Scheduling](#)," *International Wireless Internet Conference (WICON)*, Maui, Hawaii, USA, November 2008.
73. D. Havey, E. Barlas, R. Chertov, K. Almeroth, and E. Belding, "[A Satellite Mobility Model for QUALNET Network Simulations](#)," *IEEE Military Communications Conference (MILCOM)*, San Diego, California, USA, November 2008.
72. J. Kayfetz and K. Almeroth, "[Creating Innovative Writing Instruction for Computer Science Graduate Students](#)," *ASEE/IEEE Frontiers in Education (FIE) Conference*, Saratoga Springs, New York, USA, October 2008.
71. G. Swamynathan, B. Zhao, K. Almeroth, and S. Rao, "[Towards Reliable Reputations for Dynamic Networked Systems](#)," *IEEE International Symposium on Reliable Distributed Systems (SRDS)*, Napoli, ITALY, October 2008.
70. B. Stone-Gross, D. Sigal, R. Cohn, J. Morse, K. Almeroth, and C. Krugel, "[VeriKey: A Dynamic Certificate Verification System for Public Key Exchanges](#)," *Conference on Detection of Intrusions and Malware & Vulnerability Assessment (DIMVA)*, Paris, FRANCE, July 2008.
69. P. Acharya, A. Sharma, E. Belding, K. Almeroth, K. Papagiannaki, "[Congestion-Aware Rate Adaptation in Wireless Networks: A Measurement-Driven Approach](#)," *IEEE Conference on Sensor, Mesh and Ad Hoc Communications and Networks (SECON)*, San Francisco, California, USA, June 2008.
68. A. Jardosh, P. Suwannat, T. Hollerer, E. Belding, and K. Almeroth, "[SCUBA: Focus and Context for Real-time Mesh Network Health Diagnosis](#)," *Passive and Active Measurement Conference (PAM)*, Cleveland, Ohio, USA, April 2008.
67. B. Stone-Gross, C. Wilson, K. Almeroth, E. Belding, H. Zheng, K. Papagiannaki, "[Malware in IEEE 802.11 Wireless Networks](#)," *Passive and Active Measurement Conference (PAM)*, Cleveland, Ohio, USA, April 2008.
66. R. Raghavendra, E. Belding, K. Papagiannaki, and K. Almeroth, "[Understanding Handoffs in Large IEEE 802.11 Wireless Networks](#)," *Internet Measurement Conference (IMC)*, San Diego, California, USA, October 2007.
65. M. Wittie, B. Stone-Gross, K. Almeroth and E. Belding, "[MIST: Cellular Data Network Measurement for Mobile Applications](#)," *IEEE International Conference on Broadband Communications, Networks,*

and Systems (BroadNets), Raleigh, North Carolina, USA, September 2007.

64. S. Karpinski, E. Belding, K. Almeroth, "[Wireless Traffic: The Failure of CBR Modeling](#)," *IEEE International Conference on Broadband Communications, Networks, and Systems (BroadNets)*, Raleigh, North Carolina, USA, September 2007.
63. A. Knight, K. Almeroth, H. Zhang, R. Mayer, and K. DeLeeuw, "[Data Cafe: A Dining Car Approach to Educational Research Data Management and Distribution](#)," *World Conference on Educational Multimedia, Hypermedia & Telecommunications (ED MEDIA)*, Vancouver, CANADA, June 2007.
62. H. Zhang, K. Almeroth, A. Knight, M. Bulger, and R. Mayer, "[Moodog: Tracking Students' Online Learning Activities](#)," *World Conference on Educational Multimedia, Hypermedia & Telecommunications (ED MEDIA)*, Vancouver, CANADA, June 2007.
61. M. Bulger, K. Almeroth, R. Mayer, D. Chun, A. Knight, H. Collins, "[Effects of Instructor Engagement on Student Use of a Course Management System](#)," Association for Psychological Science (APS) Annual Conference, Washington DC, USA, May 2007.
60. R. Mayer, A. Stull, K. Almeroth, B. Bimber, D. Chun, M. Bulger, J. Campbell, Allan Knight, and H. Zhang, "[Using Technology-Based Methods to Foster Learning in Large Lecture Classes: Evidence for the Pedagogic Value of Clickers](#)," *American Educational Research Association (AERA) Annual Conference*, Chicago, Illinois, USA, April 2007.
59. K. Ramachandran, I. Sheriff, E. Belding, and K. Almeroth, "[Routing Stability in Static Wireless Mesh Networks](#)," *Passive and Active Measurement Conference (PAM)*, Louvain-la-neuve, BELGIUM, April 2007.
58. G. Swamynathan, T. Close, S. Banerjee, R. McGeer, B. Zhao, and K. Almeroth, "[Scalable Access Control For Web Services](#)," *International Conference on Creating, Connecting and Collaborating through Computing (C5)*, Kyoto, JAPAN, January 2007.
57. A. Knight, M. Bulger, K. Almeroth, and H. Zhang, "[Is Learning Really a Phone Call Away? Knowledge Transfer in Mobile Learning](#)," *World Conference on Mobile Learning (mLearn)*, Banff, Alberta, CANADA, October 2006.
56. J. Kurian, K. Sarac, and K. Almeroth, "[Defending Network-Based Services Against Denial of Service Attacks](#)," *International Conference on Computer Communication and Networks (IC3N)*, Arlington, Virginia, USA, October 2006.
55. A. Jardosh, K. Sanzgiri, E. Belding and K. Almeroth, "[IQU: Practical Queue-Based User Association Management for WLANs--Case Studies, Architecture, and Implementation](#)," *ACM Mobicom*, Marina del Rey, California, USA, September 2006.
54. C. Holman, K. Harras, and K. Almeroth, "[A Proactive Data Bundling System for Intermittent Mobile Connections](#)," *IEEE International Conference on Sensor and Ad Hoc Communications and Networks (SECON)*, Reston, Virginia, USA, September 2006.
53. G. Banks, M. Cova, V. Felmetsger, K. Almeroth, R. Kemmerer and G. Vigna, "[SNOOZE: toward a Stateful NetwOrk prOtocol fuzZER](#)," *Information Security Conference (ISC)*, Samos Island, GREECE, September 2006.
52. K. Harras and K. Almeroth, "[Inter-Regional Messenger Scheduling in Delay Tolerant Mobile Networks](#)," *IEEE International Symposium on a World of Wireless, Mobile and Multimedia Networks*

(WoWMoM), Niagara Falls, New York, USA, June 2006.

51. M. Bulger, R. Mayer, and K. Almeroth, "[Engaged By Design: Using Simulation to Promote Active Learning](#)," **Outstanding Paper** at the *World Conference on Educational Multimedia, Hypermedia & Telecommunications (ED MEDIA)*, Orlando, Florida, USA, June 2006.
50. A. Knight, K. Almeroth, R. Mayer, D. Chun, and B. Bimber, "[Observations and Recommendations for Using Technology to Extend Interaction](#)," *World Conference on Educational Multimedia, Hypermedia & Telecommunications (ED MEDIA)*, Orlando, Florida, USA, June 2006.
49. H. Zhang, and K. Almeroth, "[A Simple Classroom Network Access Control System](#)," *World Conference on Educational Multimedia, Hypermedia & Telecommunications (ED MEDIA)*, Orlando, Florida, USA, June 2006.
48. K. Harras and K. Almeroth, "[Transport Layer Issues in Delay Tolerant Mobile Networks](#)," *IFIP Networking Conference*, Coimbra, PORTUGAL, May 2006.
47. R. Mayer, A. Stull, J. Campbell, K. Almeroth, B. Bimber, D. Chun and A. Knight, "[Some Shortcomings of Soliciting Students' Self-Reported SAT Scores](#)," *American Educational Research Association (AERA) Annual Conference*, San Francisco, California, USA, April 2006.
46. K. Ramachandran, E. Belding, K. Almeroth, and M. Buddhikot, "[Interference-Aware Channel Assignment in Multi-Radio Wireless Mesh Networks](#)," *IEEE Infocom*, Barcelona, SPAIN, April 2006.
45. A. Jardosh, K. Ramachandran, K. Almeroth, and E. Belding, "[Understanding Congestion in IEEE 802.11b Wireless Networks](#)," *ACM/USENIX Internet Measurement Conference (IMC)*, Berkeley, California, USA, October 2005.
44. H. Zhang, K. Almeroth and M. Bulger, "[An Activity Monitoring System to Support Classroom Research](#)," *World Conference on Educational Multimedia, Hypermedia & Telecommunications (ED MEDIA)*, Montreal, Quebec, CANADA, pp. 1444-1449, June 2005.
43. Z. Xiang, H. Zhang, J. Huang, S. Song and K. Almeroth, "[A Hidden Environment Model for Constructing Indoor Radio Maps](#)," *IEEE International Symposium on a World of Wireless, Mobile and Multimedia Networks (WoWMoM)*, Taormina, ITALY, June 2005.
42. K. Harras, K. Almeroth and E. Belding, "[Delay Tolerant Mobile Networks \(DTMNs\): Controlled Flooding in Sparse Mobile Networks](#)," *IFIP Networking Conference*, Waterloo, Ontario, CANADA, May 2005.
41. A. Garyfalos and K. Almeroth, "[Coupons: Wide Scale Information Distribution for Wireless Ad Hoc Networks](#)," *IEEE Global Telecommunications Conference (Globecom) Global Internet and Next Generation Networks Symposium*, Dallas, Texas, USA, pp. 1655-1659, December 2004.
40. A. Knight and K. Almeroth, "[DeCAF: A Digital Classroom Application Framework](#)," *IASTED International Conference on Communications, Internet and Information Technology (CIIT)*, St. Thomas, US Virgin Islands, November 2004.
39. P. Namburi, K. Sarac and K. Almeroth, "[SSM-Ping: A Ping Utility for Source Specific Multicast](#)," *IASTED International Conference on Communications, Internet and Information Technology (CIIT)*, St. Thomas, US Virgin Islands, November 2004.
38. K. Ramachandran, E. Belding and K. Almeroth, "[DAMON: A Distributed Architecture for Monitoring](#)

- [Multi-hop Mobile Networks](#)," *IEEE International Conference on Sensor and Ad Hoc Communications and Networks (SECON)*, Santa Clara, California, USA, October 2004.
37. A. Garyfalos and K. Almeroth, "[Coupon Based Incentive Systems and the Implications of Equilibrium Theory](#)," *IEEE Conference on Electronic Commerce (CEC)*, San Diego, California, USA, pp. 213-220, July 2004.
36. A. Knight, K. Almeroth and B. Bimber, "[An Automated System for Plagiarism Detection Using the Internet](#)," *World Conference on Educational Multimedia, Hypermedia & Telecommunications (ED MEDIA)*, Lugano, Switzerland, pp. 3619-3625, June 2004.
35. H. Zhang and K. Almeroth, "[Supplement to Distance Learning: Design for a Remote TA Support System](#)," *World Conference on Educational Multimedia, Hypermedia & Telecommunications (ED MEDIA)*, Lugano, Switzerland, pp. 2821-2830, June 2004.
34. U. Mohan, K. Almeroth and E. Belding, "[Scalable Service Discovery in Mobile Ad hoc Networks](#)," *IFIP Networking Conference*, Athens, Greece, pp. 137-149, May 2004.
33. V. Thanedar, K. Almeroth and E. Belding, "[A Lightweight Content Replication Scheme for Mobile Ad hoc Environments](#)," *IFIP Networking Conference*, Athens, Greece, pp. 125-136, May 2004.
32. R. Chalmers and K. Almeroth, "[A Mobility Gateway for Small-Device Networks](#)," *IEEE International Conference on Pervasive Computing and Communications (PerCom)*, Orlando, Florida, USA, March 2004.
31. A. Jardosh, E. Belding, K. Almeroth and S. Suri, "[Towards Realistic Mobility Models For Mobile Ad hoc Networks](#)," *ACM Mobicom*, San Diego, California, USA, September 2003.
30. K. Sarac, P. Namburi and K. Almeroth, "[SSM Extensions: Network Layer Support for Multiple Senders in SSM](#)," *International Conference on Computer Communication and Networks (IC3N)*, Dallas, Texas, USA, October 2003.
29. K. Ramachandran and K. Almeroth, "[MAFIA: A Multicast Management Solution for Access Control and Traffic Filtering](#)," *IEEE/IFIP Conference on Management of Multimedia Networks and Services (MMNS)*, Belfast, Northern Ireland, September 2003.
28. J. Humfrey, S. Rollins, K. Almeroth, and B. Bimber, "[Managing Complexity in a Networked Learning Environment](#)," *World Conference on Educational Multimedia, Hypermedia & Telecommunications (ED MEDIA)*, Honolulu, Hawaii, USA, pp. 60-63, June 2003.
27. K. Almeroth, S. Rollins, Z. Shen, and B. Bimber, "[Creating a Demarcation Point Between Content Production and Encoding in a Digital Classroom](#)," *World Conference on Educational Multimedia, Hypermedia & Telecommunications (ED MEDIA)*, Honolulu, Hawaii, USA, pp. 2-5, June 2003.
26. M. Kolsch, K. Kvilekval, and K. Almeroth, "[Improving Speaker Training with Interactive Lectures](#)," *World Conference on Educational Multimedia, Hypermedia & Telecommunications (ED MEDIA)*, Honolulu, Hawaii, USA, June 2003.
25. P. Rajvaidya and K. Almeroth, "[Analysis of Routing Characteristics in the Multicast Infrastructure](#)," *IEEE Infocom*, San Francisco, California, USA, April 2003.
24. S. Rollins and K. Almeroth, "[Pixie: A Jukebox Architecture to Support Efficient Peer Content Exchange](#)," *ACM Multimedia*, Juan Les Pins, FRANCE, December 2002.

23. S. Rollins, R. Chalmers, J. Blanquer, and K. Almeroth, "[The Active Information System\(AIS\): A Model for Developing Scalable Web Services](#)," *IASTED International Conference on Internet and Multimedia Systems and Applications (IMSA)*, Kauai, Hawaii, USA, August 2002.
22. S. Rollins and K. Almeroth, "[Seminal: Additive Semantic Content for Multimedia Streams](#)," *IASTED International Conference on Internet and Multimedia Systems and Applications (IMSA)*, Kauai, Hawaii, USA, August 2002.
21. B. Stiller, K. Almeroth, J. Altmann, L. McKnight, and M. Ott, "[Content Pricing in the Internet](#)," *SPIE ITCOM Conference on Internet Performance and Control of Network Systems (IPCNS)*, Boston, Massachusetts, USA, July 2002.
20. S. Jagannathan, J. Nayek, K. Almeroth and M. Hofmann, "[A Model for Discovering Customer Value for E-Content](#)," *ACM International Conference on Knowledge Discovery and Data Mining (SIGKDD)*, Edmonton, Alberta, CANADA, July 2002.
19. S. Rollins and K. Almeroth, "[Deploying and Infrastructure for Technologically Enhanced Learning](#)," **Outstanding Paper** at the *World Conference on Educational Multimedia, Hypermedia & Telecommunications (ED MEDIA)*, Denver, Colorado, USA, pp. 1651-1656, June 2002.
18. P. Rajvaidya and K. Almeroth, "[Building the Case for Distributed Global Multicast Monitoring](#)," *Multimedia Computing and Networking (MMCN)*, San Jose, California, USA, January 2002.
17. S. Jagannathan and K. Almeroth, "[An Adaptive Pricing Scheme for Content Delivery Systems](#)," *IEEE Global Internet*, San Antonio, Texas, USA, November 2001.
16. K. Sarac and K. Almeroth, "[Providing Scalable Many-to-One Feedback in Multicast Reachability Monitoring Systems](#)," *IFIP/IEEE International Conference on Management of Multimedia Networks and Services (MMNS)*, Chicago, Illinois, USA, October 2001.
15. S. Jagannathan and K. Almeroth, "[The Dynamics of Price, Revenue and System Utilization](#)," *IFIP/IEEE International Conference on Management of Multimedia Networks and Services (MMNS)*, Chicago, Illinois, USA, October 2001.
14. A. Kanwar, K. Almeroth, S. Bhattacharyya, and M. Davy, "[Enabling End-User Network Monitoring via the Multicast Consolidated Proxy Monitor](#)," *SPIE ITCOM Conference on Scalability and Traffic Control in IP Networks (STCIPN)*, Denver, Colorado, USA, August 2001.
13. S. Jagannathan and K. Almeroth, "[Using Tree Topology for Multicast Congestion Control](#)," *International Conference on Parallel Processing (ICPP)*, Valencia, SPAIN, September 2001.
12. P. Rajvaidya and K. Almeroth, "[A Router-Based Technique for Monitoring the Next-Generation of Internet Multicast Protocols](#)," *International Conference on Parallel Processing (ICPP)*, Valencia, SPAIN, September 2001.
11. R. Chalmers and K. Almeroth, "[Modeling the Branching Characteristics and Efficiency Gains of Global Multicast Trees](#)," *IEEE Infocom*, Anchorage, Alaska, USA, April 2001.
10. R. Chalmers and K. Almeroth, "[Developing a Multicast Metric](#)," *Global Internet*, San Francisco, California, USA, December 2000.
9. K. Sarac and K. Almeroth, "[Monitoring Reachability in the Global Multicast Infrastructure](#)," *IEEE International Conference on Network Protocols (ICNP)*, Osaka, JAPAN, November 2000.

8. K. Almeroth, "[A Long-Term Analysis of Growth and Usage Patterns in the Multicast Backbone \(MBone\)](#)," *IEEE INFOCOM*, Tel Aviv, ISRAEL, March 2000.
7. K. Almeroth, K. Obraczka and D. De Lucia, "[A Lightweight Protocol for Interconnecting Heterogeneous Devices in Dynamic Environments](#)," *IEEE International Conference on Multimedia Computing and Systems (ICMCS)*, Florence, ITALY, June 1999.
6. K. Almeroth and M. Ammar, "[The Interactive Multimedia Jukebox \(IMJ\): A New Paradigm for the On-Demand Delivery of Audio/Video](#)," **Best Paper** at the *Seventh International World Wide Web Conference (WWW)*, Brisbane, AUSTRALIA, April 1998.
5. K. Almeroth, M. Ammar and Z. Fei, "[Scalable Delivery of Web Pages Using Cyclic Best-Effort \(UDP\) Multicast](#)," *IEEE INFOCOM*, San Francisco, California, USA, June 1998.
4. K. Almeroth and M. Ammar, "[Delivering Popular Web Pages Using Cyclic Unreliable Multicast \(Extended Abstract\)](#)," *SPIE Conference on Voice, Video and Data Communications*, Dallas, Texas, USA, November 1997.
3. K. Almeroth, A. Dan, D. Sitaram and W. Tetzlaff, "[Long Term Resource Allocation in Video Delivery Systems](#)," *IEEE INFOCOM*, Kobe, JAPAN, April 1997.
2. K. Almeroth and M. Ammar, "[On the Performance of a Multicast Delivery Video-On-Demand Service with Discontinuous VCR Actions](#)," *International Conference on Communications (ICC)*, Seattle, Washington, USA, June 1995.
1. K. Almeroth and M. Ammar, "[A Scalable, Interactive Video-On-Demand Service Using Multicast Communication](#)," *International Conference on Computer Communication and Networks (IC3N)*, San Francisco, California, USA, September 1994.

C. Workshop Papers (refereed)

34. M. Tavakolifard, J. Gulla, K. Almeroth, F. Hopfgartner, B. Kille, T. Plumbaum, A. Lommatzsch, T. Brodt, A. Bucko, and T. Heintz, "[Workshop and Challenge on News Recommender Systems](#)," *ACM RecSys News Recommender Systems (NRS) Workshop and Challenge*, Hong Kong, CHINA, October 2013.
33. M. Tavakolifard, K. Almeroth, and J. Gulla, "[Does Social Contact Matter? Modelling the Hidden Web of Trust Underlying Twitter](#)," *ACM International Workshop on Social Recommender Systems (SRS)*, Rio de Janeiro, BRAZIL, May 2013.
32. D. Johnson, E. Belding, K. Almeroth and G. van Stam, "[Internet Usage and Performance Analysis of a Rural Wireless Network in Macha, Zambia](#)," *ACM Networked Systems for Developing Regions (NSDR) Workshop*, San Francisco, California, USA, June 2010.
31. D. Havey, R. Chertov, and K. Almeroth, "[Wired Wireless Broadcast Emulation](#)," *International Workshop on Wireless Network Measurement (WiNMee)*, Seoul, Korea, June 2009.
30. R. Raghavendra, P. Acharya, E. Belding, and K. Almeroth, "[MeshMon: A Multi-Tiered Framework for Wireless Mesh Network Monitoring](#)," *ACM Mobihoc Wireless of the Students, by the Students, for the Students Workshop (S3)*, New Orleans, Louisiana, USA, May 2009.

29. G. Swamynathan, C. Wilson, B. Boe, B. Zhao, and K. Almeroth, "[Do Social Networks Improve e-Commerce: A Study on Social Marketplaces](#)," *ACM Sigcomm Workshop on Online Social Networks (WOSN)*, Seattle, Washington, USA, August 2008.
28. R. Raghavendra, E. Belding, and K. Almeroth, "[Antler: A Multi-Tiered Approach to Automated Wireless Network Management](#)," *IEEE Workshop on Automated Network Management (ANM)*, Phoenix, Arizona, USA, April 2008.
27. S. Karpinski, E. Belding, and K. Almeroth, "[Towards Realistic Models of Wireless Workload](#)," *International Workshop on Wireless Network Measurement (WiNMee)*, Limassol, CYPRUS, April 2007.
26. K. Harras, M. Wittie, K. Almeroth, and E. Belding, "[ParaNets: A Parallel Network Architecture for Challenged Networks](#)," *IEEE Workshop on Mobile Computing Systems and Applications (HotMobile)*, Tucson, Arizona, USA, February 2007.
25. H. Caituiro-Monge, K. Almeroth, M. del Mar Alvarez-Rohena, "[Friend Relay: A Resource Sharing Framework for Mobile Wireless Devices](#)," *ACM International Workshop on Wireless Mobile Applications and Services on WLAN Hotspots (WMASH)*, Los Angeles, California, September 2006.
24. G. Swamynathan, Ben Y. Zhao and K. Almeroth, "[Exploring the Feasibility of Proactive Reputations](#)," *International Workshop on Peer-to-Peer Systems (IPTPS)*, Santa Barbara, California, USA, February 2006.
23. G. Swamynathan, Ben Y. Zhao and K. Almeroth, "[Decoupling Service and Feedback Trust in a Peer-to-Peer Reputation System](#)," *International Workshop on Applications and Economics of Peer-to-Peer Systems (AEPP)*, Nanjing, CHINA, November 2005.
22. K. Ramachandran, M. Buddhikot, G. Chandranmenon, S. Miller, E. Belding, and K. Almeroth, "[On the Design and Implementation of Infrastructure Mesh Networks](#)," *IEEE Workshop on Wireless Mesh Networks (WiMesh)*, Santa Clara, California, USA, September 2005.
21. A. Jardosh, K. Ramachandran, K. Almeroth and E. Belding, "[Understanding Link-Layer Behavior in Highly Congested IEEE 802.11b Wireless Networks](#)," *Sigcomm Workshop on Experimental Approaches to Wireless Network Design and Analysis (EWIND)*, Philadelphia, Pennsylvania, USA, August 2005.
20. A. Sen Mazumder, K. Almeroth and K. Sarac, "[Facilitating Robust Multicast Group Management](#)," *Network and Operating System Support for Digital Audio and Video (NOSSDAV)*, Skamania, Washington, USA, June 2005.
19. Y. Sun, I. Sheriff, E. Belding and K. Almeroth, "[An Experimental Study of Multimedia Traffic Performance in Mesh Networks](#)," *MobiSys International Workshop on Wireless Traffic Measurements and Modeling (WitMeMo)*, Seattle, Washington, USA, June 2005.
18. K. Ramachandran, K. Almeroth and E. Belding, "[A Framework for the Management of Large-Scale Wireless Network Testbeds](#)," *International Workshop on Wireless Network Measurement (WiNMee)*, Trentino, ITALY, April 2005.
17. A. Garyfalos, K. Almeroth and K. Sanzgiri, "[Deployment Complexity Versus Performance Efficiency in Mobile Multicast](#)," *International Workshop on Broadband Wireless Multimedia: Algorithms, Architectures and Applications (BroadWiM)*, San Jose, California, USA, October 2004.

16. C. Ho, K. Ramachandran, K. Almeroth and E. Belding, "[A Scalable Framework for Wireless Network Monitoring](#)," *ACM International Workshop on Wireless Mobile Applications and Services on WLAN Hotspots (WMASH)*, Philadelphia, Pennsylvania, USA, October 2004.
15. A. Garyfalos, K. Almeroth and J. Finney, "[A Hybrid of Network and Application Layer Multicast for Mobile IPv6 Networks](#)," *International Workshop on Large-Scale Group Communication (LSGC)*, Florence, ITALY, October 2003.
14. A. Garyfalos, K. Almeroth and J. Finney, "[A Comparison of Network and Application Layer Multicast for Mobile IPv6 Networks](#)," *ACM Workshop on Modeling, Analysis and Simulation of Wireless and Mobile Systems (MSWiM)*, San Diego, California, USA, September 2003.
13. S. Jagannathan, and K. Almeroth, "[Pricing and Resource Provisioning for Delivering E-Content On-Demand with Multiple Levels-of-Service](#)," *International Workshop on Internet Charging and QoS Technologies (ICQT)*, Zurich, SWITZERLAND, October 2002.
12. S. Rollins, K. Almeroth, D. Milojicic, and K. Nagaraja, "[Power-Aware Data Management for Small Devices](#)," *Workshop on Wireless Mobile Multimedia (WoWMoM)*, Atlanta, GA, USA, September 2002.
11. K. Almeroth, S. Bhattacharyya, and C. Diot, "[Challenges of Integrating ASM and SSM IP Multicast Protocol Architectures](#)," *International Workshop on Digital Communications: Evolutionary Trends of the Internet (IWDC)*, Taormina, ITALY, September 2001.
10. K. Sarac and K. Almeroth, "[Scalable Techniques for Discovering Multicast Tree Topology](#)," *Network and Operating System Support for Digital Audio and Video (NOSSDAV)*, Port Jefferson, New York, USA, June 2001.
9. P. Rajvaidya, K. Almeroth and K. Claffy, "[A Scalable Architecture for Monitoring and Visualizing Multicast Statistics](#)," *IFIP/IEEE International Workshop on Distributed Systems: Operations & Management (DSOM)*, Austin, Texas, USA, December 2000.
8. S. Jagannathan, K. Almeroth and A. Acharya, "[Topology Sensitive Congestion Control for Real-Time Multicast](#)," *Network and Operating System Support for Digital Audio and Video (NOSSDAV)*, Chapel Hill, North Carolina, USA, June 2000.
7. K. Sarac and K. Almeroth, "[Supporting the Need for Inter-Domain Multicast Reachability](#)," *Network and Operating System Support for Digital Audio and Video (NOSSDAV)*, Chapel Hill, North Carolina, USA, June 2000.
6. D. Makofske and K. Almeroth, "[MHealth: A Real-Time Multicast Tree Visualization and Monitoring Tool](#)," *Network and Operating System Support for Digital Audio and Video (NOSSDAV)*, Basking Ridge New Jersey, USA, June 1999.
5. K. Almeroth and Y. Zhang, "[Using Satellite Links as Delivery Paths in the Multicast Backbone \(MBone\)](#)," *ACM/IEEE International Workshop on Satellite-Based Information Services (WOSBIS)*, Dallas, Texas, USA, October 1998.
4. M. Ammar, K. Almeroth, R. Clark and Z. Fei, "[Multicast Delivery of Web Pages OR How to Make Web Servers Pushy](#)," *Workshop on Internet Server Performance (WISP)*, Madison, Wisconsin, USA, June 1998.
3. K. Almeroth and M. Ammar, "[Prototyping the Interactive Multimedia Jukebox](#)," *Mini-conference on Multimedia Appliances, Interfaces, and Trials--International Conference on Communications (ICC)*,

Montreal, Quebec, CANADA, June 1997.

2. K. Almeroth and M. Ammar, "[Collection and Modeling of the Join/Leave Behavior of Multicast Group Members in the MBone](#)," *High Performance Distributed Computing Focus Workshop (HPDC)*, Syracuse, New York, USA, August 1996.
1. K. Almeroth and M. Ammar, "[The Role of Multicast Communication in the Provision of Scalable and Interactive Video-On-Demand Service](#)," *Network and Operating System Support for Digital Audio and Video (NOSSDAV)*, Durham, New Hampshire, USA, April 1995.

D. Non-Refereed Publications

8. K. Almeroth, E. Belding, M. Buddhikot, G. Chandranmenon, S. Miller, and K. Ramachandran, "[Infrastructure Mesh Networks](#)," *U.S. Patent Application US20070070959 A1*, September 2005.
7. K. Almeroth, R. Caceres, A. Clark, R. Cole, N. Duffield, T. Friedman, K. Hedayat, K. Sarac, M. Westerlund, "[RTP Control Protocol Extended Reports \(RTCP XR\)](#)," *Internet Engineering Task Force (IETF) Request for Comments (RFC) 3611*, November 2003.
6. Z. Albanna, K. Almeroth, D. Meyer, and M. Schipper, "[IANA Guidelines for IPv4 Multicast Address Allocation](#)," *Internet Engineering Task Force (IETF) Request for Comments (RFC) 3171*, August 2001.
5. B. Quinn and K. Almeroth, "[IP Multicast Applications: Challenges and Solutions](#)," *Internet Engineering Task Force (IETF), Request for Comments (RFC) 3170*, September 2001.
4. K. Almeroth, L. Wei and D. Farinacci, "[Multicast Reachability Monitor \(MRM\) Protocol](#)," *Internet Engineering Task Force Internet Draft*, July 2000.
3. K. Almeroth and L. Wei, "[Justification for and use of the Multicast Reachability Monitor \(MRM\) Protocol](#)," *Internet Engineering Task Force Internet Draft*, March 1999.
2. K. Almeroth, "[Managing IP Multicast Traffic: A First Look at the Issues, Tools, and Challenges](#)," IP Multicast Initiative White Paper, San Jose, California, USA, February 1999.
1. K. Almeroth, K. Obraczka and D. De Lucia, "[Pseudo-IP: Providing a Thin Network Protocol for Semi-Intelligent Wireless Devices](#)," *DARPA/NIST Smart Spaces Workshop*, Gaithersburg, Maryland, USA, July 1998.

E. Released Software Systems

19. *A Multi-radio Wireless Mesh Network Architecture* -- <http://moment.cs.ucsb.edu/tic/>. Released December 1, 2006 (with K. Ramachandran, I. Sheriff, and E. Belding). The software as part of a multi-radio wireless mesh network that includes a Split Wireless Router that alleviates the interference that can occur between commodity radios within a single piece of hardware. The second is server software to perform channel assignment and communicate the assignments throughout the mesh network.
18. *AODV-Spanning Tree (AODV-ST)* -- <http://www.cs.ucsb.edu/~krishna/aodv-st/>. Released September 1, 2006 (with K. Ramachandran and E. Belding). AODV-ST is an extension of the well-known AODV

protocol specifically designed for wireless mesh networks. The advantages of AODV-ST over AODV include support for high throughput routing metrics, automatic route maintenance for common-case traffic, and low route discovery latency.

17. ***The Multicast Detective*** -- http://www.nmsl.cs.ucsb.edu/mcast_detective/. Released September 1, 2005 (with A. Sen Mazumder). The multicast detective is a robust solution to determine the existence and nature of multicast service for a particular user. By performing a series of tests, a user can determine whether there is network support for multicast, and consequently, whether a multicast group join is likely to succeed.
16. ***AutoCap: Automatic and Accurate Captioning*** -- <http://www.nmsl.cs.ucsb.edu/autocap/>. Released August 1, 2005 (with A. Knight). AutoCap is a software system that takes as input an audio/video file and a text transcript. AutoCap creates captions by aligning the utterances in the audio/video file to the transcript. For those words that are not recognized, AutoCap estimates when the words were spoken along with an error bound that gives the content creator an idea of caption accuracy. The result is a collection of accurately time-stamped captions that can be displayed with the video.
15. ***PAIRwise Plagiarism Detection System*** -- <http://cits.ucsb.edu/pair/>. Released July 1, 2005 (with A. Knight). PAIRwise is a plagiarism detection system with: (1) an easy-to-use interface for submitting papers, (2) a flexible comparison engine that allows intra-class, inter-class, and Internet-based comparisons, and (3) an intuitive graphical presentation of results.
14. ***DAMON Multi-Hop Wireless Network Monitoring*** -- <http://moment.cs.ucsb.edu/damon/>. Released October 1, 2004 (with K. Ramachandran and E. Belding). DAMON is a distributed system for monitoring multi-hop mobile networks. DAMON uses agents within the network to monitor network behavior and send collected measurements to data repositories. DAMON's generic architecture supports the monitoring of a wide range of protocol, device, or network parameters.
13. ***Multicast Firewall*** -- <http://www.nmsl.cs.ucsb.edu/mafia/>. Released June 1, 2004 (with K. Ramachandran). MAFIA, a multicast firewall and traffic management solution, has the specific aim of strengthening multicast security through multicast access control, multicast traffic filtering, and DoS attack prevention.
12. ***AODV@IETF Peer Routing Software*** -- <http://moment.cs.ucsb.edu/aodv-ietf/>. Released November 1, 2003 (with K. Ramachandran and E. Belding). One of the first large-scale efforts to run the Ad hoc On demand Distance Vector (AODV) routing protocol in a public space (at the Internet Engineering Task Force (IETF)). The implementation includes a daemon that runs on both the Linux and Windows operating systems.
11. ***Mobility Obstacles*** -- <http://moment.cs.ucsb.edu/mobility/>. Released September 1, 2003 (with A. Jardosh, E. Belding, and S. Suri). The topology and movement of nodes in ad hoc protocol simulation are key factors in protocol performance. In this project, we have developed ns-2 simulation plug-ins that create more realistic movement models through the incorporation of obstacles. These obstacles are utilized to restrict both node movement and wireless transmissions.
10. ***mwalk*** -- <http://www.nmsl.cs.ucsb.edu/mwalk/>. Released December 1, 2000 (with R. Chalmers). Mwalk is a collection of Java applications and Perl scripts which re-create a global view of a multicast session from mtrace and RTCP logs. Users to the site can download mwalk, examine the results of our analysis, or download data sets for use in simulations dependent on multicast tree characteristics.
9. ***MANTRA2*** -- <http://www.nmsl.cs.ucsb.edu/mantra/>. Released December 1, 1999 (with P. Rajvaidya). This new version of MANTRA focuses on the visualization of inter-domain routing statistics. Working

in conjunction with the Cooperative Association for Internet Data Analysis (CAIDA) we have developed advanced collection and visualization techniques.

8. **MRM** -- <http://www.nmsl.cs.ucsb.edu/mrm/>. Released October 1, 1999 (with K. Sarac). MRM is the Multicast Reachability Protocol. We have implemented an end-host agent that responds to MRM Manager commands. Our end-host agent works in conjunction with Cisco routers to detect and isolate multicast faults.
7. **MANTRA** -- <http://www.nmsl.cs.ucsb.edu/mantra/>. Released January 1, 1999 (with P. Rajvaidya). MANTRA is the Monitoring and Analysis of Traffic in Multicast Routers. It uses scripts to collect and display data from backbone multicast routers.
6. **SDR Monitor** -- <http://www.nmsl.cs.ucsb.edu/sdr-monitor/>. Released January 1, 1999 (with K. Sarac). The SDR Monitor receives e-mail updates from participants containing information about observed sessions in the MBone. A global view of multicast reachability is then constructed.
5. **The MHealth tool** -- <http://www.nmsl.cs.ucsb.edu/mhealth/>. Released September 1, 1998 (with D. Makofske). The mhealth tool graphically visualizes MBone multicast group trees and provides 'health' information including end-to-end losses per receiver and losses on a per hop basis. The implementation required expertise in Java, the MBone tools, and Unix.
4. **The MControl tool** -- <http://www.nmsl.cs.ucsb.edu/mcontrol/>. Released August 1, 1998 (with D. Makofske). Mcontrol is a tool to provide VCR-based interactivity for live MBone sessions. The implementation required expertise in Java, the MBone tools, and Unix.
3. **Interactive Multimedia Jukebox (IMJ)** -- <http://imj.ucsb.edu/>. Released October 1, 1996. The IMJ combines the WWW and the MBone conferencing tools to provide a multi-channel video jukebox offering both instructional and entertainment programming on a wide scale. The implementation required expertise in HTML, Perl, C, the MBone tools, and Unix.
2. **Mlisten** -- <http://www.cc.gatech.edu/computing/Telecomm/mbone/>. Released September 1, 1995. A tool to continuously collect MBone multicast group membership information including number and location of members, membership duration, and inter-arrival time for all audio and video sessions. The implementation required expertise in C, Tcl/Tk, the MBone tools, and UNIX socket programming.
1. **Audio-on-Demand (AoD)**. March 1, 1995. A server/client prototype to demonstrate interactivity in near VoD systems. The AoD server provides songs-on-demand and VCR-like functions via multicast IP over Ethernet. The implementation required expertise in C, OpenWindows programming, UNIX socket programming, and network programming.

F. Tutorials, Panels and Invited Talks

- "25th Anniversary Panel," Network and Operating System Support for Digital Audio and Video (NOSSDAV), Portland, Oregon, USA, March 2015.
- "Sensing and Opportunistic Delivery of Ubiquitous Video in Health Monitoring, On-Campus and Social Network Applications," Workshop on Mobile Video Delivery (MoViD), Chapel Hill North Carolina, USA, February 2012.
- "Medium Access in New Contexts: Reinventing the Wheel?," USC Invited Workshop on Theory and

Practice in Wireless Networks, Los Angeles, California, USA, May 2008.

- "The Wild, Wild West: Wireless Networks Need a New Sheriff," University of Florida CISE Department Lecture Series, Gainesville, Florida, USA, February 2008.
- "Distinguishing Between Connectivity, Intermittent Connectivity, and Intermittent Disconnectivity," Keynote at the ACM MobiCom Workshop on Challenged Networks (CHANTS), Montreal, CANADA, September 2007.
- "The Three Ghosts of Multicast: Past, Present, and Future," Keynote at the Trans-European Research and Education Networking Association (TERENA) Networking Conference, Lynby, DENMARK, May 2007.
- "Multicast Help Wanted: From Where and How Much?," Keynote at the Workshop on Peer-to-Peer Multicasting (P2PM), Las Vegas, Nevada, USA, January 2007.
- "The Confluence of Wi-Fi and Apps: What to Expect Next," Engineering Insights, UC-Santa Barbara, Santa Barbara, California, USA, October 2006.
- "Challenges, Opportunities, and Implications for the Future Internet," University of Minnesota Digital Technology Center, Minneapolis, Minnesota, USA, September 2006.
- "Wireless Technology as a Catalyst: Possibilities for Next-Generation Interaction," Santa Barbara Forum on Digital Transitions, Santa Barbara, California, USA, April 2006.
- "Challenges and Opportunities in an Internet with Pervasive Wireless Access," University of Texas--Dallas Computer Science Colloquium, Dallas, Texas, USA, March 2006.
- "Challenges and Opportunities with Pervasive Wireless in the Internet," Duke University Computer Science Colloquium, Durham, North Carolina, USA, February 2006.
- "The Span From Wireless Protocols to Social Applications," Intel Research Labs, Cambridge, United Kingdom, December 2005.
- "The Internet Dot.Com Bomb and Beyond the Dot.Com Calm," CSE IGERT and Cal Poly Lecture Series, San Luis Obispo, California, USA, October 2005.
- "Panel: Directions in Networking Research," IEEE Computer Communications Workshop (CCW), Irvine, California, USA, October 2005.
- "Economic Incentives for Ad Hoc Networks," KAIST New Applications Seminar, Seoul, South Korea, March 2004.
- "New Applications for the Next Generation Internet," Citrix Systems, Santa Barbara, California, USA, March 2004.
- "PI: The Imperfect Pursuit of Pure Pattern," CITS Visions in Technology Series, Santa Barbara, California, USA, January 2004.
- "Panel: Core Networking Issues and Protocols for the Internet," National Science Foundation (NSF) Division of Advanced Networking Infrastructure and Research (ANIR) Principal Investigators Workshop, Washington DC, USA, March 2003.

- "Panel: Pricing for Content in the Internet," SPIE ITCom Internet Performance and Control of Network Systems, Boston, Massachusetts, USA, July 2002.
- "The Technology Behind Wireless LANs," Central Coast MIT Enterprise Forum, Santa Barbara, California, USA, March 2002.
- "Lessons Learned in the Digital Classroom," Center for Information and Technology Brown Bag Symposium, Santa Barbara, California, USA, March 2002.
- "The Evolution of Advanced Networking Services: From the ARPAnet to Internet2," California State University--San Luis Obispo CS Centennial Colloquium Series, San Luis Obispo, California, USA, February 2002.
- "Deployment of IP Multicast in Campus Infrastructures," Internet2 Campus Deployment Workshop, Atlanta, Georgia, USA, May 2001.
- "Multicast: Is There Anything Else to Do?," Sprint Research Retreat, Miami, Florida, USA, May 2001.
- "The Evolution of Next-Generation Internet Services and Applications," Government Technology Conference 2001 (GTC) for the Western Region, Sacramento, California, USA, May 2001.
- "I2 Multicast: Not WIDE-scale Deployment, FULL-scale Deployment," Closing Plenary, Internet2 Member Meetings, Washington, D.C., USA, March 2001.
- "Panel: Beyond IP Multicast," Content Delivery Networks (CDN), New York, New York, USA, February 2001.
- "Viable Multicast Pricing & Business Models for Wider-Scale Deployment," Content Delivery Networks (CDN), New York, New York, USA, February 2001.
- "IP Multicast: Modern Protocols, Deployment, and Management," Content Delivery Networks (CDN), New York, New York, USA, February 2001 & San Jose, California, USA, December 2001.
- "Under the Hood of the Internet," Technology 101: Technology for Investors, Center for Entrepreneurship & Engineering Management, November 2000.
- "Understanding Multicast Traffic in the Internet," (1) University of Virginia, (2) University of Maryland, and (3) Columbia University, September 2000.
- "The Bad, The Ugly, and The Good: The Past, Present, and Future of Multicast," Digital Fountain, San Francisco, California, USA, August 2000.
- "Implications of Source-Specific Multicast (SSM) on the Future of Internet Content Delivery," Occam Networks, Santa Barbara, California, USA, August 2000.
- "Introduction to Multicast Routing Protocols," UC-Berkeley Open Mash Multicast Workshop, Berkeley, California, USA, July 2000.
- "Efforts to Understand Traffic and Tree Characteristics," University of Massachusetts--Amherst Colloquia, Amherst, Massachusetts, USA, May 2000.
- "Monitoring Multicast Traffic," Sprint Research Retreat, Half Moon Bay, California, USA, April 2000.

- "What is the Next Generation of Multicast in the Internet?," HRL Laboratories, Malibu, California, USA, January 2000.
- "Mission and Status of the Center for Information Technology and Society (CITS)," Intel Research Council, Portland, Oregon, USA, September 1999.
- "Multicast at a Crossroads," IP Multicast Initiative Summits and Bandwidth Management Workshops, San Francisco, CA, USA, (1) October 1999; (2) February 2000; and (3) June 2000.
- "IP Multicast: Modern Protocols, Deployment, and Management," Network+Interop: (1) Las Vegas, Nevada, USA--May 2000; (2) Tokyo, JAPAN--June 2000; (3) Atlanta, Georgia, USA--September 2000; (4) Las Vegas, Nevada, USA--May 2001; (5) Las Vegas, Nevada, USA--May 2002.
- "IP Multicast: Practice and Theory" (w/ Steve Deering), Network+Interop: (1) Las Vegas, Nevada, USA--May 1999; (2) Tokyo, JAPAN--June 1999; and (3) Atlanta, Georgia, USA--September 1999.
- "Internet2 Multicast Testbeds and Applications," Workshop on Protocols for High Speed Networks (PfHSN), Salem, Massachusetts, USA, August 1999.
- "IP Multicast: Protocols for the Intra- and Inter-Domain," Lucent Technologies, Westford, Massachusetts, USA, August 1999.
- "Internet2 Multicast Testbeds and Applications," NASA Workshop: Bridging the Gap, Moffett Field, California, USA, August 1999.
- "The Evolution of Next-Generation Services and Applications in the Internet," Tektronix Distinguished Lecture Series, Portland, Oregon, USA, May 1999.
- "Multicast Applications and Infrastructure in the Next Generation Internet," CENIC 99 Workshop on Achieving Critical Mass for Advanced Applications, Monterey, California, USA, May 1999.
- "Multicast Traffic Monitoring and Analysis Work at UCSB" (w/ P. Rajvaidya), Workshop on Internet Statistics and Metrics Analysis (ISMA), San Diego, California, USA, April 1999.
- "How the Internet Works: Following Bits Around the World," Science Lite, Santa Barbara General Affiliates and Office of Community Relations, California, USA, February 1999.
- "Managing Multicast: Challenges, Tools, and the Future," IP Multicast Initiative Summit, San Jose, California, USA, February 1999.
- "The Future of Multicast Communication and Protocols," Internet Bandwidth Management Summit (iBAND), San Jose, California, USA, November 1998.
- "An Overview of IP Multicast: Applications and Deployment," (1) Workshop on Evaluating IP Multicast as the Solution for Webcasting Real-Time Networked Multimedia Applications, New York, New York, USA, July 1998; and (2) Satellites and the Internet Conference, Washington, D.C., USA, July 1998.
- "IETF Developments in IP Multicast," IP Multicast Initiative Summit, San Jose, California, USA, February 1998.
- "An Introduction to IP Multicast and the Multicast Backbone (MBone)" vBNS Technical Meeting

sponsored by the National Center for Network Engineering (NLNR), San Diego, California, USA, February 1998.

- "Using Multicast Communication to Deliver WWW Pages" Computer Communications Workshop (CCW '97), Phoenix, Arizona, USA, September 1997.

G. Research Funding

- K. Almeroth, "Packet Scheduling Using IP Embedded Transport Instrumentation," Cisco Systems Inc., \$100,000, 3/1/13-8/31/14.
- K. Almeroth, E. Belding and S.J. Lee, "GOALI: Maximizing Available Bandwidth in Next Generation WLANs", National Science Foundation (NSF), \$101,088, 10/1/13-9/30/14.
- K. Almeroth and E. Belding, "GOALI: Intelligent Channel Management in 802.11n Networks," National Science Foundation (NSF), \$51,000, 10/1/10-9/30/11.
- B. Zhao, K. Almeroth, H. Zheng, and E. Belding, "NeTS: Medium: Airlab: Distributed Infrastructure for Wireless Measurements," National Science Foundation (NSF), \$700,000, 9/1/09-8/13/13.
- K. Almeroth, E. Belding and T. Hollerer, "NeTS-WN: Wireless Network Health: Real-Time Diagnosis, Adaptation, and Management," National Science Foundation (NSF), \$600,000, 10/1/07-9/30/10.
- K. Almeroth, "Next-Generation Service Engineering in Internet2," University Consortium for Advanced Internet Development (UCAID), \$1,254,000, 7/1/04-6/30/09 (reviewed and renewed each year).
- B. Manjunath, K. Almeroth, F. Bullo, J. Hespanha, T. Hollerer, C. Krintz, U. Madhow, K. Rose, A. Singh, and M. Turk, "Large-Scale Multimodal Wireless Sensor Network," Office of Naval Research Defense University Research Instrumentation Program (DURIP), \$655,174, 4/14/08-4/14/09.
- K. Almeroth and E. Belding, "Improving Robustness in Evolving Wireless Infrastructures," Intel Corporation, \$135,000, 7/1/06-6/30/09 (reviewed and renewed for second and third year).
- K. Almeroth and K. Sarac, "Bridging Support in Mixed Deployment Multicast Environments," Cisco Systems Inc., \$100,000, 9/1/07-8/31/08.
- K. Sarac and K. Almeroth, "Building the Final Piece in One-to-Many Content Distribution," Cisco Systems Inc., \$95,000, 9/1/06-8/31/07.
- E. Belding, K. Almeroth and J. Gibson, "Real-Time Communication Support in a Ubiquitous Next-Generation Internet," National Science Foundation (NSF), \$900,000, 10/1/04-9/30/07.
- K. Almeroth and K. Sarac, "Improving the Robustness of Multicast in the Internet," Cisco Systems Inc., \$80,000, 9/1/04-8/31/05.
- R. Mayer, B. Bimber, K. Almeroth and D. Chun, "Assessing the Pedagogical Implications of Technology in College Courses," Mellon Foundation, \$350,000, 7/1/04-6/30/07.
- B. Bimber, A. Flanagan and C. Stol, "Technological Change and Collective Association: Changing

Relationships Among Technology, Organizations, Society and the Citizenry," National Science Foundation (NSF), \$329,175, 7/1/04-6/30/07.

- K. Almeroth and B. Bimber, "Plagiarism Detection Techniques and Software," UCSB Instructional Development, \$22,000, 7/1/04-6/30/05.
- K. Almeroth, "Student Travel Support for the 14th International Workshop on Network and Operating Systems Support for Digital Audio and Video (NOSSDAV)," National Science Foundation (NSF), \$10,000, 5/1/04-8/31/04.
- K. Almeroth, "An Automated Indexing System for Remote, Archived Presentations," QAD Inc., \$25,000, 5/1/04-6/30/05.
- K. Almeroth and M. Turk, "A Remote Teaching Assistant Support System," Microsoft, \$40,000, 1/1/04-6/30/05.
- K. Almeroth, "Supporting Multicast Service Functionality in Helix," Real Networks, \$30,000, 9/1/03-6/30/04.
- K. Almeroth and E. Belding, "Service Discovery in Mobile Networks," Nokia Summer Research Grant (U. Mohan), \$10,240, 7/1/03-9/30/03.
- K. Almeroth, D. Zappala, "Building a Global Multicast Service," Cisco Systems Inc., \$100,000, 1/1/03-6/30/04.
- K. Almeroth, "Developing A Dynamic Protocol for Candidate Access Router Discovery," Nokia Graduate Student Fellowship (R. Chalmers), \$26,110, 9/01/02-6/30/03.
- B. Bimber and K. Almeroth, "The Role of Collaborative Groupware in Organizations," Toole Family Foundation, \$182,500 (\$20,000 cash plus \$162,500 in software), 9/1/02-8/30/07.
- B. Manjunath, et al., "Digital Multimedia: Graduate Training Program in Interactive Digital Multimedia," National Science Foundation (NSF), \$2,629,373, 4/1/02-3/31/07.
- J. Green, K. Almeroth, et al., "Inquiry in the Online Context: Learning from the Past, Informing the Future," UCSB Research Across Disciplines, \$10,000, 9/1/01-8/31/02.
- K. Almeroth, "Monitoring and Maintaining the Global Multicast Infrastructure," Cisco Systems Inc., \$54,600, 7/1/01-6/30/02.
- R. Kemmerer, K. Almeroth, et al., "Hi-DRA High-speed, Wide-area Network Detection, Response, and Analysis," Department of Defense (DoD), \$4,283,500, 5/1/01-4/30/06.
- A. Singh, K. Almeroth, et al., "Digital Campus: Scalable Information Services on a Campus-wide Wireless Network," National Science Foundation (NSF), 1,450,000, 9/15/00-12/31/04.
- K. Almeroth, "Visualizing the Global Multicast Infrastructure," UC MICRO w/ Cisco Systems Inc., \$85,438, 7/1/00-6/30/02.
- H. Lee, K. Almeroth, et al., "Dynamic Sensing Systems," International Telemetering Foundation, \$260,000, 07/01/00-06/30/04.
- B. Bimber and K. Almeroth, "Funding for the Center on Information Technology and Society,"

\$250,000 from Dialogic (an Intel Company) and \$250,000 from Canadian Pacific.

- K. Almeroth, "CAREER: From Protocol Support to Applications: Elevating Multicast to a Ubiquitous Network Service," National Science Foundation (NSF), \$200,000, 9/1/00-8/31/04.
- K. Almeroth, "Characterizing Multicast Use and Efficiency in the Inter-Domain," Sprint Advanced Technology Laboratories, \$62,500, 3/1/00-6/30/01.
- K. Almeroth, "Producing the Next Generation of Multicast Monitoring and Management Protocols and Tools," UC MICRO w/ Cisco Systems Inc., \$124,500, 7/1/99 - 6/30/01.
- K. Almeroth, "Utilizing Satellite Links in the Provision of an Inter-Wide Multicast Service," HRL Laboratories, \$20,000, 7/1/99 - 6/30/00.
- T. Smith, K. Almeroth, et al., "Alexandria Digital Earth Prototype," National Science Foundation, \$5,400,000, 4/1/99-3/31/04.
- V. Vesna, K. Almeroth, et al., "Online Public Spaces: Multidisciplinary Explorations in Multi-User Environments (OPS:MEME), Phase II," UCSB Research Across Disciplines, \$50,000, 9/1/98-8/31/99.
- K. Almeroth, "Techniques and Analysis for the Provision of Multicast Route Management," UC MICRO w/ Cisco Systems Inc., \$97,610, 7/1/98 - 6/30/00.
- K. Almeroth, "Capturing and Modeling Multicast Group Membership in the Multicast Backbone (MBone)," UC MICRO w/ Hughes Research Labs, \$19,146, 7/1/98 - 12/31/99.
- K. Almeroth, "Building a Content Server for the Next Generation Digital Classroom," UCSB Faculty Research Grant, \$5,000, 7/1/98-6/31/99.

H. Research Honors and Awards

- IEEE Fellow Status, 2014
- Finalist for Best Paper Award, IEEE Conference on Sensor and Ad Hoc Communications and Networks (SECON), June 2008
- Best Paper Award, Passive and Active Measurement (PAM) Conference, April 2007
- Outstanding Paper Award, World Conference on Educational Multimedia, Hypermedia & Telecommunications (ED MEDIA), June 2006
- IEEE Senior Member Status, 2003
- Finalist for Best Student Paper Award, ACM Multimedia, December 2002
- Outstanding Paper Award, World Conference on Educational Multimedia, Hypermedia & Telecommunications (ED MEDIA), June 2002
- Computing Research Association (CRA) Digital Government Fellowship, 2001
- National Science Foundation CAREER Award, 2000
- Best Paper Award, 7th International World Wide Web Conference, April 1998

III. Service

A. Professional Activities

1. Society Memberships

Member, Association for Computing Machinery (ACM): 1993-present
Member, ACM Special Interest Group on Communications (SIGComm): 1993-present
Fellow, Institute of Electrical and Electronics Engineers (IEEE): 1993-present
Member, IEEE Communications Society (IEEE ComSoc): 1993-present
Member, American Society for Engineering Education (ASEE): 2003-2006

2. Review Work for Technical Journals and Publishers

NSF CISE research proposals, IEEE/ACM Transactions on Networking, IEEE/ACM Transactions on Computers, IEEE/ACM Transactions on Communications, IEEE Transactions on Circuits and Systems for Video Technology, IEEE Transactions on Parallel and Distributed Systems, IEEE Transactions on Multimedia, IEEE Communications, IEEE Communications Letters, IEEE Network, IEEE Internet Computing, IEEE Multimedia, IEEE Aerospace & Electronics Systems Magazine, ACM Transactions on Internet Technology, ACM Transactions on Multimedia Computing, Communications and Applications, ACM Computing Surveys, ACM Computer Communications Review, ACM Computeres in Entertainment, ACM/Springer Multimedia Systems Journal, AACE Journal of Interactive Learning (JILR), International Journal of Computer Mathematics, Journal of Communications and Networks, Journal of Parallel and Distributed Computing, Journal of Network and Systems Management, Journal of High Speed Networking, Journal of Communications and Networks, Journal on Selected Areas in Communications, Journal of Wireless Personal Communications, Personal Mobile Communications, Annals of Telecommunications, International Journal of Wireless and Mobile Computing, Pervasive and Mobile Computing (PMC), Wireless Networks Journal, Computer Networks Journal, Cluster Computing, Computer Communications, Mobile Computing and Communications Review, Performance Evaluation, Software--Practice & Experience, Information Processing Letters, ACM Sigcomm, ACM Multimedia, ACM Network and System Support for Digital Audio and Video Workshop (NOSSDAV), ACM Sigcomm Workshop on the Economics of Peer-to-Peer Systems (P2PEcon), ACM Sigcomm Workshop on Challenged Networks (CHANTS), IEEE Infocom, IEEE Globecom, IEEE Global Internet (GI) Symposium, IEEE Globecom Automatic Internet Symposium, IEEE Globecom Internet Services and Enabling Technologies (IS&ET) Symposium, IEEE International Symposium on a World of Wireless, Mobile and Multimedia Networks (WoWMoM), IEEE International Conference on Network Protocols (ICNP), IEEE Conference on Sensor and Ad Hoc Communications and Networks (SECON), IEEE International Conference on Multimedia and Exposition (ICME), IEEE International Conference on Communications (ICC), IEEE International Conference on Parallel and Distributed Systems (ICPADS) IEEE International Symposium on High-Performance Distributed Computing (HPDC), IEEE International Conference on Distributed Computing Systems (ICDCS), IEEE International Workshop on Quality of Service (IWQoS), IEEE/IFIP Network Operations and Management Symposium (NOMS), IFIP/IEEE International Symposium on Integrated Network Management (IM), IFIP/IEEE International Conference on Management of Multimedia Networks and Services (MMNS), IEEE Aerospace & Electronics Systems Magazine, SPIE Conference on Multimedia Computing and Networking (MMCN), IFIP

Networking, IASTED International Conference on Information Systems and Databases (ISD), IASTED International Conference on Communications, Internet, and Information Technology, IASTED International Conference on Internet and Multimedia Systems and Applications (IMSA), IASTED International Conference on European Internet and Multimedia Systems and Applications (EuroIMSA), IASTED International Conference on Communications and Computer Networks (CCN), IASTED International Conference on Software Engineering and Applications (SEA), International Conference on Computer and Information Science (ICIS), International Association for Development of the Information Society (IADIS) International Conference on the WWW/Internet, Workshop on Network Group Communication (NGC), International Conference on Next Generation Communication (CoNEXT), International Conference on Parallel Processing (ICPP), International Conference on Computer Communications and Networks (IC3N), International Workshop on Hot Topics in Peer-to-Peer Systems (Hot-P2P), International Workshop on Wireless Network Measurements (WiNMe), International Workshop on Incentive-Based Computing (IBC), International Workshop on Multi-hop Ad Hoc Networks (REALMAN), International Workshop on Broadband Wireless Multimedia: Algorithms, Architectures and Applications (BroadWIM), International Packet Video (PV) Workshop, High Performance Networking Conference (HPN), International Parallel Processing Symposium (IPPS), International Symposium on Innovation in Information & Communication Technology (ISIICT), Workshop on Coordinated Quality of Service in Distributed Systems (COQODS), Pearson Education (Cisco Press) Publishers, Macmillan Technical Publishing, and Prentice Hall Publishers.

3. Conference Committee Activities

Journal/Magazine Editorial Board

IEEE Transactions on Mobile Computing (TMC): 2006-2011, 2017-2020 (Associate Editor-in-Chief)
 IEEE Networking Letters: 2018-2021
 IEEE Transactions on Network and Service Management (TNSM): 2015-2021
 Journal of Network and Systems Management (JNSM): 2011-present
 IEEE/ACM Transactions on Networking (ToN): 2003-2009, 2013-2017
 ACM Computers in Entertainment: 2002-2015
 IEEE Network: 1999-2012
 AACE Journal of Interactive Learning Research (JILR): 2003-2012
 IEEE Transactions on Mobile Computing (TMC): 2006-2011
 ACM Computer Communications Review (CCR): 2006-2010

Journal/Magazine Guest Editorship

IEEE Journal on Selected Areas in Communications (JSAC) Special Issue on "Delay and Disruption Tolerant Wireless Communication", June 2008
 Computer Communications Special Issue on "Monitoring and Measuring IP Networks", Summer 2005
 Computer Communications Special Issue on "Integrating Multicast into the Internet", March 2001

Conference/Workshop Steering Committee

IEEE International Conference on Network Protocols (ICNP): 2007-present
 ACM Sigcomm Workshop on Challenged Networks (CHANTS): 2006-present

IEEE Global Internet (GI) Symposium: 2005-2013, 2018-present
International Workshop on Network and Operating System Support for Digital Audio and Video (NOSSDAV): 2001-2020, 2005-2011 (chair), 2012-2020 (co-chair)
IFIP/IEEE International Conference on Management of Multimedia Networks and Services (MMNS): 2005-2009

Conference/Workshop Chair

International Conference on Communication Systems and Networks (COMSNETS): 2014 (co-chair)
ACM International Conference on Next Generation Communication (CoNext): 2013 (co-chair)
ACM RecSys News Recommender Systems (NRS) Workshop and Challenge: 2013 (co-chair)
ACM Sigcomm Workshop on Challenged Networks (CHANTS): 2006 (co-chair)
IEEE International Conference on Network Protocols (ICNP): 2003 (co-chair), 2006
International Workshop on Wireless Network Measurements (WiNMee): 2006 (co-chair)
IFIP/IEEE International Conference on Management of Multimedia Networks and Services (MMNS): 2002 (co-chair)
International Workshop on Network and Operating System Support for Digital Audio and Video (NOSSDAV): 2002 (co-chair), 2003 (co-chair)
IEEE Global Internet (GI) Symposium: 2001 (co-chair), 2018 (co-chair)
International Workshop on Networked Group Communication (NGC): 2000 (co-chair)

Program Chair

International Conference on Computer Communication and Networks (ICCCN): 2015 (Track co-chair)
International Conference on Communication Systems and Networks (COMSNETS): 2010
IEEE International Conference on Network Protocols (ICNP): 2008 (co-chair)
IEEE Conference on Sensor and Ad Hoc Communications and Networks (SECON): 2007 (co-chair)
IFIP Networking: 2005 (co-chair)

Posters/Demonstrations Chair

ACM Sigcomm: 2012 (co-chair)

Student Travel Grants Chair

ACM Sigcomm: 2010 (co-chair)

Publicity Chair

IFIP/IEEE International Conference on Management of Multimedia Networks and Services (MMNS): 2004 (co-chair)

Keynote Chair

IEEE Infocom: 2005 (co-chair)

Local Arrangements Chair

Internet2 "Field of Dreams" Workshop: 2000

Tutorial Chair

ACM Multimedia: 2000

IEEE International Conference on Network Protocols (ICNP): 1999

Panel/Session Organizer

NSF ANIR PI 2003 Panel on "Core Networking Issues and Protocols for the Internet"

CCW 2001 Session on "Multicast/Peer-to-Peer Networking"

NOSSDAV 2001 Panel on "Multimedia After a Decade of Research"

NGC 2000 Panel on "Multicast Pricing"

Technical Program Committee

IEEE International Conference on Network Protocols (ICNP): 1999, 2000, 2001, 2003, 2004, 2005, 2006, 2007, 2008, 2009 (Area Chair), 2010 (Area Chair), 2011 (Area Chair), 2012 (Area Chair), 2013, 2014 (Area Chair), 2015 (Area Chair), 2016 (Area Chair), 2017 (Area Chair), 2018 (Area Chair), 2019 (Area Chair), 2020 (Area Chair), 2021 (Area Chair)

International Workshop on Network and Operating System Support for Digital Audio and Video (NOSSDAV): 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019

ACM Multimedia (MM): 2001, 2003, 2004, 2005 (short paper), 2006, 2007, 2008, 2008 (short paper), 2010, 2011, 2012, 2013, 2015, 2016, 2017, 2018, 2019, 2023, 2024

IEEE Conference on Sensor and Ad Hoc Communications and Networks (SECON): 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011 (Area Chair), 2012 (Area Chair), 2013, 2014 (Area Chair), 2015, 2016 (Area Chair), 2017, 2018, 2019

IEEE/IFIP Network Operations and Management Symposium (NOMS): 2004, 2006, 2010

IEEE Infocom: 2004, 2005, 2006, 2008, 2009, 2010 (Area Chair), 2011 (Area Chair), 2012 (Area Chair)

IFIP Networking: 2004, 2005, 2006, 2007, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2022

IEEE International Conference on Communications (ICC) Next Generation Networking and Internet Symposium (NGNI): 2018, 2019

ACM Workshop on Mobile Video (MoVid): 2014, 2015, 2016, 2017

ACM Student Research Competition (SRC) Grand Finals: 2014

Mobile and Social Computing for Collaborative Interactions (MSC): 2014

IEEE Conference on Communications and Network Security (CNS): 2013

IEEE International Symposium on a World of Wireless, Mobile and Multimedia Networks (WoWMoM): 2005, 2006, 2007, 2008, 2009, 2010

ACM Sigcomm Workshop on Challenged Networks (CHANTS): 2006, 2008, 2009, 2010, 2011, 2012, 2016, 2017, 2018, 2019

IEEE International Conference on Distributed Computing Systems (ICDCS): 2006, 2010, 2011, 2012, 2013

International Workshop on Wireless Network Measurements (WiNMee): 2006, 2008, 2010

ACM Sigcomm: 2004 (poster), 2008 (poster), 2010

IEEE International Conference on Computer Communication and Networks (IC3N): 2008, 2009, 2010, 2011, 2012

International Conference on Communication Systems and Networks (COMSNETS): 2009, 2010, 2011, 2012, 2013

International Conference on Sensor Networks (SENSORNETS): 2012

International Workshop on Social and Mobile Computing for Collaborative Environments (SOMOCO): 2012
 Workshop on Scenarios for Network Evaluation Studies (SCENES): 2009, 2010, 2011
 ACM Multimedia Systems (MMSys): 2010, 2011, 2012, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022
 IEEE International Symposium on Multimedia (ISM): 2016
 IEEE International Conference on Pervasive Computing and Communications (PerCom): 2010
 IEEE Wireless Communications and Networking Conference (WCNC): 2010, 2011
 ACM International Symposium on Mobility Management and Wireless Access (MobiWac): 2010, 2011
 International Conference on Computing, Networking and Communications, Internet Services and Applications Symposium (ICNC-ISA): 2012, 2013
 IEEE WoWMoM Workshop on Hot Topics in Mesh Networking (HotMesh): 2010, 2011, 2012, 2013
 IEEE Workshop on Pervasive Group Communication (PerGroup): 2010
 ACM International Conference on Next Generation Communication (CoNEXT): 2005, 2006, 2007, 2009, 2012
 IEEE International Conference on Broadband Communications, Networks, and Systems (BroadNets) Wireless Communications, Networks and Systems Symposium: 2007, 2008, 2009
 IEEE International Conference on Broadband Communications, Networks, and Systems (BroadNets) Internet Technologies Symposium: 2007, 2008, 2009
 International Workshop on Mobile and Networking Technologies for Social Applications (MONET): 2008, 2009
 Extreme Workshop on Communication-The Midnight Sun Expedition (ExtremeCom): 2009
 IEEE International Workshop on Cooperation in Pervasive Environments (CoPE): 2009
 International Workshop on the Network of the Future (FutureNet): 2009, 2010, 2011, 2012
 IEEE International Conference on Multimedia and Exposition (ICME): 2010
 SPIE Conference on Multimedia Computing and Networking (MMCN): 2004, 2008
 ACM Sigcomm Workshop on the Economics of Networks, Systems, and Computation (NetEcon): 2008
 IEEE International Conference on Communications (ICC): 2008
 IEEE International Conference on Mobile Ad-hoc and Sensor Systems (MASS): 2008
 IFIP/IEEE International Symposium on Integrated Network Management (IM): 2005, 2007
 Global Internet (GI) Symposium: 2001, 2002, 2004, 2006, 2007, 2022, 2023
 IEEE/ACM International Conference on High Performance Computing (HiPC): 2007
 ACM International Symposium on Mobile Ad Hoc Networking and Computing (MobiHoc): 2007
 IEEE Workshop on Embedded Systems for Real-Time Multimedia (ESTIMedia): 2007
 IEEE/IFIP Wireless On Demand Network Systems and Services (WONS): 2007
 IFIP/IEEE International Conference on Management of Multimedia Networks and Services (MMNS): 2001, 2002, 2003, 2004, 2005, 2006
 IASTED International Conference on European Internet and Multimedia Systems and Applications (EuroIMSA): 2004, 2006
 IEEE International Conference on Parallel and Distributed Systems (ICPADS): 2005, 2006
 IEEE Globecom Internet Services and Enabling Technologies (IS&ET) Symposium: 2006
 International Workshop on Incentive-Based Computing (IBC): 2006
 IEEE International Workshop on Quality of Service (IWQoS): 2006, 2014, 2015

International Workshop on Multi-hop Ad Hoc Networks (REALMAN): 2006
 IEEE Globecom Automatic Internet Symposium: 2005
 ACM Sigcomm Workshop on the Economics of Peer-to-Peer Systems (P2PEcon): 2005
 International Conference on Parallel Processing (ICPP): 2001, 2003, 2004
 International Packet Video (PV) Workshop: 2002, 2003, 2004
 IEEE International Symposium on High-Performance Distributed Computing (HPDC): 2004
 International Workshop on Broadband Wireless Multimedia: Algorithms, Architectures and Applications (BroadWIM): 2004
 International Symposium on Innovation in Information & Communication Technology (ISIICT): 2004
 Workshop on Coordinated Quality of Service in Distributed Systems (COQODS): 2004
 IASTED International Conference on Networks and Communication Systems (NCS): 2004
 IASTED International Conference on Communications, Internet, and Information Technology (CIIT): 2004
 IASTED International Conference on Internet and Multimedia Systems and Applications (IMSA): 2003, 2004
 International Workshop on Networked Group Communication (NGC): 1999, 2000, 2001, 2002, 2003
 International Association for Development of the Information Society (IADIS)
 International Conference on the WWW/Internet: 2003
 International Conference on Computer and Information Science (ICIS): 2003
 Human.Society@Internet: 2003
 IASTED International Conference on Communications and Computer Networks (CCN): 2002
 The Content Delivery Networks (CDN) Event: 2001
 IP Multicast Initiative Summit: 1998, 1999, 2000
 Corporation for Education Network Initiatives in California (CENIC): 1999
 Internet Bandwidth Management Summit (iBAND): 1998, 1999

B. Technical Activities

1. Working Groups

Internet2 Working Group on Multicast, Chair: 1998-2005
 IEEE Communications Society Internet Technical Committee (ITC), Conference Coordinator: 2000-2004
 IETF Multicast Directorate (MADDOGS), Member: 1999-2001
 IASTED Technical Committee on the Web, Internet and Multimedia, Member: 2002-2005
 Internet Engineering Task Force (IETF), various working groups: 1995-present

2. Meeting Support Work

Internet Engineering Task Force MBone broadcasts: 1995-2005
 Conference MBone broadcasts: Sigcomm '99, and '00
 Interop+Networld Network Operations Center (NOC) Team Member: 1995-1997

C. University of California Committees

1. Department of Computer Science Committees

Public Relations: 2005-2006 (chair 2005-2006), 2009-2011 (chair 2009-2011)
Strategic Planning: 2000-2002, 2003-2006, 2009-2011
Undergraduate Advising and Affairs: 2006-2007, 2014-2015
Vice Chair: 2000-2005
Graduate Admissions: 2000-2005 (chair 2000-2005), 2011-2012
Graduate Affairs: 2000-2005 (co-chair 2000-2005)
Teaching Administration: 2000-2005
Facilities: 1997-2001 (chair 1999-2000), 2006-2007
External Relations: 1999-2002
Computer Engineering Public Relations: 2011-2012
Computer Engineering Awards: 2011-2012
Computer Engineering Administration/Recruiting: 1998-2001
Computer Engineering Lab and Computer Support: 1998-2001
Faculty Recruiting: 1999-2002
Graduate Advising: 1998-1999, 2000-2005

2. University Committees

Member, Campus Budget and Planning: 2013-2015
Faculty, Cognitive Science Program: 2006-2020
Faculty, Technology Management Program (TMP): 2003-2014
Faculty, Media Arts and Technology (MAT) Program: 1998-2014
Faculty, Computer Engineering Degree Program: 1998-2020
Steering Committee, Center for Information Technology and Society (CITS): 2012-2020
Associate Director, Center for Information Technology and Society (CITS): 1999-2012
Member, Campus Committee on Committees: 2010-2013
Member, Campus Income and Recharge Committee: 2010-2013
Member, College of Engineering Executive Committee: 2010-2012 (chair 2011-2012), 2014-2015 (chair 2014-2015)
Member, Distinguished Teaching Award Committee: 2009, 2010, 2011
Member, Campus Classroom Design and Renovation Committee: 2003-2010
Member, ISBER Advisory Committee: 2008-2011
Member, Fulbright Campus Review Committee: 2007
Member, Faculty Outreach Grant Program Review Committee: 2007
Executive Vice Chancellor's Information Technology Fee Committee: 2005-2006
Council on Research and Instructional Resources: 2003-2006
Executive Vice Chancellor's Working Group on Graduate Diversity: 2004-2005
Member, Engineering Pavillion Planning Committee: 2003-2005
Information Technology Board: 2001-2004
Executive Committee, Center for Entrepreneurship & Engineering Management (CEEM): 2001-2004

3. System Wide Committees

UCSB Representative to the Committee on Information Technology and Telecommunications
Policy (ITTP): 2003-2005

UCSB Representative to the Executive Committee, Digital Media Innovation (DiMI): 1998-2003

D. Georgia Tech Committees and Service (while a graduate student)

Graduate Student Body President: 1994-1995

Georgia Tech Executive Board: 1994-1995

Georgia Tech Alumni Association Executive Committee: 1994-1995

Dean of Students National Search Committee: 1995

Institute Strategic Planning Committee: 1994-1996

Cases in last 4 years I have been deposed or testified at hearing/trial:

- Trial testimony in Two Way Media LTD v. Telefonica (517/2017-X, Barcelona, Spain). 12/2015-05/2022.
- A deposition and claim construction hearing testimony in Peloton Interactive, Inc. v. Icon Health and Fitness, Inc. (1:20-cv-00662-RGA, D. Del.). 10/2020-05/2022.
- Depositions in Icon Health and Fitness, Inc. v. Peloton Interactive, Inc. (20-1386-RGA, D. Del.). 10/2020-05/2022.
- A deposition and hearing testimony in UMG Recordings, Inc., et al. v. Bright House Networks, LLC (8:19-cv-00710-MSS-TGW, M. D. Fla.). 11/2019-05/2022.
- A deposition in Inter Partes Review of U.S. Patent Nos. 9,860,198 (IPR2021-00882) and 10,728,192 (IPR2021-00883) [Meta Platforms, Inc. v. Wrinkl, Inc.]. 12/2021-06/2022.
- Depositions in TQ Delta, LLC v. AdTran, Inc. (14-cv-954-RGA, 15-cv-121-RGA, D. Del). 03/2017-06/2022.
- Depositions in Inter Partes Review of U.S. Patent Nos. 8,166,081 (IPR2021-01267), 8,688,028 (IPR2021-01303), 8,903,307 (IPR2021-01305), and 8,200,203 (IPR2021-01371) [Hyundai Motor America v. StratosAudio, Inc.]. 06/2021-08/2022.
- A deposition and trial testimony in Shopify, Inc. v. Express Mobile, Inc. (1:19-cv-00439-RGA, D. Del.). 05/2020-08/2022.
- A deposition in FirstFace Co, LTD v. Apple, Inc (3:18-cv-02245-JD, N. D. Cal.). 05/2022-11/2022.
- Depositions in Inter Partes Review of U.S. Patent Nos. 9,291,475 (IPR2022-00708 and IPR2023-00031); 9,602,608 (IPR2022-00709); 7,484,008 (IPR2022-00857); and 6,832,283 (IPR2022-0970) [Toyota Motor Corp. and American Honda Motor Co, Inc. v. Intellectual Ventures II LLC]. 01/2022-02/2023.
- A deposition in Inter Partes Review of U.S. Patent No. 9,182,231 (IPR2022-00586) [Qualcomm Inc. v. FedEx Corporate Services, Inc.]. 09/2021-04/2023.
- A deposition in WebRoot, Inc. and Open Text, Inc. v. Trend Micro, Inc. (22-cv-00239-ADA-DTG, W. D. Tex.). 06/2022-04/2023.
- Depositions and trial testimony in Sonos, Inc. v. Google, LLC (6:20-cv-881-ADA, W. D. Tex.; 3:20-cv-06754-WHA, N. D. Cal.; and 3:21-cv-07559-WHA, N. D. Cal.). 11/2019-05/2023.
- A deposition in Inter Partes Review of U.S. Patent No. 8,072,968 (IPR2022-00890) [IBM Corp. v. Ebates Performance Marketing, Inc.]. 06/2022-05/2023.
- Depositions and trial testimony in Personal Audio, LLC v. Google, Inc. (1:17-cv-01751-VAC-CJB, D. Del). 03/2018-06/2023.
- A deposition and trial testimony in Centripetal Networks, Inc. v. Cisco Systems, Inc. (2:18-cv-00094, E. D. Va.). 01/2019-06/2023.
- A deposition in Orckit Corp v. Cisco Systems, Inc. (2:22-cv-276, E. D. Tex.). 05/2023-06/2023.

- A deposition and trial testimony in Touchstream Technologies, Inc. v. Google, LLC (6:21-cv-00569-ADA, W. D. Tex.). 08/2022-07/2023.
- A deposition in Inter Partes Review of U.S. Patent No. 8,784,113 (IPR2022-01439) [Go1 Pty, Ltd. v. OpenSesame, Inc.]. 01/2022-09/2023.
- A deposition and trial testimony in SB IP Holdings, LLC v. Vivint Smart Home, Inc. (4:20-cv-00886-ALM, E. D. Tex.). 12/2021-10/2023.
- Depositions and trial testimony in Alacritech, Inc. v. Centurylink Communications LLC; Winstrom Corporation, Dell, Inc. (2:16-cv-693-RWS, 2:16-cv-692-RWS, 2:16-cv-695-RWS, E. D. Tex.). 04/2016-10/2023.
- A deposition in Inter Partes Review of U.S. Patent Nos. 9,503,498 (IPR2023-00185); 9,516,091 (IPR2023-00186); and 8,924,457 (IPR2023-00187) [Bright Data LTD v. Oxylabs, UAB]. 06/2020-11/2023.
- Trial testimony in GoodRx, Inc. v. Famulus Health LLC (AAA Ref. No. 01-23-000-5919). 06/2023-11/2023.
- A deposition in Entropic Communications LLC v. Charter Communications, Inc. (2:22-cv-00125-JRG, E. D. Tex.). 03/2023-12/2023.
- Depositions in Post-Grant Review of U.S. Patent No. 10,782,951 (PGR2021-00096) and 11,157,256 (PGR2022-00053) [IronSource Ltd. v. Digital Turbine, Inc.]. 05/2021-12/2023.
- Trial testimony in Certain Wi-Fi Routers, Wi-Fi Devices, Mesh Wi-Fi Network Devices, and Hardware and Software Components Thereof (US ITC Inv. No. 337-TA-1361) [Netgear v. TP-Link]. 05/2023-01/2024.
- A deposition in Antonio McKinney et al. v. Corsair Gaming, Inc. (3:22-cv-00312-CRB, N. D. Cal.). 07/2023-01/2024.
- A deposition in Certain Fitness Devices, Streaming Components Thereof, and Systems Containing Same (US ITC Inv. No. 337-TA-1265E) [iFit Inc., FreeMotion Fitness, Inc. and NordicTrack, Inc. v. DISH DBS Corporation, DISH Technologies LLC, and Sling TV LLC]. 10/2023-02/2024.
- A deposition in Marble VOIP Partners LLC v. Zoom Video Communications, Inc. 4:23-cv-03619-JSW, N. D. Cal.). 12/2023-04/2024.
- Depositions in IBM Corp. v. Rakuten, Inc. and Ebates Performance Marketing, Inc. (21-461-VAC, D. Del.). 06/2022-06/2024.
- A deposition and trial testimony in Omnitracs, LLC v. Platform Science, Inc. (3:20-cv-0958-CAB-DDL, S. D. Cal.). 05/2023-07/2024.
- A deposition in NetSocket, Inc. v. Cisco Systems, Inc. (2:22-cv-00172-JRG, E. D. Tex.). 09/2022-08/2024.
- Depositions in Partes Review of U.S. Patent Nos. 7,230,931 (IPR2023-00098) and 9,426,794 (IPR2023-01147) [Verizon Wireless v. General Access Solutions, Ltd.]. 03/2023-08/2024.
- A deposition and trial testimony in International Business Machines Corp v. Zynga, Inc. (22-590-GBW, D. Del.). 08/2023-09/2024.

- A deposition in Lionra Technologies Limited v. Fortinet, Inc. (2:22-cv-00322-JRG-RSP, E. D. Tex.). 02/2023-09/2024.
- Depositions in STA Group LLC v. Motorola Solutions, Inc. (2:23-cv-00030-JRG-RSP, E. D. Tex.). 04/2024-01/2025.
- A deposition and trial testimony in WSOU Investments, LLC v. Cisco Systems, Inc. (6:20-cv-00128-ADA, W. D. Tex.). 03/2021-02/2025.
- A deposition and trial testimony in Touchstream Technologies, Inc. v. Comcast Cable Communications, LLC (2:23-cv-00062-JRG, E. D. Tex.). 01/2024-03/2025.
- A deposition and trial testimony in VidStream, LLC v. X, formerly Twitter, Inc. (3:16-cv-0764-N, N. D. Tex.). 07/2016-04/2025.
- Depositions in Western Digital Technologies, Inc. v. Viasat, Inc. (4:22-cv-4376-HSG, N. D. Cal.). 08/2022-05/2025.
- Depositions in Video Solutions PTE. LTD. v. Cisco Systems, Inc. (2:23-cv-222-JRG, E. D. Tex.). 08/2023-05/2025.
- Trial testimony in Adeia Guides, Inc. v. Bell Canada, Inc. (T-1184-21, Canada Federal Court). 01/2022-05/2025.
- A deposition in Certain Smart Televisions (ITC Inv. No. 337-TA-1420). [Maxell, Ltd. v. TCL Multimedia Technology Holdings, Ltd.]. 12/2024-06/2025.
- Trial testimony in The Nielsen Company (US), LLC v. Hyphametrics, Inc. (23-126-GBW-CJB, D. Del.). 10/2023-07/2025.
- A deposition in Plus One, LCC v. Capital Relocation Services, LLC (23-cv-2016-KMM-JFD, D. Minn.). 06/2024-07/2025.
- A deposition in Inter Partes Review of U.S. Patent No. 7,924,802 (IPR2024-01336) [Qualcomm, Inc. v. Cobblestone Wireless LLC]. 08/2024-09/2025.
- A deposition in Beijing Meishe Network Technology Co. LTD. v. TikTok, Inc. (5:23-cv-6012-SI, N. D. Cal.). 05/2023-08/2025.
- Trial testimony in Contour IP Holding, LLC v. GoPro, Inc. (17-cv-04738-WHO, N. D. Cal.). 10/2019-10/2025.
- Depositions in Inter Partes Review of U.S. Patent Nos. 8,875,185 (IPR2024-01338), 9,317,597 (IPR2024-01339), 8,145,704 (IPR2024-01340), 9,215,261 (IPR2024-01341), 8,886,753 (IPR2024-01342), and 9,923,947 (IPR2024-01343) [TikTok, Inc. v. NTECH Properties, Inc.]. 04/2024-10/2025.
- A deposition and trial testimony in Express Mobile, Inc. v. GoDaddy.com, LLC (1:19-cv-01937-RGA, D. Del.). 05/2020-11/2025.
- A deposition in Inter Partes Review of U.S. Patent No. 11,973,731 (IPR2024-01489 and IPR2024-01490) [Slack Technologies, LLC and Salesforce, Inc. v. Wrinkl, Inc.]. 01/2025-11/2025.
- A deposition and trial testimony in BARCO, Inc. v. YeaLink Network Technology Co., LTD (2:23-cv-00521-JRG-RSP, E. D. Tex.). 06/2024-11/2025.

- A deposition and trial testimony in SmartSky Networks, LLC v. Gogo Business Aviation, LLC (22-266-VAC, D. Del.). 12/2023-11/2025.
- Trial testimony in MyChoice, LLC and BarBoards, LLC v Taiv, Inc. (2:23-cv-00507-JRG-RSP, E. D. Tex.). 04/2025-12/2025.
- A deposition in Certain Wi-Fi Routers, Wi-Fi Devices, Mesh Wi-Fi Network Devices and Components Thereof (US ITC Inv. No. 337-TA-1454) [Estelgia, LLC v. Plume Design Inc.]. 07/2025-03/2026.
- A deposition in Motorola Solutions, Inc. v. Hytera Communications Corp. LTD (1:17-cv-01972, N. D. Ill.). 04/2017-present.
- Depositions and trial testimony in Luminati Networks Ltd. v. UAB Tesonet and UAB Metacluster LT (2:18-cv-00299-JRG, E. D. Tex.); Luminati Networks Ltd. v. Teso LT, UAB; Oxysales, UAB; and Metacluster LT, UAB, (2:19-cv-00395-JRG, E. D. Tex.); Luminati Networks Ltd. v. Code 200, UAB; Oxysales, UAB; and Metacluster LT, UAB (2:19-cv-00396-JRG, E. D. Tex.); Bright Data Networks Ltd. v. Tefincom S.A. (2:19-cv-00414-JRG, E. D. Tex.); Metacluster LT, UAB v. Bright Data Ltd. (2:23-cv-00011-JRG-RSP, E. D. Tex.); Bright Data Ltd. v. Oxylabs, UAB (2:23-cv-00171-JRG-RSP, E. D. Tex.). 06/2020-present.
- A deposition in Zilkr Cloud Technologies, LLC v. Cisco Systems, Inc. (2:22-cv-00166-JRG-RSP, E. D. Tex.). 02/2023-present.
- A deposition in STA Group, LLC v. Motorola Solutions, Inc. (2:22-cv-00381-JRG-RSP, E. D. Tex.). 05/2023-present.
- A deposition in NEC Corporation v. Peloton Interactive, Inc. (1-22-cv-00987-CJB, D. Del.). 08/2023-present.
- A deposition in Robocast, Inc. v. Netflix, Inc. (1:22-cv-00305-RGA, D. Del.). 07/2022-present.
- Depositions in Time Warner Cable Enterprises, LLC v. Nokia of America Corp. (650748/2022, IAS Part 43, N. Y. and 654900/2022, IAS Part 43, N. Y.). 01/2024-present.
- A deposition in Charter Communications, LLC v. Sonus Networks, Inc. and Ribbon Communications Operating Company, Inc. (N22C-09-529-EMD-CCLD, DE and 653435/2022, Part 49, N. Y.). 01/2024-present.
- A deposition in Stellar LLC v. Motorola Solutions, Inc. and Watchguard Video, Inc. (4:23-cv-750-SDJ, E. D. Tex.). 01/2024-present.
- A deposition in Inter Partes Review of U.S. Patent Nos. 10,407,026 (IPR2024-00785), 9,171,268 (IPR2024-00786), 11,396,244 (IPR2024-00814), 9,365,188 (IPR2024-00981), 11,738,659 (IPR2024-001167), 11,104,245 (IPR2026-00059), 12,337,716 (IPR2026-00070), and 12,337,715 (PGR2026-00008) [Toyota Motor Corp and Kia Corp v. Emerging Automotive LLC]. 11/2023-present.
- A deposition in Warner Records, Inc. et al. v. Altice USA, Inc. (2:23-cv-00576-JRG-RSP, E. D. Tex.). 09/2024-present.
- A deposition in Cal Bridge, Inc. v. OneCal (1:24-cv-22361, S. D. Fla.). 03/2025-present.

- Depositions in Inter Partes Review of U.S. Patent Nos. 10,762,002 (IPR2024-01436), 11,403,237 (IPR2024-01437), 11,258,676 (IPR2024-01438), 11,422,951 (IPR2024-01439), 10,684,972 (IPR2025-00491), 11,966,346 (IPR2025-00597) and 11,966,347 (IPR2025-00598) [YeaLink Network Technology Co., LTD v. BARCO N. V.]. 06/2024-present.
- A deposition in Audio Pod IP, LLC v Amazon.com, Inc. (3:24-cv-00406-RCY, E. D. Va.). 05/2025-present.
- A deposition in Voxtur Analytics Corp v AutomationRE, Inc. (1:25-cv-742-GBW, D. Del.). 07/2025-present.
- A deposition in Sonos, Inc. v. Google, LLC (2:20-cv-00169-JAK, C. D. Cal.). 03/2025-present.
- A deposition in SoftEx, LLC v Absolute Software Corp (1:22-cv-1308-DAE, W. D. Tex.). 10/2022-present.
- A deposition in Adaptive Spectrum and Signal Alignment, Inc. v. Charter Communications, Inc. et al. (2:24-cv-00124-JRG-RSP, E. D. Tex.). 04/2024-present.
- A deposition in AutoConnect Holdings, LLC v. Toyota Motor Corp and General Motors, LLC (2:24-cv-00802-JRG-RSP and 2:24-cv-00877-JRG-RSP, E. D. Tex.). 04/2025-present.