

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

CISCO SYSTEMS, INC.,
Petitioner,

v.

VIDEO SOLUTIONS PTE. LTD.,
Patent Owner.

U.S. Patent No. 8,446,823
Issue Date: May 21, 2013

Title: METHOD OF MANAGING THE FLOW OF TIME-SENSITIVE DATA OVER
PACKET NETWORKS

Inter Partes Review No.: IPR2024-00922

**PETITION FOR *INTER PARTES* REVIEW OF PATENT NO. 8,446,823
UNDER 35 U.S.C. §§ 311-319 AND 37 C.F.R. §§ 42.1-.80, 42.100-.107**

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TABLE OF CONTENTS

	Page
I. INTRODUCTION.....	1
II. OVERVIEW.....	1
III. GROUNDS FOR STANDING (37 C.F.R. §42.104(a)).....	6
IV. RELIEF REQUESTED (37 C.F.R. §42.22(a))	6
V. REASONS FOR THE RELIEF REQUESTED	7
A. Summary of the '823 Patent.....	7
B. Summary of the Prosecution History	14
C. Summary of the Challenged Claims	16
D. Claim Construction	17
E. Priority Date of the Challenged Claims	18
F. Person of Ordinary Skill in the Art	18
G. State of the Art	18
1. Known Simultaneous Traffic Peaks in Multiple Compressed Video Streams Problem and Known Avoiding Coincidence Solution	22
2. Well-Known Delay Sensitivity Problem of Videoconferencing and Well-Known Dynamic RTD Determination Solution.....	25
3. Well-Known Heterogeneous Packet Network Connection Problem and Known Avoiding Increases in the Maximum Determined Delay Solution.....	27
VI. Identification of Challenges	33
A. Challenged Claims	33

B.	Statutory Grounds for Challenges.....	33
VII.	IDENTIFICATION OF HOW THE CLAIMS ARE UNPATENTABLE.....	34
A.	Ground 1: Claims 1-8 are obvious under 35 U.S.C. §103(a) over Larson in view of Cai and the Knowledge of a POSITA.....	34
1.	Larson	34
2.	Cai	39
3.	Motivation to Combine the Teachings of Larson with the Teachings of Cai.....	41
4.	Detailed Application of Larson, Cai and Knowledge of a POSITA to the Challenged Claims	45
a.	Claim 1	45
i.	[1.0.1] A method of managing multiple data streams transported through a common communications resource in a packet network, [1.0.2] wherein data flowing through said resource travels in both directions, and [1.0.3] wherein each stream is subject to data peaks, comprising:.....	45
ii.	[1.1] establishing logical two-way connections through the common communications resource between one or more near endpoints and one or more far endpoints,...	47
iii.	[1.2] determining an undelayed round trip delay for each said logical two-way connection, ...	49
iv.	[1.3] determining the maximum round trip delay among all said logical two-way connections, ...	52
v.	[1.4] preparing each of said data streams for transmission over respective said logical connections from a said near endpoint to a said far endpoint,.....	56
vi.	[1.5] determining the location of said data peaks in said	

	data streams,.....	56
vii.	[1.6] transmitting said data streams over said respective logical two-way connections to said one or more far endpoints, and	58
viii.	[1.7] delaying the transmission of one or more of said data streams that are transmitted over a said logical two-way connection having an undelayed round trip delay less than the maximum round trip delay by an amount dependent on the location of said peaks to reduce the degree of coincidence in the data peaks of different streams without increasing the maximum round trip delay for the logical two-way connections. 59	
b.	Claim 2.....	62
i.	A method as claimed in claim 1, wherein the transmission of said data streams is delayed so as to remove any coincidence in said data peaks of different data streams.....	62
c.	Claim 3.....	62
i.	A method as claimed in claim 1, wherein the delays introduced into the different data streams are ranked in accordance with the determined round trip delays for each logical two-way connection.....	62
d.	Claim 4.....	63
i.	A method as claimed in claim 3, wherein the amount of delay that can be introduced into a data stream is capped at a predetermined value.....	63
e.	Claim 5.....	64
i.	A method as claimed in claim 3, wherein the round trip delays are monitored over a period of time, and the rank order is changed as necessary to take into account	

	changing round trip delays.....	64
f.	Claim 6	64
i.	A method as claimed in claim 3, wherein the delays are introduced so as to evenly distribute the data peaks in different streams.....	64
g.	Claim 7.....	64
i.	A method as claimed in claim 1, wherein the logical connections are established between a common source endpoint and multiple destination endpoints.	64
h.	Claim 8.....	65
i.	A method as claimed in claim 1, wherein said data streams represent video streams and said data peaks correspond to I-frames.	65
VIII.	DISCRETIONARY DENIAL WOULD BE INAPPROPRIATE.....	65
A.	Discretionary denial under the <i>Fintiv</i> factors is not appropriate.	65
B.	Discretionary denial under 35 U.S.C. §325(d) is not appropriate.	68
IX.	MANDATORY NOTICES UNDER 37 C.F.R. § 42.8.....	69
A.	Real Party-in-Interest (37 C.F.R. § 42.8(b)(1))	69
B.	Related Matters (37 C.F.R. § 42.8(b)(2)).....	69
1.	Judicial Matters.....	69
2.	Administrative Matters	69
3.	Related Patents.....	69
C.	Lead/Back-up Counsel (37 C.F.R. § 42.8(b)(3)):.....	69
D.	Notice of Service Information (37 C.F.R. § 42.8(b)(4)):.....	70

X.	CONCLUSION	70
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PETITIONER’S EXHIBIT LIST

EX-1001	U.S. Patent No. 8,446,823 to Hosseini et al. (“’823 Patent”), Filing Date of June 23, 2009
EX-1002	Prosecution History of U.S. Patent No. 8,446,823.
EX-1003	Declaration of Dr. Immanuel Freedman under 37 C.F.R. § 1.68.
EX-1004	<i>Curriculum Vitae</i> of Dr. Freedman.
EX-1005	U.S. Patent Publication Serial No. 2009/0141800 to Larson (“Larson”), Patent Application Filing Date of September 3, 2008 and Publication Date of June 4, 2009
EX-1006	Colin Perkins, “RTP: Audio and Video for the Internet”, Addison-Wesley, 2003 (“Perkins”).
EX-1007	Michael Welzl, “Network Congestion Control: Managing Internet Traffic”, John Wiley & Sons Ltd., August 2005 (“Welzl”).
EX-1008	N. G. Duffield, et al, “On Adaptive Bandwidth Sharing with Rate Guarantees,” Proceedings IEEE INFOCOM ‘98, the Conference on Computer Communications, Seventeenth Annual Joint Conference of the IEEE Computer and Communications Societies, Gateway to the 21 st Century (Cat. No.98, San Francisco, CA, USA, 1998, pp. 1122-1130, vol.3) (“Duffield”).
EX-1009	Z. Cai et al., “IQ-Services: Network-Aware Middleware for Interactive Large-Data Applications”, 2004, Proceedings of the 2 nd Workshop on Middleware for Grid Computing (MGC '04), Association for Computing Machinery, New York, NY, USA, pp. 11–16 (“Cai”).
EX-1010	U.S. Patent No. 8,446,452 to Hosseini et al. (“’452 Patent”), Filing Date of November 7, 2008.
EX-1011	H. Schulzrinne, et al., “RTP: A Transport Protocol for Real-Time Applications,” <i>IETF RFC 3550</i> , July 2003, archived at Internet Archive Wayback Machine on August 18, 2003 at https://web.archive.org/web/20030818200653/http://www.ietf.org/rfc/rfc3550.txt .

EX-1012	M. Handley, et al., “TCP Friendly Rate Control (TFRC): Protocol Specification,” <i>IETF RFC 3448</i> , January 2003, archived at Internet Archive Wayback Machine on April 25, 2003 at https://web.archive.org/web/20030425051207/http://www.ietf.org/rfc/rfc3448.txt .
EX-1013	Federal Court Trial Statistics – December 31, 2023, accessible at: https://www.uscourts.gov/statistics-reports/federal-court-management-statistics-december-2023 and https://www.uscourts.gov/sites/default/files/fcms_na_distprofile1231.2023_0.pdf .
EX-1014	“Transmission Control Protocol,” <i>IETF RFC 793</i> , J. Postel, ed., September 1981, archived at Internet Archive Wayback Machine on February 2, 2007 at https://web.archive.org/web/20070202201546/https://tools.ietf.org/html/rfc793 .
EX-1015	“User Datagram Protocol,” <i>IETF RFC 768</i> , J. Postel, ed., August 28, 1980, archived at Internet Archive Wayback Machine on January 27, 2007 at https://web.archive.org/web/20070127071930/http://tools.ietf.org/html/rfc768 .
EX-1016	“Internet Protocol,” <i>IETF RFC 791</i> , J. Postel, ed., September 1981, archived at Internet Archive Wayback Machine on February 4, 2007 at https://web.archive.org/web/20070204151303/https://tools.ietf.org/html/rfc791 .
EX-1017	U.S. Patent Publication Serial No. 2008/0320170 to Yamauchi et al. (“Yamauchi”), Patent Application Filing Date of June 24, 2008, Claimed Priority Date of June 25, 2007 and Publication Date of December 25, 2008.
EX-1018	International Patent Publication Serial No. WO 2004/047444 to Cooper et al. (“Cooper”), Patent Publication Filing Date of October 27, 2003, Claimed Priority Date of November 15, 2002, and Publication Date of June 3, 2004.
EX-1019	W. Zhu et al., “JQoS: Design and Implementation of a QoS-based Internet Videoconferencing System Using the Java Media Framework”, Proceedings of the IEEE Canadian Conference on Electrical and Computer Engineering (Ontario, Canada, May 13--16

	2001), July 2001.
EX-1020	H. Song et al., “Dynamic Flow Control Using Packet Loss Rate and Round Trip Time”, Proceedings of the 4 th WSEAS International Conference on Electronics, Control and Signal Processing, 2005.
EX-1021	Uyless Black, “Voice Over IP”, 2000, Prentice Hall PTR (“Black”).
EX-1022	ITU-T Recommendation H.323, “Packet-Based Multimedia Communications Systems”, June 2006 (“H.323”).
EX-1023	U.S. Patent Publication Serial No. 2009/0135906 to Comer et al. (“Comer”), Patent Application Filing Date of July 27, 2006, Claimed Priority Date of July 28, 2005 and Publication Date of May 28, 2009.
EX-1024	Declaration of Dr. Ingrid Hsieh-Yee
EX-1025	Original Complaint - <i>Video Solutions Pte. Ltd. v. Cisco Systems, Inc.</i> , EDTX-2-23-cv-00222 (May 19, 2023).
EX-1026	Amended Complaint - <i>Video Solutions Pte. Ltd. v. Cisco Systems, Inc.</i> , EDTX-2-23-cv-00222 (November 16, 2023).
EX-1027	Third Amended Docket Control Order - <i>Video Solutions Pte. Ltd. v. Cisco Systems, Inc.</i> , EDTX-2-23-cv-00222 (May 3, 2024).
EX-1028	Intentionally Left Blank
EX-1029	United States Copyright Office Catalog Record for Colin Perkins, RTP: Audio and Video for the Internet”, Addison-Wesley, 2003. (EX-1006)
EX-1030	United States Copyright Office Catalog Record for Uyless Black, “Voice Over IP”, 2000, Prentice Hall PTR (EX-1021).
EX-1031	Calendar Events Set for 2/10/2025 to 2/11/2025 – Judge Rodney Gilstrap, retrieved on June 13, 2024 from the Calendar Events Report on the PACER website for the Eastern District of Texas: https://ecf.txed.uscourts.gov/cgi-bin/CalEvents.pl

I. INTRODUCTION

Pursuant to 35 U.S.C. §§311 *et seq.* and 37 C.F.R. §§42.1 *et seq.*, Cisco Systems, Inc. (“Petitioner”) petitions for *inter partes* review of Patent No. 8,446,823 (the “’823 Patent”) (EX-1001). Petitioner submits that claims 1-8 (the “Challenged Claims”) of the ’823 Patent are unpatentable under (pre-AIA) 35 U.S.C. §103(a) in view of the prior art discussed herein. This Petition demonstrates by a preponderance of the evidence that there is a reasonable likelihood that Petitioner will prevail with respect to at least one of the Challenged Claims. Accordingly, Petitioner requests that the Board institute an IPR of the ’823 Patent pursuant to 37 C.F.R. §42.108.

II. OVERVIEW

The ’823 Patent is directed to streaming multiple compressed video streams over a packet network, such as in multi-party videoconferencing systems. In such systems, video data is sent that includes periodic, larger data peaks called “I-frames” 44a (which contain “the entire picture” (annotated red)) among smaller “P-frames” 44b (which “only contain information about the changes relative to a previous frame”):

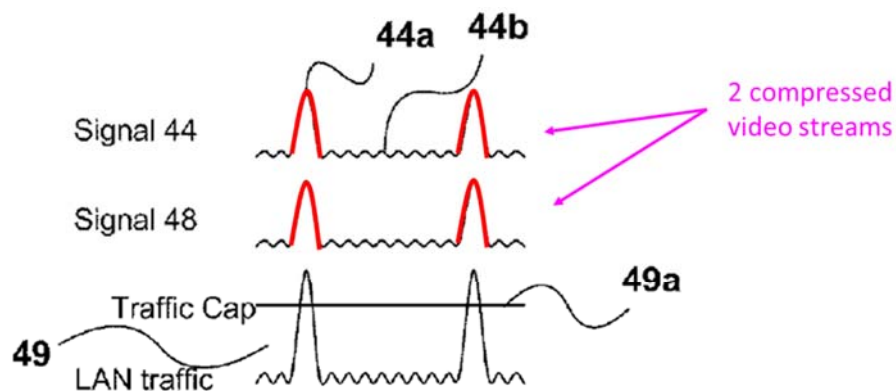


Fig. 3

EX-1001, 1:20-36, 3:7-20.

The '823 Patent is directed to the known problem illustrated in FIG. 3 (above) when streaming multiple compressed video streams (signals 44 and 48) over a packet network: simultaneous traffic peaks (*e.g.*, simultaneous I-frames) 44a may occur that instantaneously exceed the capacity (traffic cap 49a) of a common network resource (*e.g.*, router) in such network resulting in congestion and packet losses. EX-1001, 1:37-45, 3:15-39, 4:49-58; §V.G.1. In other words, the sum of the I-frame peaks of signals 44 and 48 exceed the capacity of the network resource shown as traffic cap 49a. As a solution to this known problem, the '823 Patent proposes intentionally applying a controlled delay (annotated green below) to one or more of the video streams to avoid coincidence in their data peaks as illustrated in FIG 4 (below):

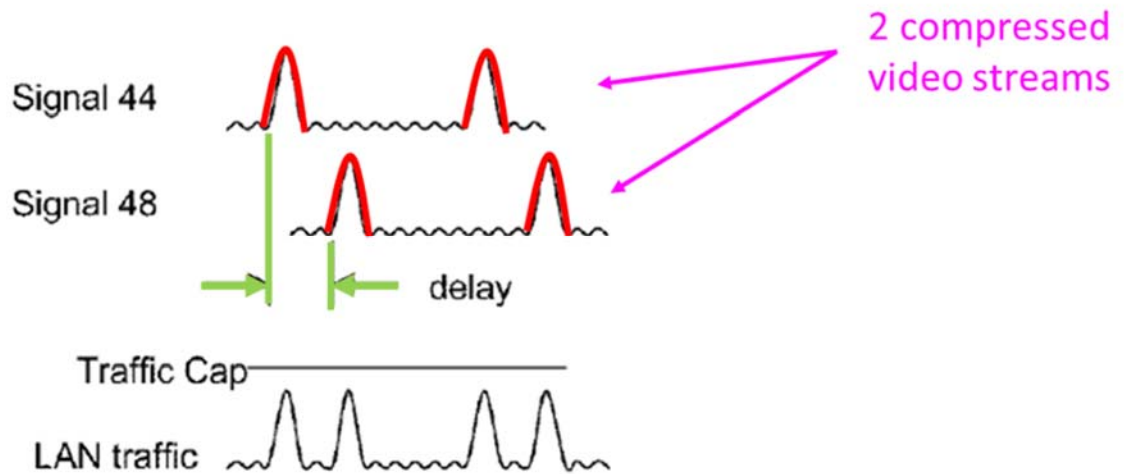


Fig. 4

EX-1001, 5:18-26.

The '823 Patent also describes how to identify which data stream(s) should be intentionally delayed. The '823 Patent explains that “round-trip delay (RTD) is a very important parameter in a videoconference system”, because as “a two-way communication, like a telephone call”, the communications in each end-to-end videoconference connection are delay sensitive as they are seemingly natural “when the RTD is kept under approximately 150ms” and become “increasingly difficult” with RTD between 150 and 600ms. EX-1001, 3:46-4:3, 1:46-52. The '823 Patent proposes that the stream(s) to be intentionally delayed should be chosen without increasing the maximum RTD for the two-way connections. EX-1001, 1:66-2:7, 4:66-5:33, 5:66-6:9, 6:22-24. In other words, for the FIG. 4 example (above), the RTD for the connection of

stream 44 is greater than the RTD for the connection of stream 48 and is therefore the maximum RTD for the two-way connections. *Id.* Accordingly, stream 48 is chosen to be intentionally delayed (green) by an amount to remove the coincidence of the data peaks between streams 44 and 48, without increasing the maximum RTD for the two-way connections (*i.e.*, without increasing the RTD of stream 44). *Id.*

However, this same problem and same solution were well-known in the prior art. For example, Larson (EX-1005) describes the same known problem when streaming multiple compressed video streams over a packet network: simultaneous traffic peaks (*e.g.*, simultaneous I-frames) may occur that instantaneously exceed the capacity of a common network resource (*e.g.*, router, network path) resulting in congestion and packet losses. EX-1005, [0005], [0015], [0019]-[0020], [0069], [0073]; §V.G.1; §VII.A.1.

Larson discloses solving this same problem with the same solution –intentionally applying a controlled delay (green) to one or more stream(s) to avoid coincidence in their data peaks (red) as illustrated in FIG. 1 (below):

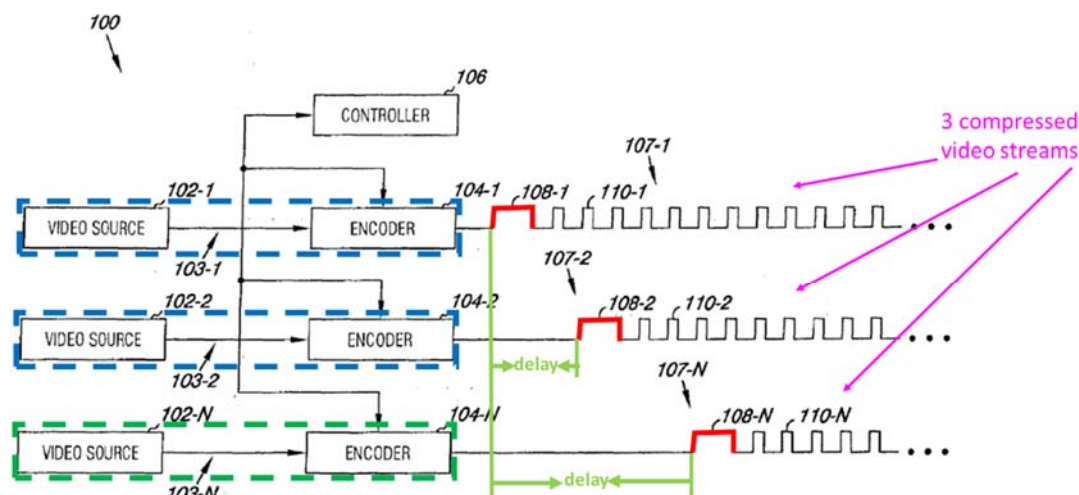


Fig. 1

EX-1005, [0031], [0033].

Larson proposes its solution in the same videoconferencing environment as the '823 Patent, but does not explicitly state how to identify which compressed video stream(s) to intentionally delay.

However, by the priority date of the '823 Patent, it was textbook knowledge that videoconferencing systems were delay sensitive, and that the delay in each videoconferencing connection over a packet network varied over time. *See* §§V.G.2-V.G.3. Accordingly, standardized videoconferencing solutions dynamically determined round-trip times (RTT)¹ of each connection, and it was known that techniques that intentionally applied a controlled delay to the video streams in the connections with less than the longest (maximum) current determined delay would reduce the delay variance

¹ *See* footnote 6 (§V.A).

across the various connections while also homogenizing the different participant experiences (by homogenizing the respective delays), reduce buffering costs, and reduce the playout buffer for the video sources. *Id.* One such prior art reference, Cai (EX-1009), identifies which videoconference connection(s) to intentionally delay based on the RTTs of the connections. Cai describes dynamically determining the RTT of each connection, determining a current maximum RTT among the determined RTTs for the connections, and choosing to intentionally delay transmission of the streams in the connections that have less than the current maximum determined RTT. EX-1009, 14(§4.1); §VII.A.2.

Thus, as shown below and in the Declaration of Dr. Immanuel Freedman (EX-1003), it would have been obvious to POSITAs to use these standardized and known solutions to problems that were well-known to occur in videoconferencing systems (like Larson's, Cai's and the '823 Patent's) to make this video stream selection decision and to achieve these known and predictable benefits.

III. GROUNDS FOR STANDING (37 C.F.R. §42.104(A))

Petitioner certifies that the '823 Patent is eligible for IPR and that Petitioner is not barred or estopped from requesting IPR of the Challenged Claims on the grounds identified herein. 37 C.F.R. §42.104(a). This Petition is filed pursuant to 37 C.F.R. §42.106(a).

IV. RELIEF REQUESTED (37 C.F.R. §42.22(A))

Petitioner respectfully requests institution of an IPR pursuant to 37 C.F.R.

§42.108 and cancellation of the Challenged Claims.

V. REASONS FOR THE RELIEF REQUESTED

As explained in §§II and V-VII of this Petition and in the Declaration of Petitioner’s Expert, Dr. Immanuel Freedman (EX-1003), the methods recited in the Challenged Claims are obvious over the prior art in view of the knowledge, skill and creativity of a POSITA at the time of the invention.²

A. Summary of the ’823 Patent

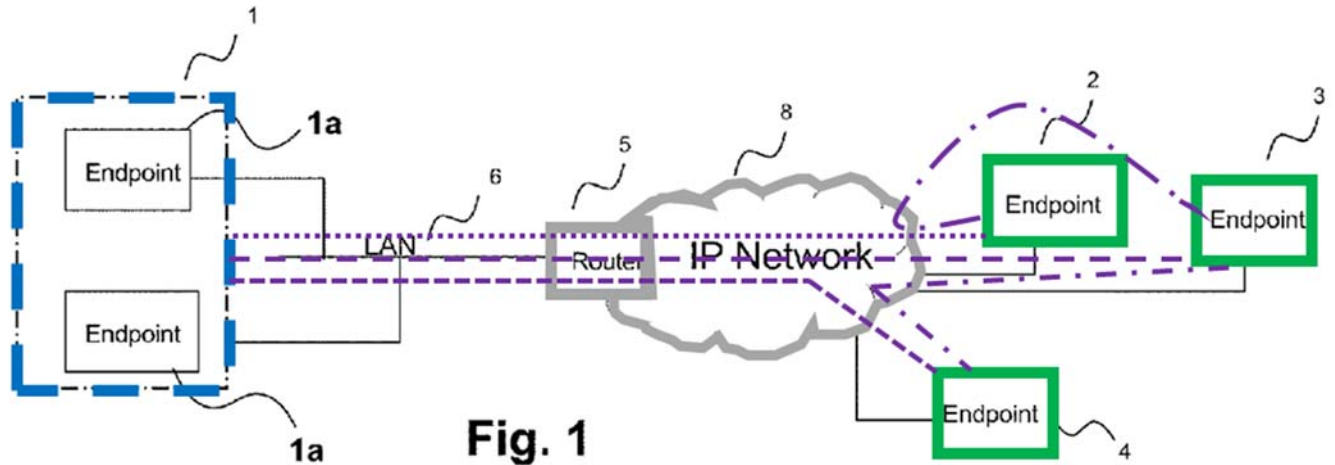
The ’823 Patent relates “to the field of packet networks, and in particular to a method of managing the flow of time-sensitive data, such as voice or audio”, and describes such method as applicable to videoconferencing. EX-1001, 1:7-52.

The ’823 Patent acknowledges that it was “common to establish video conferencing sessions over IP networks” such as “LANs, WANs, or virtual networks established over the Internet.” EX-1001, 1:13-22, 2:61-3:6. The ’823 Patent also acknowledges that, in “typical” videoconferencing sessions, a “virtual connection is established between a pair of video endpoints,” and, in the case of more than two video endpoints, “between each source and each destination endpoint”, which “stream video and audio data to each other over other virtual connections (e.g. using RTP).” *Id.*, FIG. 1 (annotated below to show virtual/logical³

² The Petition cites to the exhibits’ original page numbers. All emphasis in quoted materials and annotations to the figures have been added by Petitioner.

³ The Applicant used “logical connection” and “virtual connection” interchangeably.

connections (purple) between each pair of endpoints (blue (at same location 1) and green (at different locations 2, 3, 4)):



see EX-1001, FIG. 2 (4:4-8 (acknowledging “[w]ith the exception of the DeSync Control block 32 and delay block 52, *the function of the remaining blocks is known in the art*”)), 4:9-20, 4:24-58; EX-1003, ¶¶32-33.

The ’823 Patent further acknowledges that the video data streamed over each of these bi-directional, logical connections (purple) was in compressed form and, in FIG. 3 (below), illustrates a “typical stylized IP Video Signal 44” that includes periodic, larger data peaks called “I-frames” 44a (which contain “the entire picture” (annotated red)) among smaller “P-frames” 44b (which “only contain information about the changes relative to a previous frame”):

EX-1001, 4:42-44, 1:17-22; EX-1002, 25.

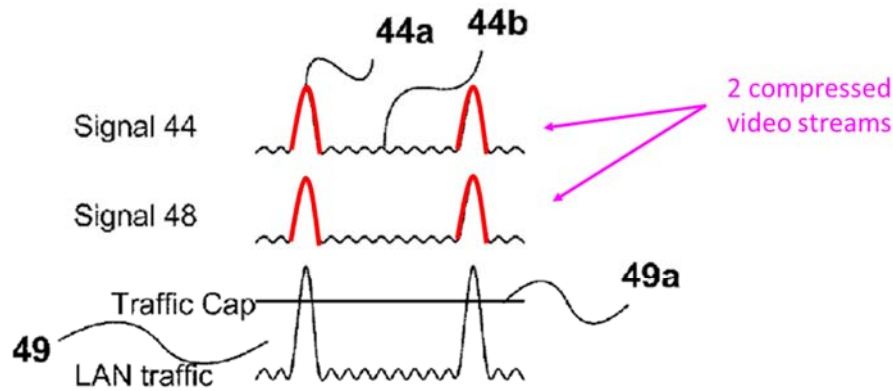


Fig. 3

EX-1001, 1:20-36, 3:7-20.

The '823 Patent explains one problem in multi-party videoconference systems is that simultaneous traffic peaks (I-frames) (44a, 48a) from multiple, substantially similar compressed video streams (44, 48)⁴ may be communicated across the same network and that instantaneously exceed the capacity (*e.g.*, 49a) of a common network resource (*e.g.*,

⁴ The '823 Patent explains “[t]hese [traffic] peaks... will always coincide if the same source streams to multiple destinations”, and that, even if “there is no particular temporal relationship between traffic peaks... coming from different [video] sources”, “[f]rom time to time drifting I-frame peaks will coincide” from these “different sources.” EX-1001, 3:15-39; §§V.G, V.G.1, VII.A.1 (it was known that different video sources may transmit substantially similar video streams with this “temporal relationship between traffic peaks” if, for example, they use a common group of pictures (GOP) size and sequence).

router 5 of LAN 6 (FIG. 1)), resulting in congestion and packet losses. EX-1001, 1:37-45, 3:15-39, 4:49-58. The '823 Patent asserts that the solution to this multi-party videoconference problem was to intentionally delay the transmission of one or more of the substantially similar video streams in order to avoid coincidence in their compressed video data peaks (as illustrated in FIG. 4 (reproduced and annotated below)):

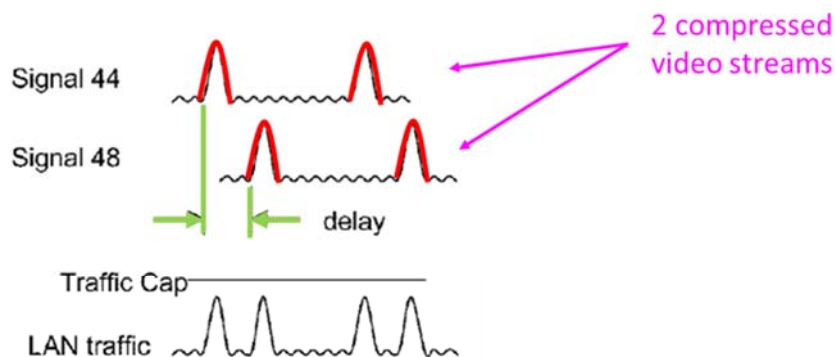


Fig. 4

EX-1001, 5:18-26; EX-1003, ¶¶35-36. The patent distinguishes its solution of “implementing a **controlled** delay” (annotated green above) from prior art solutions that “**indiscriminately** delay[ed] arbitrary packets” to “smooth traffic” and which “further deteriorate[d] the user experience.” *Id.*, EX-1001, 4:1-3, 1:46-48.

The '823 Patent recognizes that, in its solution, which intentionally applies a controlled delay to one or more video streams of a videoconference to avoid coincidence in their traffic peaks (I-frames), it is important for the system to know **when** these simultaneous traffic peaks **will** occur among the streams and, accordingly,

the patent assumes that, at the time **before** it introduces the controlled delay (*i.e.*, before it performs the “**d**esync function”), the video data from the corresponding source(s) of the streams are “synchronized” in the sense that the streams **will** have coincident peaks (I-frames) at a given time. EX-1001, 3:15-25, 4:49-58, 4:66-5:3, 5:12-13, 5:63-65, 6:5-7, FIGS. 3-5. Specifically, the patent discloses that the system: (i) receives, “from each controlled video source”, “the time the last I-frame was transmitted” by the respective source, and where each such time signal is “relative to a common arbitrary real time clock” (EX-1001, 4:63-65, 5:63-65); (ii) assumes “that I values are roughly periodic” in each of the video streams (*Id.*, 6:5-9, FIGS. 3-5); and (iii) assumes that the “signal traffic” from each video source is “similar” (*Id.*, 3:15-20, 3:28-39, 4:49-58, 5:18-20 (FIGS. 3-4), 5:27-30 (FIG. 5), 6:5-9, FIGS. 3-5). EX-1003, ¶¶37-38.

POSITAs reading the '823 Patent would understand that, absent the simplistic case of a common video source⁵, if the patent's system did not know the timing of **when** these simultaneous traffic peaks **will** occur among the different streams (requiring “synchronization” before “desync” among the different streams), then the system would not know **if** nor **when** the “simultaneous traffic peaks in multiple compressed video

⁵ In the Challenged Claims, the “one **or more** near endpoints” (from which the “data streams” are transmitted) recited in Claim 1 is further limited to “**a common** source endpoint” in dependent Claim 7.

streams” problem will occur and, accordingly, would not know **if** nor **when** to apply a controlled delay to one or more of the streams. EX-1003, ¶39.

However, the same “avoiding coincidence” solution to the same “simultaneous traffic peaks in multiple compressed video streams” problem was known in the prior art. §V.G.1; §VII.A.1; EX-1003, ¶¶36, 40.

The ’823 Patent also explains that “round-trip delay (RTD)⁶ is a very important parameter in a videoconference system”, because as “a two-way communication, like a telephone call”, the communications in each end-to-end videoconference connection are delay sensitive in that voice communications are seemingly natural “when the RTD is kept under approximately 150ms” and become “increasingly difficult” with RTD between 150 and 600ms. EX-1001, 3:46-4:3, 1:46-52. This delay sensitivity problem was textbook knowledge for videoconferencing applications implemented over packet networks, and the identical solution as the ’823 Patent to this problem – techniques to dynamically determine RTD of each connection throughout a multi-party

⁶ POSITAs understood the ’823 Patent’s use of the term “Round-Trip **Delay** (RTD)” refers to the standardized, well-understood “Round-Trip **Time** (RTT)” value, including because the patent discloses that RTD is “derived from Real-Time Control Protocol (RTCP).” EX-1001, 1:66-2:1, 4:42-48, 4:59-62; §V.G.2.

communication session (EX-1001, 1:66-2:1, 4:42-48, 4:59-62) – were standardized⁷, and published in textbooks and other literature, including to address the delay sensitivities of interactive applications like videoconferencing. §V.G.2; §§VII.A.2-VII.A.3; EX-1003, ¶¶41-42.

The '823 Patent further identifies that another problem in multi-party videoconference systems implemented over packet networks was that the RTD experienced by each connection over a packet network may change over time, which may result in the connection with the greatest delay at one moment being replaced by a different connection at another moment. EX-1001, 5:35-39. And, the patent explains that, “other factors being equal”, its solution to this problem – dynamically determining a maximum among the determined RTDs for the various connections, and choosing to intentionally delay transmission of the stream(s) in the connection(s) that have less than the maximum RTD (EX-1001, 4:66-5:33, 5:66-6:4, 6:22-24, FIGS. 4, 5) – will “smooth

⁷ As expressly acknowledged by the identical inventors in Pat. No. 8,446,452 (EX-1010), the '823 Patent's particular disclosed technique to solve this delay sensitivity problem simply involved each receiving endpoint periodically transmitting standardized information usable to calculate RTD of each connection in a standardized way. EX-1001, 4:42-48, 4:59-62; EX-1010, 2:36-40, 4:30-40, 5:4-32, 5:44-50, FIG. 1 (*citing* EX-1011, EX-1012); §V.G.2.

net traffic” and “ensure that no party in a multiparty conference will experience RTD greater than would be experienced by parties communicating via the path of greatest point to point delay when all other connections are disconnected” (EX-1001, 1:66-2:7, 5:66-6:9, 6:22-24). EX-1003, ¶¶43-45. In other words, this solution to the “heterogeneous packet network connection” problem has the benefit of reducing the delay variance across the various videoconference connections while also homogenizing the different participant experiences (by homogenizing the respective delays). *Id.*

The same “heterogeneous packet network connection” problem was textbook knowledge for videoconferencing applications implemented over packet networks, and the same solution as the ’823 Patent to this problem, along with similar (and additional) benefits, was known to POSITAs. §V.G.3; §§VII.A.2-VII.A.3; EX-1003, ¶45.

Accordingly, as detailed below, the ’823 Patent describes and claims no more than the combination of (i) a known solution to a known problem occurring when multiple, substantially similar compressed video streams are transmitted over a packet network and through a common communication resource (*e.g.*, router, network path), with (ii) standardized and known solutions to well-known problems occurring when implementing an interactive application (*e.g.*, videoconferencing) over a packet network, to achieve known and predictable results. EX-1003, ¶46.

B. Summary of the Prosecution History

The ’823 Patent was filed June 23, 2009. The claims were rejected as being anticipated by Pat. No. 5,805,983 to Naidu (“Naidu”). EX-1002, 32-39. In response, the

Applicant argued that Naidu's teaching of equalizing the different transmission delays that respectively existed in "separate RF links between a base station and individual antenna units" because each antenna unit was "at [a] different distance[] from the base station", was not directed to solving any of the identified problems encountered when streaming compressed video data over packet networks. EX-1002, 25-27. The Applicant then amended the claims "to place the invention more squarely within its intended context of packet networks and logical (virtual connections) passing through a common resource, such as a router", and to recite that only "the data streams for which their respective logical connections have a round trip time less than the maxim[um] [are] delayed so that the peaks no longer coincide and the maximum round trip delay is not increased." *Id.* This is illustrated below in the amendments to claim 1 (bracketed notations added):

[1.0.1] A method of managing multiple data streams transported ~~over~~through a common communications resource in a packet network,
[1.0.2] wherein data flowing through said resource travelss in both directions, and [1.0.3] wherein each stream is subject to data peaks, comprising:

[1.1] establishing logical two-way connections through the common communications resource between one or more near endpoints and one or more far endpoints,

[1.2] determining an undelayed round trip delay for ~~each said~~each data-streamlogical two-way connection;

[1.3] determining the maximum round trip delay among all said logical

two-way connections, and

[1.4] preparing each of said data streams for transmission over respective said logical connections from a said near endpoint to a said far endpoint,

[1.5] determining the location of said data peaks in said data streams,

[1.6] ~~delaying transmission of data peaks in~~transmitting said data streams over said respective logical two-way connections to said one or more far endpoints, and

[1.7] delaying the transmission of one or more of said data streams that are transmitted over a said logical two-way connection having an undelayed round trip delay less than the maximum round trip delay by an amount dependent on the location of said peaks to~~to at least~~reduce the degree of coincidence in the data peaks of different streams without increasing the maximum round trip delay for the data streamslogical two-way connections.

EX-1002, 20-21.

The Examiner allowed the claims based on these amendments, and the patent issued on May 21, 2013. EX-1002, 2, 8-12.

C. Summary of the Challenged Claims

As discussed in §V.A above, many limitations of the Challenged Claims, of which Claim 1 (bracketed notations added in §V.B above) is the only independent claim – specifically, limitations [1.0.1]-[1.0.3], [1.1], and [1.4]-[1.6]) – simply recite features that the '823 Patent itself expressly acknowledges were well-known to POSITAs. *See* §V.A; §V.B (bracketed notations added); §V.G. Moreover, because the Challenged Claims require “**multiple** data streams transported through a common communication

resource in a packet network” [1.0.1], “coincidence in the data peaks of **different** streams” [1.7], and plural “logical two-way connections” established “through the common communication resource” [1.1], POSITAs would recognize that there must be at least two “near endpoints” **or** at least two “far endpoints” ([1.1], [1.4], [1.6])⁸, wherein, without the “delaying” step of element [1.7], the near endpoint(s) would otherwise have simultaneously transmitted two (or more) substantially similar data streams toward the far endpoint(s) in a manner that the coincident peaks (*e.g.*, I-frames) of the streams would have, at that instant in time, exceeded the capacity of the common communication resource. *See also* plural elements recited in [1.4], [1.6] above; EX-1003, ¶¶51-53.

Stripping away what the ’823 Patent acknowledges to be well-known, what remains is a claimed solution that uses dynamically determined RTDs of each connection, and the maximum current RTD, to decide which one (or more) of the multiple data streams to delay. *Id.*

D. Claim Construction

Petitioner proposes that each claim term in the Challenged Claims be given its

⁸ This could be, for example, (i) a common video source endpoint and two or more destination endpoints, (ii) two or more video source endpoints and a common destination endpoint, or (iii) two or more video source endpoints and two or more destination endpoints.

plain and ordinary meaning in this proceeding, and that no specific construction of any claim term is required because the prior art relied on in this Petition meets each of the claim terms under any reasonable construction. EX-1003, ¶¶56-58.

E. Priority Date of the Challenged Claims

The application that issued as the '823 Patent was filed June 23, 2009 and, therefore, Petitioner assumes that the priority date is June 23, 2009.

F. Person of Ordinary Skill in the Art

A POSITA in June 2009 would have been someone knowledgeable and familiar with the video codec technology and communications protocols and standards associated with the real-time multimedia transport arts, that are pertinent to the '823 Patent. A POSITA would have had a bachelor's degree in electrical engineering, computer science, physics, computer engineering, or an equivalent degree or equivalent training, and approximately two to three years of experience working with real-time multimedia transport, including videoconferencing systems, video codecs and/or similar technology. Lack of professional experience can be remedied by additional education, and vice versa. EX-1003, ¶¶60-61.

G. State of the Art

The following section describes the state of the art for streaming video data over packet networks as of June 2009. EX-1003 ¶¶63-64. The prior art references, and the discussions of what was known to POSITAs, provide the factual support for the general description of the state of the art at the time of the invention, and provide additional

motivation to modify or combine teachings in the references. Accordingly, these references should be considered by the Board.

Streaming video data over packet networks, including for interactive (bi-directional) applications such as videoconferencing, was known and widely implemented long before the filing date of the '823 Patent. EX-1006, 5-14; EX-1005, [0002], [0015]; EX-1019, 1; EX-1020, 1. Indeed, the '823 Patent acknowledges that, as of June 2009, it was “common to establish video conferencing sessions over IP networks” such as “LANs, WANs, or virtual networks established over the Internet.” §V.A (EX-1001, 1:13-22, 2:61-3:6).

Before video data is streamed over a packet network, it is compressed using a standardized codec, such as the Moving Pictures Expert Group (MPEG) codecs. EX-1005, [0003]-[0004], EX-1001, 1:23-36, 4:4-8, FIG. 3; EX-1017, [0005]-[0006]; EX-1018, 4:19-33; EX-1006, 11-12. A video stream includes video data representing a series of frames that make up a video sequence. To encode a video stream, codecs will designate different frames in different ways. Frames may be designated as reference frames (I-frames) or non-reference frames (P- frames). MPEG coding, for example, includes “I-frames” which “are coded using information only found in the picture itself” and “P-frames” which are predictive frames that “only contain information about the changes relative to a previous frame” (and thus are “coded with respect to other P-frames or I-frames”). EX-1005, [0003]; EX-1001, 1:23-31; EX-1018, 4:19-23. In this manner,

the data representing the P-frames is much smaller than the data representing the I-frames. EX-1005, [0004]; EX-1001, 1:35-36, FIG. 3; EX-1017, [0008]. The '823 Patent acknowledges that video data being streamed over packet networks was typically in compressed I-frames and P-frames. §V.A (EX-1001, 1:13-36, 2:59-3:16, FIGS. 1, 3); EX-1003, ¶¶65-66.

An encoder may encode video streams into “groups of pictures” (or “GOPs”), with a GOP referring to a sequence of an I-frame and a number of P-frames, and with the GOP size (generally the number of P-frames between I-frames) being variable, with the understood tradeoff being that a higher frequency of encoding I-frames generally yields a higher picture quality but also increased bandwidth consumption. EX-1005, [0002], [0004], [0025]-[0028]; FIG. 2A; EX-1018, 4:26-5:10, 8:15-24, FIGS. 2-3; EX-1006, 11-12, 150-152; EX-1001, 1:49-52. Compressed video streams may include various GOPs, or the same GOP, one after the other, and may include varying positions of the I-frame within the same GOP and/or different GOPs. EX-1005, [0032]; EX-1023, [0023]-[0024]; FIG. 2; EX-1018, 5:22-6:7, FIGS. 4, 6; EX-1003, ¶67.

As of June 2009, it was well-understood that the IETF-standardized Real-time Transport Protocol (RTP) (EX-1011) was the predominant protocol used for streaming video and audio data over packet networks and between two or more endpoints, including for interactive (bi-directional) multimedia applications such as videoconferencing. EX-1006, 9-11; EX-1019, 2; EX-1005, [0017]-[0018]; EX-1001,

1:13-22. As acknowledged by the '823 Patent, when implementing RTP, it was well-understood that logical (rather than physical) two-way connections were established between endpoints at different locations. §V.A; §V.B; EX-1006, 67-69 (describing that each participant in an RTP session is identified by a logical (rather than physical) network (IP) address and a logical (rather than physical) port pair), 21-22; EX-1006, 55 (identifying ITU-T H.323 adopted RTP); EX-1022, 6-8; EX-1021, 22, 42; EX-1011; EX-1013; EX-1015; EX-1014. As also acknowledged by the '823 Patent, in typical videoconferencing sessions, the endpoints are both senders and receivers, and commonly located endpoints will often stream video data over a common communication resource (*e.g.*, router, network path). §V.A (EX-1001, FIG. 2, 4:4-11, 4:14-20, 4:24-41); EX-1005, [0019]; EX-1019, 1; EX-1003 ¶¶68-69.

Although the '823 Patent described its claimed solution as solving three problems that it identified as occurring within the context of this admittedly well-known framework for streaming video data over packet networks as part of videoconferencing sessions, each of these three problems, the patent's respectively described solution to each problem, and similar (and additional) benefits to those identified by the patent for each such solution, were also known to POSITAs. §V.A; EX-1003 ¶70.

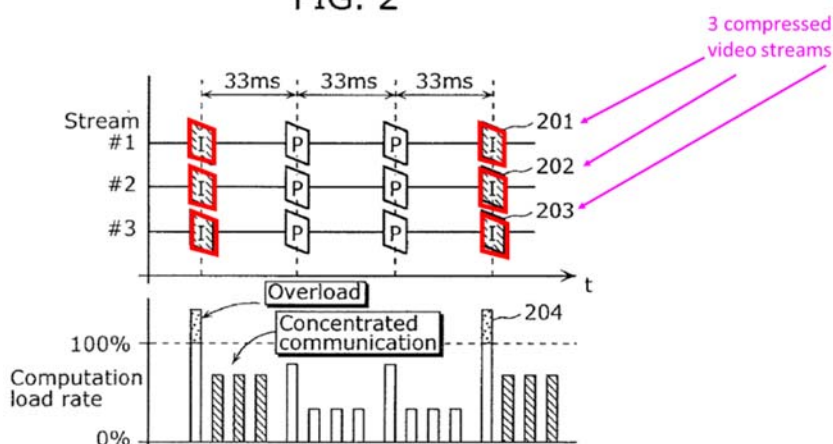
1. Known Simultaneous Traffic Peaks in Multiple Compressed Video Streams Problem and Known Avoiding Coincidence Solution

When multiple, substantially similar video streams⁹ are communicated across the same network, a well-known problem was that simultaneous traffic peaks (*e.g.*, simultaneous I-frames in multiple streams) may occur that instantaneously exceed the capacity of a common network resource (*e.g.*, router, network path) resulting in congestion and packet losses. EX-1001, 1:37-45, 3:15-39, FIG. 3. The same solution disclosed in the '823 Patent for solving this same problem – intentionally applying a controlled delay to one or more of the video streams to avoid coincidence in their data peaks – was also known to POSITAs. EX-1001, 5:18-26, FIG. 4; EX-1003, ¶¶71-72.

For example, Yamauchi (EX-1017) describes that, when a common video source (*e.g.*, a “real-time streaming” source) “generat[es] coded frames of multiple data streams” for “simultaneous[] distribut[ion] to multiple communication terminals”, “I-frames 201, 202 and 203 are generated within the same frame period in [the] three different data streams” and, “[t]hus, intra coding for the I-frames are overlapped, coded frames that exceed transmission capacity of the communication apparatus is generated, code amount to be transmitted increases in the period in which an I-frame is generated, causing the overload 204” and “causing packet losses”:

⁹ See footnote 4 (§V.A).

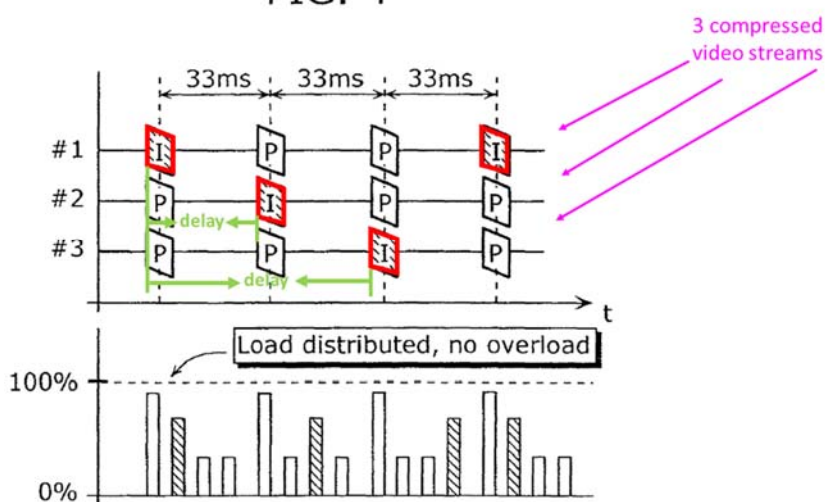
FIG. 2



EX-1017, Abstract, [0169], [0008]-[0009], [0012]-[0013], FIG. 2 (annotated above).

To solve this problem (as shown in the example below), Yamauchi teaches intentionally applying a controlled delay to its generation of the traffic peaks (I-frames) in two of the compressed video streams:

FIG. 4



EX-1017, FIG. 4 (annotated above), [0019], [0021], [0023], [0033], [0081]-[0086], FIG. 9; *compare with* EX-1001, FIG. 5, 5:28-32 (“distribute I-frame peaks in signals 48 and 50 between successive peaks of Signal 44” and with P-frames (44b) distributed therebetween in each signal); *see* EX-1023, [0023]-[0024], FIG. 2; EX-1003, ¶¶73-74.

As another example, Cooper (EX-1018) describes its “invention” as “relat[ing] to... improved bandwidth utilization during concurrent transmission of a plurality of video signals” and describes known problems in “multi-channel video transmission system[s]” when “the I frames for all of the channels appear at the same time point”:

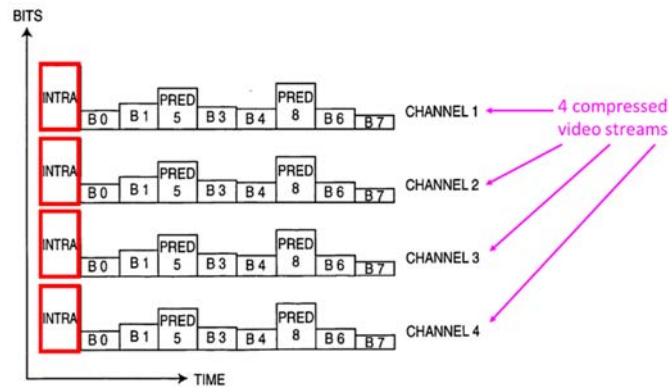


FIG. 3

EX-1018, 1:6-8, 2:27-3:2, 5:7-21, 6:19-24, FIG. 3 (annotated above). To solve this problem (as shown in the example below), Cooper teaches, “based on use of MPEG coding/compression of the video signals, the Intra-coded (I) frames are temporally displaced by a controlled amount so as to avoid a temporal alignment of I frames among a selected group of channels sharing a common transmission medium”:

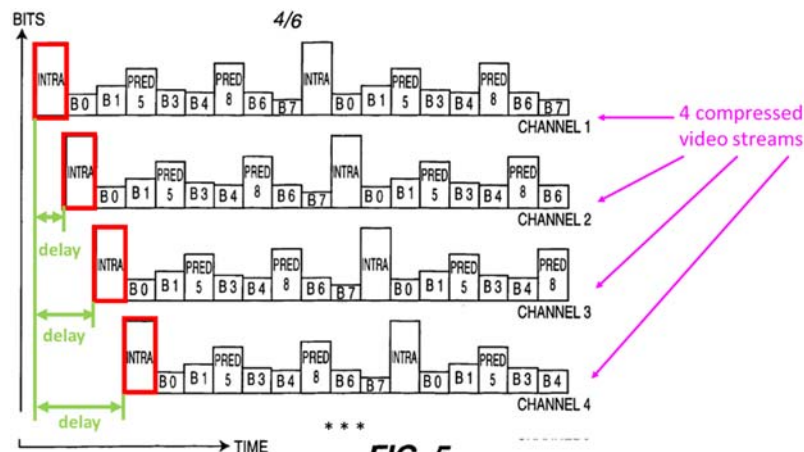


FIG. 5

EX-1018, 3:5-8, 6:19-24; FIG. 5 (excerpt annotated above); *see also* §VII.A.1; EX-1003, ¶¶75-77.

This state of the art delaying I-frames a controlled amount demonstrates that the '823 Patent's description that prior art systems indiscriminately delayed arbitrary packets is not accurate. EX-1003, ¶78.

2. Well-Known Delay Sensitivity Problem of Videoconferencing and Well-Known Dynamic RTD Determination Solution

The second problem that the '823 Patent identified it was solving – the delay sensitivity of communications in each end-to-end videoconference connection because voice communications are seemingly natural with a RTD of less than 150ms and become increasingly difficult with a RTD between 150 and 600ms – was textbook knowledge to POSITAs in June 2009. EX-1001, 1:46-52, 3:46-4:3. For example, Perkins, a 2003 textbook, (EX-1006; EX-1029) disclosed that RTD¹⁰ was an important network parameter in interactive applications (like videoconferencing) because the usability of such applications demanded low latency (less than approximately 300ms) in sending and receiving data over each connection. EX-1006, 105-106, 170; *see also* EX-1006, 33; EX-1021, 26, 34; EX-1009, 11; EX-1019, 1; EX-1003, ¶¶79-80.

And, the identical solution disclosed in the '823 Patent for solving this identical delay sensitivity problem – techniques to dynamically determine RTD throughout a

¹⁰ *See* footnote 6 (§V.A).

multi-party communication session – was standardized, and published in textbooks and other literature, including to address the delay sensitivities of interactive applications like videoconferencing. For example, Perkins describes IETF-standardized techniques to use information provided in RTP Control Protocol (RTCP) Receiver Reports (RR) to determine RTD between a sender and each receiver (*i.e.*, for each logical connection of a multi-party videoconferencing session):

One of the primary uses of RTCP is reception quality reporting, which is accomplished through RTCP receiver report (RR) packets, which are sent by all participants who receive data... The reception quality feedback in RR packets is useful not only for the sender, but also for other participants and third-party monitoring tools. The feedback provided in RR packets can allow the sender to adapt its transmissions according to the feedback... A sender can use the [Last Sender Report] and [Delay since Last Sender Report] fields to calculate the round-trip time¹¹ between it and each receiver... The process is shown in Figure 5.4, an example taken from the RTP specification... Note that the calculated value is the network round-trip time, and it excludes any processing at the endpoints... [R]ound-trip time is important in interactive applications because delay hinders interactivity.

EX-1006, 101, 105-106; *compare with* EX-1001, 4:42-48, 4:60-62, 5:56-62; *see also* §V.G above (discussing RTP logical connections); EX-1006, 285; EX-1011, 31, 33-34,

¹¹ See footnote 6 (§V.A) (“round-trip **delay** (RTD)” and “round-trip **time** (RTT)” refer to the same value).

FIG. 2; EX-1020, 1-2; EX-1019, 2-3, FIG. 1; EX-1007, 164-165); *see also* §VII.A.2 (EX-1009, 11, 14(§4.1)); EX-1003, ¶¶81-82.

3. Well-Known Heterogeneous Packet Network Connection Problem and Known Avoiding Increases in the Maximum Determined Delay Solution

The third problem that the '823 Patent identified it was solving – that the amount of network transit delay (RTD) in packet networks transporting streaming audio and/or video data varied over time, and varied among different end-to-end logical connections – was textbook knowledge to POSITAs in June 2009. EX-1001, 5:35-39. For example, Perkins describes this same problem:

How long does it take packets to transit the network? The answer depends on the route taken... the speed of the links, the number of routers through which a packet must pass, and the amount of queuing delay imposed by each router... In network terms a short path is most often the one with the least hops, even if it covers a longer physical distance... Measures of the delay in itself are not very interesting because they so clearly depend on the location of the source and the destination. Of more interest is how the network transit time varies from packet to packet... Some sample measurements of the variation in transit time... are presented... Note the following... Several step changes in the average transit time, perhaps due to route changes in the network, can be observed... The transit time is not constant; rather it shows significant variation throughout the session. These are all problems that an application, or higher-layer protocol, must be prepared to handle and, if necessary, correct.

EX-1006, 32-36;

Sending to a group means that more things can go wrong: Reception quality is no longer affected by a single path through the network, but by the path from the source to each individual receiver. The defining factor in the measurement of loss and delay characteristics for a multicast session is *heterogeneity*.

EX-1006, 38-39 (original emphasis);

A multimedia session comprises several media streams, and in RTP each is transported via a separate RTP session. Because... the streams are transported separately across the network, the media will tend to have different playout times.

EX-1006, 209; *see id.*, 105-106 (“[T]he round-trip time... calculated value is the *network* round-trip time, and it excludes any processing at the endpoints.”); *id.*, 184 (“When RTP packets flow over a real-world IP network, variation in the interpacket timing is inevitable.”); EX-1003, ¶¶83-84.

Other examples are the Welzl textbook (EX-1007; EX-1024, 46-58) and the Black textbook (EX-1021; EX-1030), which each describe this same problem:

[B]oth the network capacity that is available to an end system and the RTT fluctuate, which is caused by effects such as routing changes or congestion in the network.

EX-1007, 128;

[O]nly three things can happen to a packet as it traverses the network: (i) it can be delayed, (ii) it can be dropped, (iii) it can be changed. At least two of these effects lend themselves to interpretations by an end-to-end receiver for the sake of providing the sender with feedback about the state of

congestion in the network: (i) delay..., and (ii) packet drops... We have also seen that, whether increasing delay is interpreted as a sign of congestion or not, measuring the RTT is useful for several things.

EX-1007, 37;

Round-trip time (RTT) is a measure of the time it takes to send a packet to a destination node and receive a reply from that node... [I]n the Internet... large variations to RTT do occur. Due to the asynchronous nature of the Internet, RTT is not consistent.

EX-1021, 34;

Hop distance is a term used to describe the number of hops between a sender and a receiver. It is a critical aspect in internet telephony because more hops means more delay, and more variable delay. Hop distance must consider round-trip time (RTT), because of the interactive, real-time nature of telephone conversations... [P]acket switches, such as routers, provide variable paths, and variable delay, which is sometimes a low delay and sometimes a lengthy delay.

EX-1021, 36-37, 135; EX-1007, 15; EX-1019, 1 (“Heterogeneity problem... [I]n a real-time videoconferencing session with many participants, some receivers may suffer congestion... while others are just fine.”); EX-1020, 1 (“[in] video teleconferencing system[s]... video data needs to be streamed to multiple recipients over continuously changing networks[, and]... must be able to quickly adapt to changing network status.”); EX-1005, [0074]; EX-1003, ¶85.

And, the same solution disclosed in the ’823 Patent for solving this third problem

– dynamically determining a maximum among the RTDs for the various connections, and choosing to intentionally delay transmission of the stream(s) in the connection(s) that have less than the determined maximum current delay (§V.A (EX-1001, 4:66-5:33, 5:66-6:4, 6:22-24, FIGS. 4, 5) – was also known to POSITAs, as were similar (and additional) benefits from this solution to those that the ’823 Patent identifies (§V.A (EX-1001, 1:66-2:7)). EX-1003, ¶86.

For example, Duffield (EX-1008; EX-1024, 19-33) identifies the prevalence of this same third problem (“variance of the delay distribution”) in implementing multi-connection, “delay sensitive” applications, like “video teleconferences”, over packet networks, and teaches that “Longest Delay First (LDF)” schemes, “that serve[] the flow with the current longest delay”, solve this problem as well as “burstiness” problems:

A primary motivation for the use of fair-queueing has been its use as a means of providing bandwidth guarantees and as a consequence end-to-end delay bounds for traffic with bounded burstiness... When excess bandwidth... is available, the fair queueing system... should redistribute this excess bandwidth in a manner which reflects **the current or instantaneous** needs of backlogged flows (i.e. a flow state dependent redistribution)... The excess bandwidth... is redistributed as follows: **1. Longest delay first (LDF) that serves the flow with current longest delay... The LDF policy uses excess bandwidth to reduce the variance of the delay distribution. This has the benefit of reducing the playout buffer for voice and video sources.** Simulations with video traces and with voice traffic show that indeed this policy performs better than [Packet

Generalized Processor Sharing (PGPS) systems] without any sacrifice of worst case guarantees.

EX-1008, 1122;

State Dependent Fair Queueing An illustration of the logical structure of our system is presented in Figure 1. When all scheduler queues are empty, a state dependent scheduler (SDS) is invoked...

Redistributing Excess Bandwidth... The basic

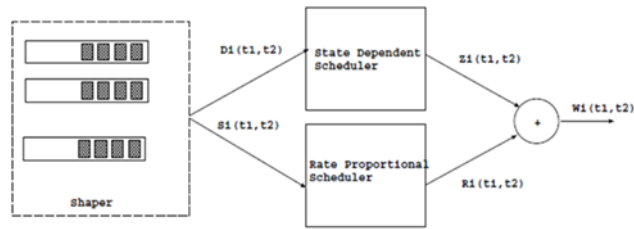


Fig. 1. Scheduling System

idea is that the scheduler, in picking connections to serve, should use information about the state of connections so as to minimize packet losses, reduce average delays for some traffic classes, or shape delay distribution... we can simply weight the queue size by the allocated bandwidth to make the scheduler a Longest Delay First scheduler. The scheduler then uses the excess bandwidth to try and equalize the delays of all connections in the system and minimize the packet losses if buffer sizes have been allocated proportional to bandwidth requirements. We will refer to this algorithm as *FQ-LDF*.

EX-1008, 1123-1124 (original emphasis);

We simulated the system shown in Figure 1 using... Video teleconference sources... We first compared the performance of FQ-LDF with PGPS... The curtailment of the tail of the delay distribution due to the use of FQ-LDF is evident... **FQ-LDF** uses the excess bandwidth to equalize delays and it **works very well when all sources have the same allowed delays...** Simulations show that the FQ-LDF... policies perform very well in comparison to PGPS. **The adaptive bandwidth redistribution reduces**

packet losses and makes the delay distributions less skewed. The control of delays, in comparison to PGPS, is very significant when very delay sensitive traffic... is mixed with traffic with more laxity in delays.

EX-1008, 1125-1129. As established in the above excerpts, Duffield teaches that Longest Delay First techniques – that choose to intentionally delay stream(s) in connection(s) which are dynamically determined to have less than the longest current delay – solve the same “heterogeneous packet network connection” problem and achieve similar (and additional) benefits to those identified by the ’823 Patent, including “reduc[ing] the variance of the delay distribution” for “video teleconference” sources, “reduc[ing] the playout buffer for voice and video sources”, and “reduc[ing] packet losses” especially “when all sources have the same allowed delays” and when “very delay sensitive traffic... is mixed with traffic with more laxity in delays.” EX-1008, 1122, 1125-1129; *compare* EX-1001, 1:66-2:7; *see* §VII.A.2 (EX-1009, 11, 14(§4.1)); EX-1003, ¶¶87-91.

Accordingly, dynamically determining a current maximum RTD among the various logical connections, and choosing to intentionally delay transmission of the stream(s) in the connection(s) that have less than the current maximum determined RTD, was a known solution with known and predictable benefits to the well-known heterogeneity problem existing in implementing interactive, multi-party, delay-sensitive applications (like videoconferencing) over packet networks. EX-1003, ¶92.

VI. IDENTIFICATION OF CHALLENGES

A. Challenged Claims

Claims 1-8 of the '823 Patent are challenged in this Petition.

B. Statutory Grounds for Challenges

The Challenge is set forth in detail below and summarized as follows:

Ground	Claims	Basis	Reference(s)
1	1-8	§103	Larson (EX-1005) in view of Cai (EX-1009) and further in view of the knowledge, skill and creativity (hereinafter “Knowledge”) of a POSITA

Larson (EX-1005) is Patent Publication No. 2009/141800 titled “Transmitting Video Streams” that published June 4, 2009 from an application filed September 3, 2008, and which further claims priority to a provisional application filed November 29, 2007. EX-1005, 1. Larson qualifies as prior art at least under (pre-AIA) 35 U.S.C. §102(a) and §102(e). Larson was not cited or applied by the examiner during the '823 Patent prosecution.

Cai (EX-1009) is “IQ-Services: Network-Aware Middleware for Interactive Large-Data Applications”, that published October 18, 2004 in Proceedings of the 2nd Workshop on Middleware for Grid Computing, pp. 11-16, and was publicly accessible no later than April 30, 2006. EX-1024, 34-46. Cai qualifies as prior art at least under (pre-AIA) 35 U.S.C. §102(b). Cai was not cited or applied by the examiner during the '823 Patent prosecution.

VII. IDENTIFICATION OF HOW THE CLAIMS ARE UNPATENTABLE

A. Ground 1: Claims 1-8 are obvious under 35 U.S.C. §103(a) over Larson in view of Cai and the Knowledge of a POSITA.

1. Larson

Larson, like the '823 Patent, discloses a technique for handling the known problem of simultaneous traffic peaks (I-frames) in multiple video streams that instantaneously exceed the capacity of a common network resource when implementing multi-party videoconferencing applications over packet networks. Larson explains that “[v]ideo conferencing may... use multiple compressed video channels”, that “[b]andwidth requirements for transmitting compressed video streams may be affected when one transmission line, having a given bandwidth limit, is used to transmit multiple video streams.” EX-1005, [0015], [0019], [0073]; [0069] (“network 420 can be... the Internet, a local area network, a wide area network, a metropolitan area network, an enterprise network...”). Larson also explains that, “[f]or instance, a communication network may have three compressed video streams that are transmitted over a shared transmission line having a given bandwidth limit” and, “[w]hen, for instance, two of the three video streams are each transmitting I-frames, their respective bandwidth allocation may simultaneously be fully utilized and insufficient to transmit each I-frame as one video frame”, which may result in “the communication network... hav[ing] latency due to insufficient bandwidth allocated to transmit each I-frame as one video frame.” EX-1005, [0019], [0020]; *see also* [0005] (explaining, when “bandwidth devoted to more

than one data channel [is] insufficient for transmission of substantially simultaneous I-frames”, the result “may be experienced by a participant in a video conference, for instance, as latency in viewing other participants in the video conference.”); EX-1003, ¶¶94-95.

This concept is the same “simultaneous traffic peaks in multiple video streams” problem in the same multi-party videoconferencing environment as described in the ’823 Patent, and with similar described user experience degradation results. EX-1001, 3:30-39, FIG. 3; EX-1003, ¶96.

Like the ’823 Patent, Larson discloses a technique in which “[i]nitiation of video streams can be staggered such that I-frames do not transmit at the same time.” EX-1005, [0033]. Larson discloses that “[t]he controller 106 can... stagger initiation of video streams from the encoders such that transmission of I-frames in the video streams are non-overlapping.” EX-1005, [0030]. More specifically, as shown in the example in the figure below, Larson discloses “video streams from encoders can be staggered such that I-frames do not overlap... [for] example... the video stream 107-1 from encoder 104-1 can start first, followed by video stream 107-2 from encoder 104-2, and then followed by video stream 107-N from encoder 104-N”:

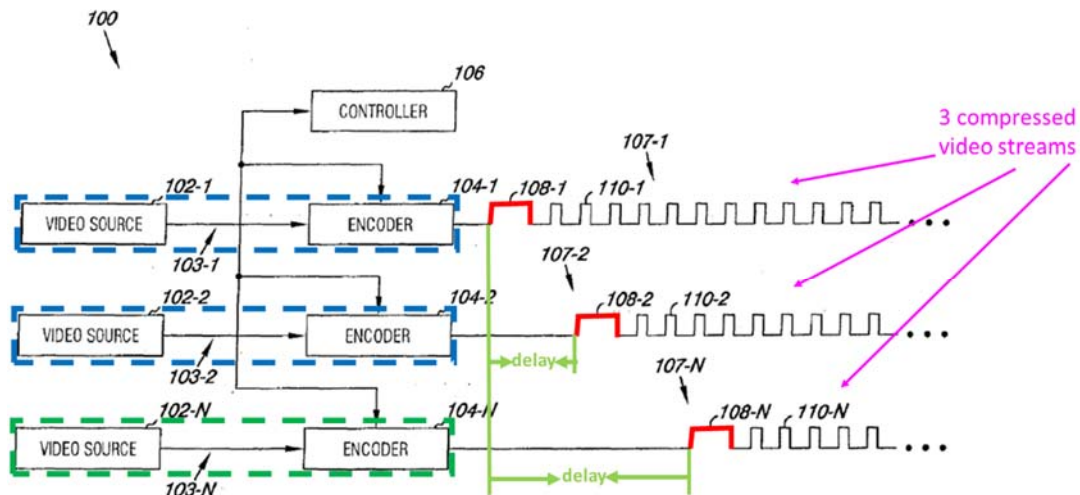


Fig. 1

EX-1005, [0031], FIG. 1 (I-frames annotated red, compressed video streams annotated purple, and intentionally applied controlled delay to video streams 107-2 and 107-N annotated light green).

Like the '823 Patent's assumption that, at the time **before** the system introduces the controlled delay (*i.e.*, before it performs the “**desync** function”), the video data from the corresponding source(s) of the video streams are “synchronized” in the sense that the video streams **will** have coincident peaks (I-frames) at a given time, Larson recognizes the importance of the controller knowing **when** these simultaneous traffic peaks **will** occur among the different streams and, accordingly, Larson discloses that, in order “to transmit **later** I-frames in a non-overlapping fashion”, “[o]ne or more method of maintaining synchronization of... transmitting video streams may be implemented.” EX-1005, [0022], [0038]-[0039]; [0031] (“the plurality of encoders can provide coordination information to the controller 106”), [0032] (“[c]ontinuing coordination of

transmission may be facilitated by, for example, encoding each video stream with a common number of pictures in their respective groups of pictures”), [0048], [0050]-[0051], [0060]-[0061]; §V.A (EX-1001, 3:15-25, 3:28-39, 4:49-58, 4:66-5:3, 5:12-13, 5:18-20, 5:27-30, 5:63-65, 6:5-9, FIGS. 3-5); EX-1003, ¶98.

Larson further discloses that:

[A] controller can stagger video streams by, for example, **an interval proportional to the number of pictures per group of pictures divided by the number of video streams**. For example, an embodiment can use a group of pictures size of 18, and three video sources. In such an embodiment, a controller can stagger initiation of video streams **107 by $18/3=6$ pictures**. In this example, the controller can **start** the second video stream **six frames after the first**, and can **start** the third video stream **twelve frames after the first**. In this example, **an I-frame can be transmitted at pictures 1, 6, and 12**. The remaining pictures can be, for example, P-frames.

EX-1005, [0037]-[0038]. In other words, Larson discloses intentionally delaying the transmission of one or more of the video streams transported through a common communication resource in a packet network to reduce the degree of coincidence in the data peaks of different streams, and where the amount of the intentionally introduced delay is an amount dependent on the determined location of the data peaks in the streams, as recited in the Challenged Claims. EX-1003, ¶100.

A similar figure from the '823 Patent is reproduced below, and showing the same “avoiding coincidence” solution to the same “simultaneous traffic peaks in multiple

video streams” problem in the same multi-party videoconferencing environment as

Larson:

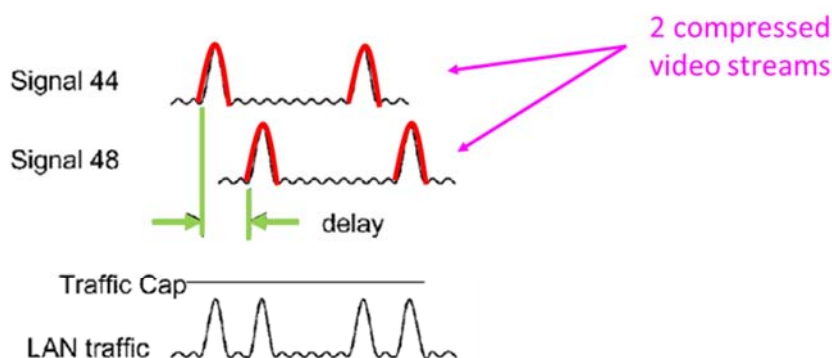


Fig. 4

EX-1001, 5:18-26, FIG. 4 (similarly annotated above); EX-1003, ¶101. Larson does not explicitly state how to identify which compressed video stream(s) to intentionally apply its controlled delay. EX-1003, ¶102. However, as explained below, POSITAs would recognize that Larson does not go into detail on which compressed video stream(s) to delay because (i) POSITAs would have the requisite background knowledge on making this selection, and (ii) it was known in the art that introducing additional delay to the video stream of the connection with the maximum (longest) current delay, especially in scenarios where the various videoconferencing connections have widely disparate RTDs (*e.g.*, participants in widely disparate geographic locations) and with a RTD approaching the well-known usability limit for interactive applications (300ms), would make the performance and user experience of the multi-party, delay-sensitive

videoconference worse. *See* elements [1.3], [1.7] below; §VII.A.3, §V.G.2-§V.G.3 (EX-1009, 11, 14(§4.1); EX-1006, 32-36, 38-39, 101-106, 170, 184, 209; EX-1021, 26, 34, 36-37, 135; EX-1007, 15, 37, 128, 164-165; EX-1019, 1-3; EX-1020, 1-2; EX-1008, 1122, 1125-1129; EX-1005, [0074]); EX-1003, ¶103.

2. Cai

Cai, like the '823 Patent, discloses a technique, when implementing “interactive”, “distributed applications” “over multiple connections”, including “telepresence” and “remote collaboration and visualization” applications, for handling the known problems associated with the “heterogeneity and dynamics of underlying [packet] networks” and that such applications “interactive nature... requir[es] data to be transferred with low latency.” EX-1009, 11, 12 (§2: “Real-Time Collaboration”), 14(§4.1); §§V.G.2-V.G.3. Like the '823 Patent, Cai discloses a “‘coordination’ solution” to these same problems in this same “interactive application” context (scenarios in which there is a “coexistence of related flows, such as video and visualization data streams in real-time collaboration”), and where this solution involves dynamically determining the RTT of each connection, determining a current maximum RTT (RTT_2 (connection 2)) among the determined RTTs for the connections, and choosing to intentionally delay transmission of the stream(s) in the connection(s) that have less than the current maximum determined RTT (choosing to intentionally delay transmission of connection 1 with $RTT_1 < RTT_2$):

The experiment emulates two remote clients that receive the same

visualization data stream. Since these two clients are engaged in a real-time collaboration, their desire is to receive and display the same data at the same time... **The experiment uses two connections that share a bottleneck link but have different RTTs and therefore, different throughput...** To better synchronize the two connections, the [Dynamic Adaptation Layer (DAL)] layer performs rate adjustment based on the RTT information of each connection... Suppose the DAL performs rate control for every G packets sent on the faster connection, and the RTTs of the two flows are RTT_1 and RTT_2 , respectively. **If $RTT_1 < RTT_2$, the DAL simply adjusts the rate of connection 1 by adding a delay of $RTT_2 - RTT_1$ to its packets.** With this adjustment, the connections 1 and 2 then experience similar RTTs.

EX-1009, 14(§4.1); EX-1003, ¶¶104-105.

Cai also identifies that this “‘coordination’ solution” achieves similar benefits to those identified by the ’823 Patent for the same solution to these same problems. *Compare* EX-1009, 14 (benefits of “improve[d] synchronization between the two clients, thereby reducing buffering costs and increasing the ‘freshness’ of information received by each client”) *with* EX-1001, 1:66-2:7 (*see* §V.A). In other words, both the ’823 Patent and Cai teach that this solution to the “delay sensitivity” and “heterogeneous packet network connection” problems has the benefit of reducing the delay variance across the various videoconference connections while also homogenizing the different participant experiences (by homogenizing the respective delays). *Id.*; §V.A; §V.G.3; EX-1003, ¶¶106-107.

3. Motivation to Combine the Teachings of Larson with the Teachings of Cai

The '823 Patent, Larson and Cai are all directed to implementing multi-party interactive applications (like videoconferencing) over a packet network, where there are multiple logical connections between participants in different locations and where multiple, substantially similar video streams are communicated through a shared communication resource. EX-1001, 1:13-22, 2:61-3:6, 3:15-20, 4:4-11, 4:14-20, 4:24-41, FIGS. 1-3; EX-1005, [0015], [0019], [0070], FIGS. 1, 4; EX-1009, 11, 14(§4.1); EX-1003, ¶108.

Applying Cai's teachings of choosing to intentionally delay transmission of the video stream(s) in the interactive application connection(s) that have less than the current maximum determined RTT among the multiple connections, to Larson's teachings of its videoconferencing system, and in order to identify which compressed video stream(s) to intentionally apply Larson's controlled delay among the multiple connections, would be applying a known technique to a known method ready for improvement to achieve known and predictable results. EX-1003, ¶109.

Combining the teachings of Larson and Cai would be achieved through known methods. These known methods include routine software application programming to dynamically determine the RTT of each videoconference connection (as taught by Cai) by implementing the standardized RTP protocol, disclosed as being used by Larson's videoconferencing system, in the standardized manner to have Larson's controller

dynamically (i) receive RTCP reports for each terminal-to-terminal connection, and (ii) use standardized information in such reports to determine the current RTT of each connection. EX-1009, 14(§4.1); EX-1005, [0017]-[0019], [0031]; §V.G.2 (EX-1006, 101, 105-106, 285; EX-1011, 31, 33-34, FIG. 2). These known methods also include routine software application programming to have Larson's controller dynamically determine the current maximum (longest) RTT among the determined RTTs for the various connections (as taught by Cai), and use this determination to choose which, of the multiple compressed video stream(s), to intentionally apply Larson's controlled delay (as also taught by Cai). EX-1009, 14(§4.1); EX-1005, [0030]-[0031], [0040]; §V.G.3 (EX-1008, 1122, 1125-1129); EX-1003, ¶¶110-112. Cai discloses that dynamically using a maximum current RTT first (longest delay first) transmission scheme is beneficial in a multi-party, interactive application context (like videoconferencing) because it addresses the "delay sensitivity" and "heterogeneous packet network connection" problems of such applications while reducing the delay variance across the various videoconference connections while also homogenizing the different participant experiences (by homogenizing the respective delays). EX-1009, 11, 12 ("Real-Time Collaboration" section), 14(§4.1); *see also* EX-1008, 1122, 1125-1129; EX-1003, ¶113.

POSITAs would have been motivated to combine the teachings of Cai to identify which of Larson's compressed video stream(s) to intentionally delay because doing so

would simply involve applying a known technique to a known method ready for improvement to yield known and predictable results. For example, adding Cai's dynamic determination of RTT of each interactive application connection feature would be, as was textbook knowledge, using the standardized and conventional control protocol (RTCP) for Larson's disclosed multimedia transport protocol (RTP) in its standardized and conventional way to determine an important network parameter to monitor during Larson's delay-sensitive videoconferencing sessions. EX-1009, 11, 14(§4.1); EX-1005, [0017]-[0019], [0031]; §V.G.2 (EX-1006, 33, 101-106, 170, 285; EX-1011, 31, 33-34, FIG. 2; EX-1021, 26, 34; EX-1019, 1-3; EX-1020, 1-2; EX-1007, 164-165). And, POSITAs would readily recognize that adding Cai's features of dynamically ranking the determined connection RTTs from longest to shortest, while applying a maximum current RTT first transmission scheme, to identify which of Larson's compressed video stream(s) to intentionally delay would be a suitable design choice among a finite number of network parameters from which this selection decision could be made without adversely impacting the performance and user experience of the multi-party videoconference, especially in scenarios where the various connections have widely disparate determined RTTs and with an RTT approaching the well-known usability limit for interactive applications (300ms). *Id.*; *see also* §V.G.3 (EX-1008, 1122, 1125-1129; EX-1006, 32-36, 38-39, 184, 209; EX-1007, 15, 37, 128; EX-1021, 34, 36-37, 135; EX-1005, [0074]); EX-1003, ¶¶114-116.

In view of this section (and discussed further below in the claims analysis),
Petitioner has demonstrated at least:

- i. Larson and Cai themselves provided teaching, suggestion or motivation that would have led POSITAs to identify which of Larson's compressed video streams to intentionally delay among Larson's multiple videoconferencing connections, using Cai's features of dynamically determining the maximum current RTT among the videoconference connections, and using this value as the criteria for selecting the connection(s) to intentionally apply a controlled delay (namely to the connection(s) that currently have determined RTTs less than this value), because these features addressed the "heterogeneity" and "delay sensitivity" problems experienced in the videoconferencing environment in which Larson's avoiding coincidence solution was disclosed as being implemented. EX-1003, ¶117(a); *see* [1.3], [1.7] below.
- ii. The general knowledge in the art was that Cai's use of dynamically determined RTTs in each connection of a multi-party videoconferencing application was an accepted, known, predictable and standardized (for RTP) mechanism to provide additional feedback information for controlling implementation of this delay-sensitive application by using software programming, and the use of this programming was identified as achieving known "homogenizing" benefits in the '823 Patent (the same known benefits

disclosed by Cai and other prior art (*e.g.*, EX-1008)). EX-1003, ¶117(b); *see* [1.2] below.

- iii. The beneficial aspects of implementing Larson's avoiding coincidence solution in Larson's videoconferencing environment based on choosing to intentionally delay the compressed video stream(s) of the videoconferencing connection(s) currently experiencing less than the maximum current RTT among all connections, would be accomplished using a straight-forward exercise of programming per standardized RTP techniques and Cai's known techniques. EX-1003, ¶117(c); *see* [1.3], [1.7] below.
- iv. POSITAs would also be confident the combination would have a reasonable likelihood of success given that such programming was well within the skill level of a POSITA and was disclosed in multiple references as resolving textbook knowledge problems, while achieving the same (and additional) benefits identified by the '823 Patent, in the same multi-party videoconferencing environment. EX-1003, ¶117(d); *see* [1.3], [1.7] below.

4. Detailed Application of Larson, Cai and Knowledge of a POSITA to the Challenged Claims

a. Claim 1

- i. *[1.0.1] A method of managing multiple data streams transported through a common communications resource in a packet network, [1.0.2] wherein data flowing through said resource travels in both directions, and [1.0.3] wherein each stream is subject to data peaks, comprising:*

Larson discloses a method of managing multiple “compressed video streams” [*managing multiple data streams*] transported through “a shared transmission line having a given bandwidth limit” [*common communications resource*] in “a communication network.” EX-1005, [0015], [0019], [0021]. Larson discloses that such encoded video data would be transmitted as “packets” over such a communication network [*packet network*]. EX-1005, [0002], [0017]-[0018], [0065], [0069] (disclosing well-known packet networks as examples of the “videoconferencing network in which embodiments of the present disclosure can be implemented”); EX-1021, 31-32. In addition, as acknowledged by the ’823 Patent, in typical videoconferencing sessions, commonly located videoconferencing terminals (such as 418-1 and 418-2) will often stream video data over a common communication resource (*e.g.*, router). EX-1005, [0070], §V.G (EX-1001, 2:61-3:6, FIGS. 1-2, 4:4-11, 4:14-20, 4:24-41; EX-1005, [0019], FIG. 4; EX-1019, 1). Accordingly, POSITAs understood Larson’s multiple compressed video streams, sent to/from commonly located terminals, to be transported through a common resource, such as a router [*common communications resource*]. EX-1003, ¶¶118-119.

POSITAs understood Larson discloses compressed video data flowing through the common communication resource in both directions as recited in the Challenged Claims. Larson discloses that “[v]ideo conferencing may ... use multiple compressed video channels with reasonably predictable bandwidth requirements”, which “may be

affected when one transmission line, having a given bandwidth limit, is used to transmit” the “compressed video streams” carrying such videoconferencing data, and Larson’s preferred embodiments are directed to videoconferencing applications. EX-1005, [0015], [0019], [0025], [0065]-[0074], FIG. 4. Larson discloses videoconferencing embodiments that include “video sources originating from different sites”, with some “videoconferencing terminals...in a same location” and others “at different locations”, and in which signals from these terminals will “reach each of the other terminals.” EX-1005, [0065], [0070], [0074]; FIG. 4. And, as acknowledged by the ’823 Patent, POSITAs understood conventional videoconferences were two-way communications of video data. EX-1001, 3:48-49, 1:13-22; EX-1003, ¶¶120-121.

Larson discloses that each compressed video stream includes “a number of I-frames” “and P-frames” and that, “[d]ue to the difference in compression ratios between I-frames and P-frames, among other factors, transmission of I-frames may occupy more bandwidth during transmission over the communications network” [*each stream is subject to data peaks*]. EX-1005, [0028], FIG. 1, [0004], [0015], [0025], [0026].

ii. [1.1] establishing logical two-way connections through the common communications resource between one or more near endpoints and one or more far endpoints,

Larson discloses “[v]ideo conferencing terminals 418-1, 418-2... can be in a same location and connected to the network 420” [*one or more near endpoints*] (annotated blue below), that “a video conference can involve video conferencing terminals from different sites, for example video conference terminals 418-4 and 418-N,

as illustrated in FIG. 4” [one or more far endpoints] (annotated green below), and that these “[v]ideo conferencing terminals can... be interconnected to each other through a network 420, as illustrated in FIG. 4” (which is a packet network and includes the common communications resource). EX-1005, [0069], [0070], [0066] (“encoder can be internal to a [video conferencing terminal (VC)]”). Larson also discloses using the standardized “Real-Time Transport Protocol (RTP)” to transport the compressed video data in each stream over the packet network. EX-1005, [0017]-[0019]; EX-1003, ¶¶123-124.

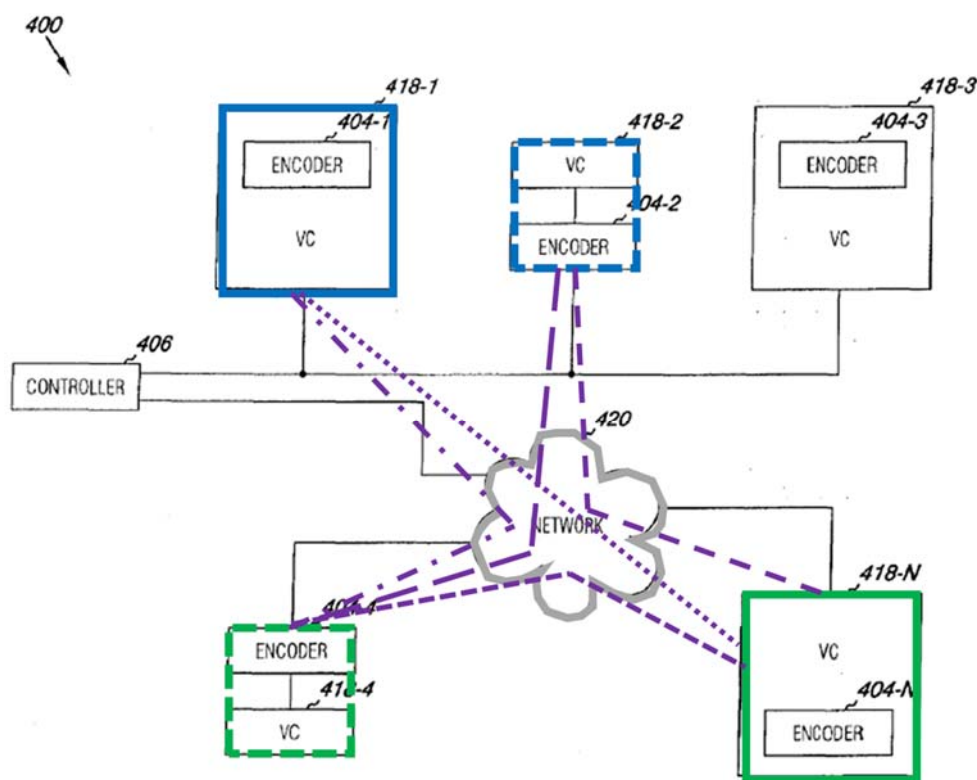


Fig. 4

As acknowledged by the '823 Patent, when implementing RTP, it was well-understood that logical (rather than physical) two-way connections were established

between endpoints, and that in typical videoconferencing sessions, all of the endpoints are both senders and receivers. §V.A (EX-1001, 1:13-22, 2:61-3:6, FIG. 1, FIG. 2, 4:4-8, 4:9-20, 4:32-58); §V.B (EX-1002, 25-26); §V.G (EX-1006, 67-69, 21-22; EX-1006, 55; EX-1022, 6-8, 19-20, 23-24, 90-94, 107). Accordingly, POSITAs understood Larson as disclosing logical two-way connections between its video conferencing terminals (annotated purple above between each pair of terminals). *Id.*; EX-1003, ¶¶124-125.

iii. [1.2] determining an undelayed round trip delay for each said logical two-way connection,

As explained in [1.1], POSITAs understood Larson disclosing implementing RTP in its standardized and conventional way, including to transport the compressed video data in each stream over the packet network, and to establish logical two-way connections between each pair of its video conferencing terminals. EX-1005, [0017]-[0019]. Larson discloses (i) that the different connections between “[videoconferencing] terminals at different locations” may have different “latency related to transmission lengths”, (ii) a feedback loop to the controller 106 in order to send it “coordination information”, and (iii) the controller has a microprocessor and memory with programmable instructions. EX-1005, [0074], [0030]-[0031], [0040]; EX-1003 ¶¶126-127.

Larson does not disclose the details in implementing RTP in its videoconferencing system for determining current RTD for each logical two-way

connection (element [1.2]). However, as acknowledged by the '823 Patent (and a different patent naming the same inventors), POSITAs understood that, in typical endpoint-to-endpoint videoconferencing sessions, the respective signals sent over each logical connection “include both the video signal (e.g. carried in Real Time Protocol-RTP) and round trip delay (RTD) information on the RTP flow (e.g. derived from RTP Control Protocol RTCP).” §V.A (EX-1001, 4:42-48, 4:5-9, 4:59-62; EX-1010, 2:36-40, 4:30-40, 5:4-32, 5:44-50, FIG. 1). In addition, it was textbook knowledge (i) that the delay sensitivity of videoconferencing applications made RTD an important network parameter to measure for each terminal-to-terminal connection, and (ii) to use standardized information provided in RTCP reports to determine the initial (*i.e.*, undelayed) RTD for each logical connection, especially in videoconferencing systems, and throughout a multi-party communication session. §V.G.2 (EX-1006, 33, 101, 105-106, 170, 285; EX-1011, 31, 33-34, FIG. 2; EX-1021, 34; EX-1020, 1-2; EX-1019, 1-3). Thus, POSITAs understood that Larson’s implementation of RTP included determining an undelayed RTD for each said logical two-way connection. EX-1003, ¶¶127-130.

To the extent Patent Owner asserts that Larson does not explicitly state that it determines an undelayed RTD for each said logical two-way connection, it would have been obvious to modify Larson’s teachings with Cai’s teachings of dynamically determining the undelayed RTD of each interactive application connection, and using

standardized techniques for doing so with RTP, as discussed in the Motivation to Combine Teachings section, above. POSITAs would have been confident that having Larson's videoconferencing terminals (*e.g.*, 418-1, 418-2, 418-4, 418-N) communicate standardized RTCP receiver reports for each logical connection (*e.g.*, 418-1-to/from-418-N, 418-2-to/from-418-4, 418-N-to/from-418-4, etc.), when each terminal has respectively received RTP packets over a respective connection during a respective reporting interval, provides the readily apparent and predictable benefit of using the standardized and conventional control protocol (RTCP) for Larson's disclosed multimedia transport protocol (RTP) in its standardized and conventional way, and having Larson's controller receive such standardized RTCP reports (*e.g.*, as part of its "coordination information") to dynamically determine RTDs of each logical connection in the standardized and conventional way, achieves the widely understood and predictable benefits of having the controller receive additional feedback information (i) that was well-understood to be an important network parameter to monitor during Larson's delay-sensitive videoconferencing sessions, and (ii) to further inform decision-making while implementing Larson's "avoiding coincidence" solution. EX-1005, [0017]-[0019], [0031]; §V.G.2, §VII.A.3 (EX-1006, 101-106, 285; EX-1011, 31, 33-34, FIG. 2; EX-1019, 2-3; EX-1020, 1-2; EX-1007, 164-165; EX-1009, 14(§4.1)), EX-1003, ¶¶131-132.

**iv. [1.3] determining the maximum round trip delay
among all said logical two-way connections,**

As explained in [1.1] and [1.2], POSITAs understood Larson disclosing implementing RTP in its standardized and conventional way, including to transport the compressed video data in each stream over the packet network, and to establish logical two-way connections between each pair of its video conferencing terminals, and it would have been obvious to POSITAs for Larson to use standardized RTCP reports, and to have Larson's controller dynamically determine RTDs of each logical connection (as taught by Cai) from such reports in the standardized and conventional way. Larson discloses (i) that the different connections between "[videoconferencing] terminals at different locations" (e.g., co-located 418-1 and 418-2, different locations 418-4, 418-N) may have different "latency related to transmission lengths" – i.e., it expressly recognizes the well-known "heterogeneous packet network connection" problem (see §V.G.3) –, (ii) a feedback loop to the controller 106 in order to send it "coordination information", and (iii) the controller has a microprocessor and memory with programmable instructions. EX-1005, [0074], [0030]-[0031], [0040]; EX-1003 ¶¶133-134.

As explained in §VII.A.1 and [1.7], like the '823 Patent, Larson discloses solving the problem of simultaneous traffic peaks (annotated red) in multiple compressed video streams (annotated purple), in a multi-party videoconferencing application (e.g., 418-1, 418-2, 418-4, 418-N) environment implemented over a packet network, with its

disclosed solution that intentionally applies a controlled delay (annotated light green below) to the transmission of one or more of the streams (e.g., stream 107-2 from 418-2 to 418-4, stream 107-N from 418-N to 418-4), while not increasing the delay of the other (e.g., stream 107-1 from 418-1 to 418-4), to avoid coincidence in their data peaks:

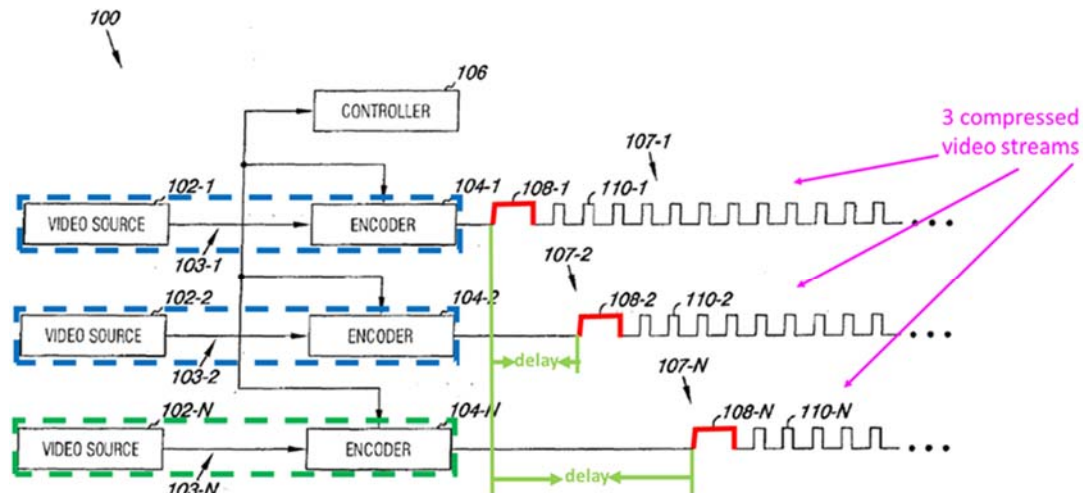


Fig. 1

§VII.A.1, [1.7] (EX-1005, [0005], [0019], [0020], [0030]-[0031], [0033]-[0034]); EX-1005, [0067] (“encoders illustrated in FIG. 4 can function substantially as described with regard to FIG[] 1”), [0068] (same for “controller 406”), [0070] (“Transmission of video sources can be coordinated between the number of sites as described in the present disclosure.”), [0071] (“the controller can coordinate encoding of the video sources such that transmission of an I-frame from, for example, a first video source is completed before a transmission of an I-frame from a second video source is initiated.”)

Given that Larson discloses that its “avoiding coincidence” solution was to be used to improve the performance and user experience of a multi-party videoconference

being implemented over a packet network, POSITAs reading Larson would understand that it would **not** select to intentionally delay transmission of a video stream that would worsen such performance and user experience. §VII.A.1; §VII.A.3; EX-1003, ¶¶135-136. And, given that it was textbook knowledge that (i) RTDs in the different terminal-to-terminal connections are different from each other and changing over time in packet networks (as also recognized by Larson), and (ii) the delay sensitivity of videoconferencing applications made RTD an important network parameter to measure for each terminal-to-terminal connection, POSITAs reading Larson would understand that, if additional delay was intentionally added to the video stream in the connection with the current maximum (longest) RTD (*e.g.*, to stream 107-1 in connection between terminals 418-1 and 418-N), then the result would be worsening the experience for that videoconference 418-N participant (and more likely causing that connection to be dropped), while leaving “unused” bandwidth (available from the connection(s) with less than the current maximum RTD (*e.g.*, connection between terminals 418-2 and 418-4)), both results of which are contrary to expressly stated purposes of Larson’s “avoiding coincidence” solution. EX-1005, [0005], [0018], [0020], [0073]-[0074]; §VII.A.3, §V.G.2-§V.G.3 (EX-1006, 32-36, 38-39, 101-106, 170, 184, 209, 285; EX-1021, 26, 34, 36-37, 135; EX-1007, 15, 37, 128, 164-165; EX-1019, 1-3; EX-1020, 1-2; EX-1008, 1122, 1125-1129; EX-1009, 11, 14(§4.1)). In other words, POSITAs understood that in implementing Larson’s “avoiding coincidence” solution, especially in scenarios where

the various connections have widely disparate determined RTTs and with an RTT approaching the well-known usability limit for interactive applications (300ms), you may cause more problems than you are solving if you do not continually “smooth” (homogenize) the delays in the various terminal-to-terminal videoconference connections so that Larson’s intentional addition of delay(s) to video stream(s) in one or more connections does not cause delays in one connection (*e.g.*, between terminals 418-1 and 418-N) to get excessive (especially if other connection(s) has/have the ability to absorb some additional delay). *Id.*; EX-1003, ¶¶137-138.

Given also that dynamically determining a current maximum RTD among the various logical connections (as taught by Cai), and using this value as the criteria for selecting the connection(s) to intentionally apply a controlled delay (namely to the video stream(s) (*e.g.*, stream 107-2) in the connection(s) that currently have RTDs less than this value (*e.g.*, connection between terminals 418-2 and 418-4)) (as also taught by Cai), was a known solution to the well-known heterogeneity problem existing in implementing multi-party, delay-sensitive videoconferencing applications over packet networks (like Larson’s), selecting this known solution – to avoid increasing the determined current maximum RTD (*e.g.*, stream 107-1 connection between terminals 418-1 and 418-N) – among a finite number of network parameters from which this selection decision could be made, would be a mere design choice to POSITAs with known and predictable benefits including reducing the delay variance across the various

videoconference connections while also homogenizing the different participant experiences (by homogenizing the respective delays), reducing buffering costs, and reducing the playout buffer for the video sources. EX-1009, 11, 12 (“Real-Time Collaboration” section), 14(§4.1)); §V.G.3, §VII.A.3 (*Id.*; EX-1008, 1122, 1125-1129); *compare* EX-1001, 1:66-2:7; EX-1003, ¶139.

v. [1.4] preparing each of said data streams for transmission over respective said logical connections from a said near endpoint to a said far endpoint,

Larson discloses “two or more uncompressed video streams 103-1, 103-2..., as illustrated in FIG. 1, having predictable bandwidth requirements, can be compressed into a number of I-frames 108-1, 108-2... and P-frames 110-1, 110-2..., respectively” [*preparing each of said data streams for transmission*], which, as explained in [1.1] and [1.3], Larson discloses as subsequently being a compressed video stream 107-1 sent over the logical connection between, for example, terminal 418-1 [*from a said near endpoint*] and terminal 418-N [*to a said far endpoint*], and a compressed video stream 107-2 sent over the logical connection between, for example, terminal 418-2 [*from a said near endpoint*] and terminal 418-4 [*to a said far endpoint*]. EX-1005, [0028], [0022]-[0024], [0030]; FIG. 1; EX-1003, ¶140.

vi. [1.5] determining the location of said data peaks in said data streams,

Larson discloses the controller determines the location of the respective I-frame in each of the compressed video data streams that are being prepared for transmission

(*i.e.*, prior to transmission) and in order to determine if they will overlap [*determining the location of said data peaks in said data streams*]. Like the '823 Patent's assumption that, at the time **before** the system introduces the controlled delay (*i.e.*, before it performs the "**desync** function"), the video data from the corresponding source(s) of the video streams are "synchronized" in the sense that the video streams **will** have coincident peaks (I-frames) at a given time, Larson recognizes the importance of the controller knowing **when** these simultaneous traffic peaks **will** occur among the different compressed video streams and, accordingly, Larson discloses that, in order "to transmit **later** I-frames in a non-overlapping fashion", "[o]ne or more methods of maintaining synchronization of... transmitting video streams may be implemented." EX-1005, [0022], [0038]-[0039]; [0031] ("the plurality of encoders can provide **coordination information** to the controller 106"), [0032] ("each encoder can continue to transmit more than one group of pictures such that **after the end of the first group of pictures, a new group of pictures is transmitted, which can begin with another I-frame (not shown). Continuing coordination of transmission** may be facilitated by, for example, encoding each video stream with a common number of pictures in their respective groups of pictures. Thus, I-frames can be generated by initiating encoding and by **reaching the end of a group of pictures (e.g., starting a new group of pictures).**"), [0048], [0050]-[0051], [0060]-[0061]; §V.A (EX-1001, 3:15-25, 3:28-39, 4:49-58, 4:66-5:3, 5:12-13, 5:18-20, 5:27-30, 5:63-65, 6:5-9, FIGS. 3-5). In other

words, just like the '823 Patent, Larson discloses that the controller uses periodically received “coordination information” (*e.g.*, stream content (*e.g.*, GOP) and timing information) for each of the compressed video data streams to determine the location of the respective I-frame in each of the streams that are being prepared for transmission (*i.e.*, prior to transmission) and in order to determine if they will overlap. *Id.*; EX-1003, ¶¶141-142.

**vii. [1.6] transmitting said data streams over said
respective logical two-way connections to said one or
more far endpoints, and**

Larson discloses that, in implementing its avoiding coincidence solution, the controller will coordinate the transmission timing of compressed video stream 107-1 over the respective logical connection between, for example, terminals 418-1 and 418-N, and of compressed video stream 107-2 over the respective logical connection between, for example, terminals 418-2 and 418-4 [*said data streams over said respective logical two-way connections to said one or more far endpoints*]. EX-1005, [0030] (“controller 106 can... stagger initiation of video streams... such that transmission of I-frames in the video streams are non-overlapping[, and]... can coordinate transmission such that an I-frame from only one encoder is allowed to transmit at any given time.”); [0071] (“the controller can coordinate encoding of the video sources such that transmission of an I-frame from, for example, a first video source is completed before a transmission of an I-frame from a second video source is initiated.”); [0031], [0033], [0034]; FIGS. 1, 4; *see also* [1.7] below (for the actual

transmitting); EX-1003, ¶143.

- viii. *[1.7] delaying the transmission of one or more of said data streams that are transmitted over a said logical two-way connection having an undelayed round trip delay less than the maximum round trip delay by an amount dependent on the location of said peaks to reduce the degree of coincidence in the data peaks of different streams without increasing the maximum round trip delay for the logical two-way connections.*

Larson discloses first transmitting (undelayed) one of the data streams (e.g., stream 107-1 that is transmitted over the logical two-way connection between, for example, terminals 418-1 and 418-N), while delaying the transmission of another one (or more) of said data streams (e.g., *delaying the transmission of stream 107-2 that is transmitted over the respective logical two-way connection between, for example, terminals 418-2 and 418-4*) “such that I-frames do not overlap” in these transmitted data streams [*to reduce the degree of coincidence in the data peaks of different streams*]:

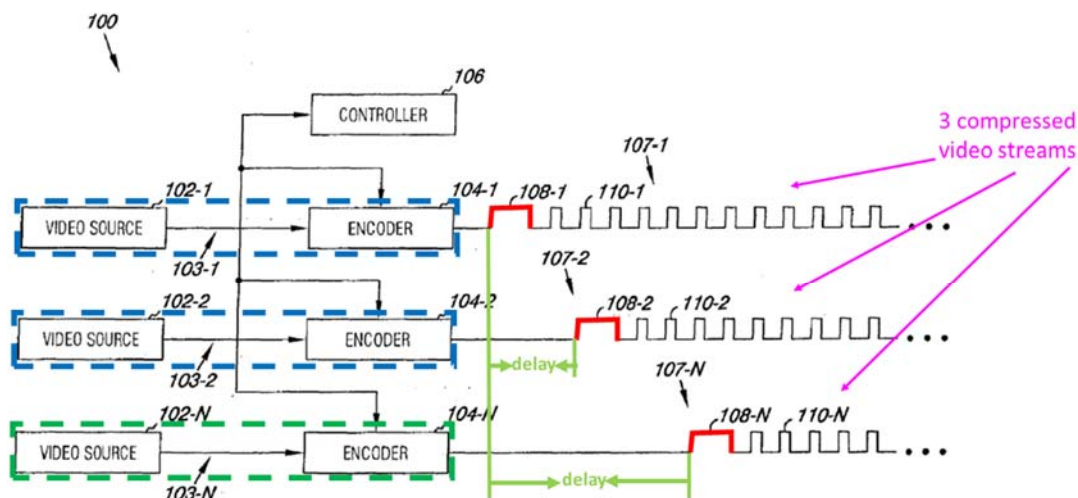


Fig. 1

EX-1005, [0031] (“video streams from encoders can be staggered such that I-frames do

not overlap... [for] example... the video stream 107-1 from encoder 104-1 can start first, **followed by** video stream 107-2 from encoder 104-2...”), [0033]-[0034]; EX-1003, ¶144.

Larson also discloses that the amount of this intentionally added delay can be *an amount dependent on the location of said peaks of different streams* (element [1.7]) and where *the delays are introduced so as to evenly distribute the data peaks in different streams* (claim 6):

[I]nitiation of transmission of the first and second video streams, for example, can be staggered... a controller can stagger video streams by, for example, **an interval proportional to the number of pictures per group of pictures divided by the number of video streams**. For example, an embodiment can use a group of pictures size of 18, and three video sources. In such an embodiment, a controller can stagger initiation of video streams 107 **by $18/3=6$ pictures**. In this example, the controller can **start** the second video stream **six frames after the first**, and can **start** the third video stream **twelve frames after the first**. In this example, **an I-frame can be transmitted at pictures 1, 6, and 12**. The remaining pictures can be, for example, P-frames.

EX-1005, [0037]-[0038], [0039], FIG. 1; EX-1003, ¶145.

As explained in [1.3], POSITAs would recognize that Larson does not go into detail on which stream(s) to delay because (i) POSITAs would have the requisite background knowledge on making this selection, and (ii) it was known in the art that introducing additional delay to the video stream of the connection with the maximum

(longest) current RTD, would make the performance and user experience of the multi-party, delay-sensitive videoconference worse, especially in scenarios where the various connections have widely disparate determined RTTs and with an RTT approaching the well-known usability limit for interactive applications (300ms). §VII.A.3, §V.G.2-§V.G.3 (EX-1006, 32-36, 38-39, 101-106, 170, 184, 209, 285; EX-1021, 26, 34, 36-37, 135; EX-1007, 15, 37, 128, 164-165; EX-1019, 1-3; EX-1020, 1-2; EX-1008, 1122, 1125-1129; EX-1009, 11, 14(§4.1)). Accordingly, as explained in [1.3] and for the reasons discussed in the Motivation to Modify Teaching section above, POSITAs would have been motivated to determine the current maximum RTD among the videoconference connections (as taught by Cai), and to use this value as the criteria for selecting the connection(s) to intentionally apply the controlled delay amount (namely to the stream(s) in the connection(s) that currently have RTDs less than this value (*e.g.*, stream 107-2 in connection between terminals 418-2 and 418-4)), without increasing the delay of the stream having current maximum RTD (*e.g.*, stream 107-1 of the connection between terminals 418-1 and 418-N) (as also taught by Cai). *Id.*; EX-1003, ¶¶146-147.

Further, applying Cai's teachings would simply involve implementing known and standardized solutions to the "heterogeneity" and "delay sensitivity" problems that were well-known to exist in videoconferencing systems like Larson's to achieve known and predictable benefits, including reducing the delay variance across the various videoconference connections while also homogenizing the different participant

experiences (by homogenizing the respective delays) [*without increasing the maximum round-trip delay for the logical two-way connections*] with a reasonable expectation of success. *Id.*; §VII.A.3, §V.G.3 (EX-1008, 1122, 1125-1129; EX-1009, 14(§4.1)); *compare* EX-1001, 1:66-2:7. Additionally, POSITAs would readily recognize that the current maximum RTD was a suitable design choice among a finite number of network parameters from which this selection decision could be made. EX-1003, ¶¶148-149.

b. Claim 2

- i. A method as claimed in claim 1, wherein the transmission of said data streams is delayed so as to remove any coincidence in said data peaks of different data streams.*

Larson discloses this limitation for the reasons discussed regarding element [1.7].

c. Claim 3

- i. A method as claimed in claim 1, wherein the delays introduced into the different data streams are ranked in accordance with the determined round trip delays for each logical two-way connection.*

As explained in [1.3] and [1.7], Larson in view of Cai renders obvious using the current maximum RTD, among the dynamically determined current RTDs of the videoconference connections, as the criteria to select the “one or more of said data streams” to delay to avoid coincidence “in the data peaks of different streams” (*e.g.*, in the respective I-frames of the not delayed stream 107-1 and the delayed stream 107-2). In implementing this known solution for two video streams, POSITAs readily recognized that the current rank order of (1) zero delay to stream 107-1, (2) delay

amount to stream 107-2, is in accordance with (1) current maximum RTD for connection 418-1-to/from-418-N, (2) less than current maximum RTD for connection 418-2-to/from-418-4. *See* [1.7]; EX-1009, 14 (rank of (1) zero delay, (2) delay of $RTT_2 - RTT_1$, because $RTT_1 < RTT_2$); EX-1008, 1122 (“Longest delay first (LDF)... policy uses excess bandwidth to reduce the variance of the delay distribution”). Additionally, in implementing this known solution for three or more video streams, it would have been obvious to POSITAs to, consistent with achieving the known benefits of this known solution (reducing the delay variance across the videoconference connections), dynamically rank the respective added delay amount from most to least (*e.g.*, delay amounts to streams 107-3, 107-2, 107-1) by connections with most to least current excess bandwidth (shortest to longest current RTD). *Id.*; EX-1003, ¶¶151-153.

d. Claim 4

- i. A method as claimed in claim 3, wherein the amount of delay that can be introduced into a data stream is capped at a predetermined value.*

The “maximum tolerable” limit for videoconferencing use was well known to be an RTD of around 300ms. §V.G.2 (EX-1006, 33, 105-106, 170; EX-1021, 26, 34). For the same reasons that POSITAs would not intentionally apply additional delay to the stream in the videoconferencing connection with the current maximum RTD – it would worsen the experience for that participant (and more likely cause that connection to be dropped), while leaving “unused” bandwidth – it would have been obvious to POSITAs implementing Larson’s avoiding coincidence solution to cap the amount of delay that

can be introduced into any stream such that the current determined RTD plus added delay for a connection never exceeded this 300ms limit. *Id.*; see [1.3], [1.7], §VII.A.3; EX-1003, ¶154.

e. **Claim 5**

- i. *A method as claimed in claim 3, wherein the round trip delays are monitored over a period of time, and the rank order is changed as necessary to take into account changing round trip delays.*

Larson discloses this limitation for the reasons discussed regarding elements [1.2], [1.3], claim 3.

f. **Claim 6**

- i. *A method as claimed in claim 3, wherein the delays are introduced so as to evenly distribute the data peaks in different streams.*

Larson discloses this limitation for the reasons discussed regarding element [1.7]. EX-1005, FIG. 1, [0037]-[0038] (for two stream example, discloses I-frames can be transmitted at picture 1 (stream 107-1) and picture 9 (stream 107-2); for three stream example, discloses I-frames can be transmitted at picture 1 (stream 107-1), picture 6 (stream 107-2) and picture 12 (stream 107-2)); EX-1003, ¶156.

g. **Claim 7**

- i. *A method as claimed in claim 1, wherein the logical connections are established between a common source endpoint and multiple destination endpoints.*

Larson discloses “[v]ideo conferencing terminals 418-1, 418-2, 418-3... can be in a same location and connected to the network 420 collectively”, but provides limited

details regarding co-located terminals being part of a common video source. EX-1005, FIG. 4, [0070]. POSITAs would recognize that Larson does not go into detail on implementing its solution for a common video source transmitting the same data to multiple destination endpoints as respective compressed video streams over different connections because, as the '823 Patent acknowledges, a common video source was well-known to be the simplest case for a controller (like Larson's) determining **when** simultaneous traffic peaks **will** occur among the different compressed video streams (as I-frame "peaks... will **always** coincide if the same source streams to multiple destinations") and, accordingly, such implementation is well within the Knowledge of a POSITA. *See* element [1.5]; EX-1001, 2:46-47, 2:50, 3:6-30, 3:27-28. Accordingly, Larson renders this limitation obvious. EX-1003, ¶¶157-158.

h. Claim 8

- i. A method as claimed in claim 1, wherein said data streams represent video streams and said data peaks correspond to I-frames.*

Larson discloses this limitation for the reasons discussed regarding elements [1.0.1], [1.0.3], [1.5].

VIII. DISCRETIONARY DENIAL WOULD BE INAPPROPRIATE

A. Discretionary denial under the *Fintiv* factors is not appropriate.

The Board has discretion to deny institution under 35 U.S.C. §314(a). Related to the Director's June 2022 interim guidance regarding application of the *Fintiv* factors, the Petition is particularly strong in the underlying merits, and Petitioner will not pursue

in co-pending litigation any ground raised in this IPR. Thus, under the Interim Guidance, the Board should not deny institution.

Nevertheless, the Board's decision in *Sotera Wireless, Inc. v. Masimo Corp.*, IPR2020-01019, Paper 12 (Dec. 1, 2020) instructs that a holistic view of the *Fintiv* factors also weighs in favor of institution.

Factor 1 is neutral because no request for stay has been filed.

Under factor 2, the co-pending district court case was filed in the Eastern District of Texas on May 19, 2023, but the original complaint did not include the '823 Patent (EX-1025), which was added in an amended complaint filed November 16, 2023 (EX-1026). Trial is currently scheduled for February 10, 2025 (EX-1027), however, there are currently three other active cases set for jury selection on the same date as the co-pending litigation (EX-1031). *In re Apple Inc.*, 979 F.3d 1332, 1344, n.5 (Fed. Cir. 2020). Due to the inherent uncertainties in scheduling where multiple trials are scheduled for the same trial date, this factor is neutral.

Under factor 3, the co-pending litigation is in its early stages with the *Markman* hearing not scheduled until August 2024. EX-1027, 4. Moreover, Petitioner diligently prepared and filed this Petition within approximately seven months of the Plaintiff first asserting the '823 Patent against it (EX-1026), which "weigh[s] against exercising the authority to deny institution." *Apple Inc. v. Fintiv, Inc.*, IPR2020-00019, Paper 11 at 11 (PTAB March 20, 2020) (precedential).

Under factor 4, there will be no overlap of prior art issues as the co-pending litigation does not involve claims 3-6 challenged herein, and Petitioner stipulates that, if trial is instituted, it will not pursue the same grounds in the litigation. *See Sand Revolution II, LLC v. Cont'l Intermodal Group-Trucking LLC*, IPR2019- 01393, Paper 24 at 12 (PTAB June 16, 2020). Consequently, this factor favors institution.

Factor 5 is neutral because, although Petitioner is a defendant in the litigation, this is “far from an unusual circumstance” for petitioners in IPR proceedings. *Sand Revolution*, Paper 24 at 12-13.

To the extent that the Board finds that factors 1-5 favor discretionary denial, under factor 6, other circumstances, including compelling merits, weigh in favor of institution. The reference combination, Larson in view of Cai, renders obvious the Challenged Claims in view of the Knowledge of a POSITA. Specifically, Larson discloses solving the same “simultaneous traffic peaks in multiple compressed video streams” problem with the same “avoiding coincidence” solution in the same videoconferencing over packet networks environment as the '823 Patent. And, in deciding which compressed video stream(s) to delay while implementing Larson’s solution, it would have been obvious to POSITAs to use known solutions to the delay sensitivity and heterogeneity problems that were well-known to occur in this videoconferencing environment (as taught by Cai) to achieve known and predictable benefits including reducing the delay variance across the various connections while

homogenizing the different participant experiences (as taught by Cai), reducing buffering costs, and reducing the playout buffer for the video sources. This evidence, if unrebutted, shows that it is highly likely that Petitioner would succeed in demonstrating the unpatentability of all claims.

When viewed holistically, the timing of the present Petition is reasonable, there has been relatively limited investment in the co-pending litigation, and there will be no overlap between the present IPR (if instituted) and the litigation. Further, coupling these *Fintiv* considerations with compelling evidence of unpatentability presented in the Petition, the efficiency and integrity of the IPR process is best served by instituting review.

B. Discretionary denial under 35 U.S.C. §325(d) is not appropriate.

Petitioner is unaware of any authority holding *Advanced Bionics* to be satisfied where (like here) the prosecution history lacks discussion of any reference relied upon in this petition. In such situations, the Board routinely does not decline institution on Section 325 grounds. Moreover, the challenges in this petition are non-cumulative because the prior art presented describes the claim limitations that were added to gain allowance (including those expressly acknowledged by the patent to be well-known). *See* §§V.A-VII.A.4.

IX. MANDATORY NOTICES UNDER 37 C.F.R. § 42.8

A. Real Party-in-Interest (37 C.F.R. § 42.8(b)(1))

Petitioner certifies that the real party-in-interest in this Petition is Cisco Systems, Inc.

B. Related Matters (37 C.F.R. § 42.8(b)(2))

1. Judicial Matters

As of the filing date of this Petition and to the best knowledge of Petitioner, the '823 Patent is involved in the following litigation:

Case Heading	Number	Court	Date
<i>Video Solutions Pte. Ltd. v. Cisco Systems, Inc.</i>	EDTX-2-23-cv-00222	EDTX	May 19, 2023

2. Administrative Matters

As of this Petition's filing date and to the best knowledge of Petitioner, the '823 Patent has not been subject to any *inter partes* reviews, reissues, or reexaminations.

3. Related Patents

To the best knowledge of Petitioner, there are no U.S. patent applications nor U.S. patents related to the '823 Patent.

C. Lead/Back-up Counsel (37 C.F.R. § 42.8(b)(3)):

Petitioner provides the following designation of counsel:

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In a concurrently filed Power of Attorney, Petitioner has granted Power of Attorney to Practitioners at Duane Morris LLP.

D. Notice of Service Information (37 C.F.R. § 42.8(b)(4)):

Please direct all correspondence to lead and back-up counsel at the above addresses. Petitioner consents to electronic service at the email addresses above.

X. CONCLUSION

Petitioner requests the Board institute IPR and cancel the Challenged Claims.

Respectfully submitted,

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Dated: June 17, 2024.

CERTIFICATE OF COMPLIANCE

Pursuant to 37 C.F.R. §42.24 *et seq.*, the undersigned certifies that this document complies with the type-volume limitations. This document contains 13,957 words as calculated by the “Word Count” feature of Microsoft Word 2016, the word processing program used to create it. Pursuant to 37 C.F.R. § 42.24(d), this word count excludes the table of contents, table of authorities, mandatory notices under § 42.8, certificate of service, certificate of word count, appendix of exhibits, and any claim listing.

Dated: June 17, 2024

/Christopher J. Tyson/
Christopher J. Tyson
Lead Counsel for Petitioner
Registration No. 63,850

CERTIFICATION OF SERVICE ON PATENT OWNER

Pursuant to 37 C.F.R. §§42.6(e), 42.8(b)(4) and 42.105, the undersigned certifies that on the June 17, 2024, a complete and entire copy of this Petition for *Inter Partes* Review of U.S. Patent 8,446,823 and all supporting exhibits were served via Federal Express, postage prepaid, to the correspondence address of record for the '823

Patent: *Date of service* June 17, 2024

Manner of service FEDERAL EXPRESS

Documents served Petition for *Inter Partes* Review Under 35 U.S.C. § 312 and 37 C.F.R. § 42.104 of U.S. 8,446,823; Petitioner's Exhibit List; All Exhibits; Petitioner's Power of Attorney.

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