

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

CISCO SYSTEMS, INC.

IPR2024-01371
U.S. Patent No. 11,019,372

DECLARATION OF DR. SANDEEP CHATTERJEE
UNDER 37 C.F.R. § 1.68 IN SUPPORT OF
PETITION FOR *INTER PARTES* REVIEW

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EXHIBIT LIST

No.	Exhibit Description
1001	U.S. Patent No. 11,019,372 (“the 372 Patent”)
1002	File History of U.S. Patent No. 11,019,372
1003	Declaration of Dr. Sandeep Chatterjee
1004	CV of Dr. Sandeep Chatterjee
1005	U.S. Patent 7,093,028 (“ <u>Shao-028</u> ”)
1006	U.S. Pub No. 2001/0047423 (“ <u>Shao-423</u> ”)
1007	Preliminary Infringement Contentions (“PIC”)
1008	RFC2507 entitled “IP Header Compression” (published February 1999)
1009	U.S. Pub No. 2004/0125797 (“ <u>Raisanen</u> ”)
1010	Patent Owner’s Reply Claim Construction Brief
1011	U.S. Patent No. 7,478,139 (“ <u>Garafolo</u> ”)
1012	RFC2460 entitled “Internet Protocol, Version 6 (IPv6) Specification” (published December 1998)
1013	<i>Video Multicast over the Internet</i> , Li, Xue et al., IEEE NETWORK, VOL. 13, NO. 2 (published 1999)
1014	Prov. App. 60/647,601
1015	“H.264 and MPEG-4 Video Compression, Video Coding for Next-generation Multimedia,” Iain E. G. Richardson, John Wiley & Sons Ltd. (published 2003)
1016	“Multimedia Communications, Directions and Innovations,” Jerry D. Gibson, Academic Press (published 2001)
1017	“TCP/IP Network Administration,” Craig Hunt, 3 rd edition, O’Reilly (published 2002)
1018	Excerpts from “Microsoft Computer Dictionary,” 5 th edition, Microsoft Press (published 2002)

1019	“Overview of the Scalable Video Coding Extension of the H.264/AVC Standard,” H. Schwarz et al, IEEE TRANSACTIONS ON CIRCUITS AND SYSTEMS FOR VIDEO TECHNOLOGY, VOL. 17, NO. 9, SEPTEMBER 2007
1020	Declaration of Mr. Michael Adams in support of Patent Owner’s Reply Claim Construction Brief
1021	U.S. Pub. No 2005/0141610 (“ <u>Isu</u> ”)
1022	ISO/IEC 14496-2 International Standard, Information technology — Coding of audio-visual objects — Part 2: Visual (published June 2004)

TABLE OF ABBREVIATIONS AND CONVENTIONS

Abbreviation	Meaning
372 Patent	Ex.1001: U.S. Patent No. 11,019,372
IPR	<i>inter partes</i> review
IPv6	Internet Protocol version 6
Petitioner	Cisco Systems, Inc. (“Cisco”)
Patent Owner	Scale Video Coding, Inc. (“SVC”)
Preliminary Infringement Contentions	PIC: Ex.1007
xx:yy–zz	column xx, lines yy to zz

1. I, Sandeep Chatterjee, Ph.D., do hereby declare as follows:

I. INTRODUCTION

2. I am making this declaration in support of Petitioner's request for an *Inter Partes* Review of U.S. Patent No. 11,019,372 ("the 372 Patent") to Zijst.

3. I am being compensated for my work in this matter at my standard hourly rate. I am also being reimbursed for reasonable and customary expenses associated with my work and testimony in this proceeding. My compensation is not contingent on the outcome of this matter or the specifics of my testimony.

4. I have been asked to provide my opinions regarding whether the subject matter of claims 1-3, 5-8, 10-13, and 15 ("the Challenged Claims") of the 372 Patent are anticipated or otherwise would have been obvious to a person having ordinary skill in the art ("POSITA") at the time of the alleged invention, in light of the prior art. It is my opinion that the Challenged Claims would have been obvious to a POSITA.

5. In the preparation of this declaration, I have studied:

- a. the 372 Patent (Ex.1001),
- b. the prosecution history of the 372 Patent ("372 File History") (Ex.1002),
- c. Prov. App. 60/647,601 (Ex.1014),
- d. U.S. Patent 7,093,028 ("Shao-028") Ex.1005,

- e. U.S. Pub No. 2001/0047423 (“Shao-423”) (Ex.1006),
- f. Patent Owner’s Preliminary Infringement Contentions (Ex.1007),
- g. Patent Owner’s Reply Claim Construction Brief at the District Court (Ex.1010),
- h. Declaration of Mr. Michael Adams in support of Patent Owner’s Reply Claim Construction Brief at the District Court (Ex.1020),
- i. The additional references and publications I refer to below and/or identified in the exhibit list.

6. In forming the opinions expressed below, I have considered: the documents listed above; the relevant legal standards, including the standard for obviousness; and my own knowledge and experience based upon my work in the field of network communications and security as described below.

7. Unless otherwise noted, all **emphasis** in any quoted material has been added. Claim terms are *italicized*.

II. QUALIFICATIONS AND PROFESSIONAL EXPERIENCE

8. My complete qualifications and professional experience are described in my *Curriculum Vitae*, a copy of which can be found in Ex.1004. The following is a brief summary of my relevant qualifications and professional experience.

9. I am the Chief Executive Officer of Experantis LLC, a technology consulting company. Previously, I was the Executive Vice President and Chief Technology Officer of SourceTrace Systems, Inc., a technology and services company enabling the delivery of secure remote electronic services over landline and wireless telecommunications networks.

10. I received my Bachelor's degree in Electrical Engineering and Computer Science from the University of California, Berkeley in 1995. I received my master's degree in Computer Science from the Massachusetts Institute of Technology (MIT) in 1997, and my doctorate in Computer Science from MIT in 2001. I received a certificate of completion for an executive education program on global leadership from Harvard University in 2011.

11. My doctoral dissertation at MIT, entitled "Composable System Resources for Networked Systems," involving networked client architectures and systems, was selected as one of the top inventions in the history of MIT's Laboratory for Computer Science. This invention is showcased in a time capsule at the Museum of Science in Boston, Massachusetts. Other recipients of this honor include Bill Gates, the founder of Microsoft, and Tim Berners-Lee, the inventor of the World Wide Web.

12. My Master's dissertation at MIT, entitled "Asynchronous Event Handling," was directed to efficient event handling and communications in a parallel

computing environment where the computing nodes are interconnected by a bidirectional 3-D mesh network.

13. In 2011, I was named a Young Global Leader. This honor, bestowed each year by the World Economic Forum, recognizes and acknowledges the top leaders—all below the age of 40—from around the world for their professional accomplishments, commitment to society, and potential to contribute to shaping the future of the world. In 2016, I was appointed to the World Economic Forum’s expert network as an expert in technology and innovation.

14. From 1997, I was the Entrepreneur-in-Residence at FidelityCAPITAL, the venture capital arm of Fidelity Investments. In 1999, I founded and served as President and Chief Technology Officer (CTO) of Satora Networks, which developed tools and technologies for building appliances and services for the Internet using wireless and other technologies to extend it beyond the desktop.

15. In 2001, I joined Bluestone Software’s Mobile Middleware Labs as a Senior Engineer developing applications and systems infrastructure for enterprise Java/J2EE, Web services, and enterprise mobile solutions. After the completion of Hewlett-Packard’s (“HP”) acquisition of Bluestone, I became a Senior Member of the Technical Staff at HP’s Middleware Division. I was responsible for architecting and developing the company’s next-generation Web services platform for enterprise as well as mobile environments, known as the Web Services Mediator.

16. I was part of the Expert Group that developed the JSR-00172 J2ME (Java 2 Platform, Micro Edition) Web Services Specification, the worldwide industry standard for mobile Web services. I am the co-author, with James Webber, of the book “Developing Enterprise Web Services: An Architect’s Guide” (published by Prentice-Hall in 2004). This book has been adopted by over 100 universities and colleges around the world and has been translated or reprinted in a number of countries around the world.

17. I have extensive experience in architecting, developing, optimizing, deploying and managing computing and networking systems, including mobile, messaging/communications, and multimedia computing systems, including hardware and software for these systems. For example, through a contract between Hewlett-Packard and the United States Agency for International Development (USAID), I architected and led the development of one of the first mobile banking solutions. This system enabled customers to use their mobile phones and other wireless handsets to connect with the core banking systems of banks and other financial institutions and perform transactions without having to travel to bank branches. This system supported many banking transactions, including loan applications, loan disbursement and loan repayments.

18. Later, after SourceTrace Systems’ acquisition of this technology, I led the expansion of this solution into multiple countries and into multiple industries.

Banks and other financial services companies utilized this technology to make their tellers more efficient, to provide self-service kiosks within branches, and to provide remote access to banking services. Additionally, through our licensing agreement with Telefonica, one of the largest cellular and telecommunications companies in the world, this solution was deployed in various other industries, including logistics and asset management and customer relationship management. Bloomberg Television selected the company I had co-founded to commercialize this technology on Bloomberg TV's "Bloomberg Innovators" program.

19. My doctoral research and dissertation involved networked computing hardware and software components that could be used in intelligent environments, e.g., smart homes. These components could be used with consumer electronic devices, e.g., televisions, set-top boxes, refrigerators, digital picture frames, and children's toys, to enable communications and coordination between different devices. At any one consumer electronic device, a number of these hardware components, including computing resources and peripheral resources, could be connected together and connected to the consumer electronic device itself using a bus architecture. One of the applications that I developed as part of my dissertation work was an intelligent television set. These hardware and software components were connected to the television set and would receive and process key presses from a remote control, e.g., power on and channel up. The system would learn the user's

television watching patterns to automate and facilitate the user's interactions with the television. This could include turning the television on at a particular time on a particular day and setting the television to a specific channel. These applications could also stream video and audio content to and between various devices. The technology underlying my doctoral dissertation work was spun out of MIT's Laboratory for Computer Science into a start-up company that developed and commercialized a number of applications of the technology, including intelligent toys and digital picture frames.

20. I have been developing hardware and software, including for communication and networking systems, for nearly thirty years. I have been familiar with cable data technologies, including the DOCSIS protocol and cable network infrastructure (e.g., hybrid-fiber coax networks, CMTSs, and cable modems) since the late 1990's.

21. I have been a retained expert witness for various disputes that involved significant technology issues, and I have been qualified as a technology expert by U.S. District and State Courts, including in California, Delaware, Florida and Texas and at the US International Trade Commission in technology areas that are relevant to this case. I have previously testified through declaration or expert report, at deposition and at trial in numerous intellectual property and commercial litigation

matters, including for patent litigation, copyright and trade secret misappropriation litigation, and contract dispute cases.

III. LEVEL OF ORDINARY SKILL IN THE ART

22. I understand there are multiple factors relevant to determining the level of ordinary skill in the pertinent art, including (1) the levels of education and experience of persons working in the field at the time of the invention; (2) the sophistication of the technology; (3) the types of problems encountered in the field; and (4) the prior art solutions to those problems.

23. Based on the materials and information I have reviewed, and on my experience in the technical areas relevant to the Asserted Patents, a POSITA with respect to the Asserted Patents as of the time of the invention, i.e., the earliest possible priority date of the 372 Patent, January 26, 2005, would have had a working knowledge of telecommunications and networking art, including video encoding, decoding, and routing over the internet that is pertinent to the 372 Patent. A POSITA would have had a bachelor's degree in electrical engineering, computer science, computer engineering, or an equivalent, and two years of relevant experience in telecommunications, networking, and video encoding, decoding, and routing. Lack of professional experience can be remedied by additional education, and vice versa.

24. For purposes of this Declaration, in general, and unless otherwise noted, my statements and opinions, such as those regarding my own experience and what a

POSITA would have understood or known generally (and specifically related to the references I consulted herein), reflect the knowledge that existed in the relevant field as of the priority date of the 372 Patent.

IV. RELEVANT LEGAL STANDARDS

25. I am not an attorney. In preparing and expressing my opinions and considering the subject matter of the 372 Patent, I am relying on certain basic legal principles that counsel has explained to me.

26. I understand that prior art to the 372 Patent includes patents and printed publications in the relevant art that predate the priority date of the 372 Patent. For purposes of this Declaration, I am applying January 26, 2005, as the priority date of the 372 Patent, but I take no position on that issue.

27. I have been informed by counsel that a claimed invention is invalid if it is “anticipated” by the prior art. I understand that, for a patent claim to be “anticipated” by the prior art, each and every requirement of the claim must be found, expressly or inherently, in a single prior art reference as recited in the claim. I understand that claim limitations that are not expressly described in a prior art reference may still be there if they are “inherent” to the thing or process being described in the prior art.

28. I understand that if a reference incorporates other documents by reference, the incorporating reference and the incorporated reference(s) should be treated as a single prior art reference for purposes of analyzing anticipation.

29. I understand that it is acceptable to consider evidence other than the information in a particular prior art document to determine if a feature is necessarily present in or inherently described by that reference.

30. I have been informed by counsel that a claimed invention is unpatentable under 35 U.S.C. § 103 if the differences between the claimed invention and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a POSITA. I have also been informed by counsel that the obviousness analysis considers factual inquiries, including the level of ordinary skill in the art, the scope and content of the prior art, and the differences between the prior art and the claimed subject matter.

31. I have been further informed by counsel that there are several recognized rationales for combining references or modifying a reference to show obviousness. These rationales include: (a) combining prior art elements according to known methods to yield predictable results; (b) simple substitution of one known element for another to obtain predictable results; (c) use of a known technique to improve a similar device (method, or product) in the same way; (d) applying a known technique to a known device (method, or product) ready for improvement to yield

predictable results; (e) choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success; and (f) some teaching, suggestion, or motivation in the prior art that would have led a POSITA to modify the prior art or to combine prior art teachings to arrive at the claimed invention.

V. OVERVIEW OF THE 372 PATENT

32. The 372 Patent issued from an application (U.S. Patent Appl. No. 15/010,573) filed on January 26, 2016 and states that it claims priority to US Pat. No. 9,414,094 (filed September 14, 2012), US Pat. No. 8,514,718 (filed June 17, 2009), US Pat. No. 7,733,868 (filed January 26, 2006), and Prov. App. 60/647,601 (filed: 01/26/2005). Ex.1001, 1:5-16. I have been asked to assume that **January 26, 2005** is the effective filing date, but, for purposes of this Declaration, I take no position on that issue.

33. I have reviewed the file history of the 372 Patent, including that of the aforementioned U.S. Patents, to which the 372 Patent claims priority.

34. The 372 Patent is generally related to a network management system that purportedly handles packet loss and network congestion problems in multicast networks. Ex.1001, Abstract. The 372 Patent describes an embodiment in which “the overlay network includes a number of software implemented routers connected by normal IP or TCP connections. A mesh is created in which every software router is connected to one or more other software routers by means of virtual connections that

appear to be direct connections to the other software routers, but are likely implemented by a number of intervening traditional TCP/IP routers situated between the software routers. Two routers that are connected this way, are adjacent in the perspective of the overlay, but in reality are many physical hops away from one another. Also, a software router that has three software router neighbors has three independent virtual links. However, it is possible that this software router only has a single physical network connection that is shared by the three virtual links.” Ex.1001, 3:27-41.

35. Because routers “use the packet priority numbers when making forwarding selections on congested parts of the network, a source carefully divides its data packets over different layers or priorities, in a way that a subset of the layers still contain a useful, uncorrupted representation of the data.” Ex.1001, 21:53-61. Thus, “[w]hen an outgoing link of a router has insufficient bandwidth to transmit all pending packets, it forwards only those packets with a designated priority or the highest priority.” Ex.1001, 21:38-47. As a result, receivers that are on congested parts of the network will then receive the highest priority parts of the data only. The 372 Patent describes that the purported benefit of this approach is that “it eliminates the need to lower the publishing rate to match the slowest receiver, while still being able to offer live, uncorrupted, thinned data streams to clients suffering from insufficient bandwidth.” Ex.1001, 21:61-66.

36. However, the concept of receiving “layered video” transmissions was well-known. As admitted in Prov. App. 60/647,601 (to which the 372 Patent claims earliest priority) dividing a data stream into multiple layers and allowing receivers to receive as many layers as their capacities permit was an active area of research.

Furthermore, the use of “sequence numbers” to detect packet loss was well-known.

This concept of layering a live multicast stream and allowing receivers to receive as many layers as bandwidth capacities permit, is an active area of research. One of the pioneers of layered multicast schemes are Steven McCanne and Van Jacobson who in 1996 divided a data stream in layers that were sent to separate IP multicast addresses. As long as bandwidth is available, McCanne's receivers

¹⁴ A data stream in Terracast is identified by its source address. For unicast streams this is the combination of unicast node address and a local tport. A multicast stream is identified by its multicast group name .

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would subscribe to more and more layers until packet loss is detected. Loss of packets is detected by appending incremental sequence numbers to the packets and is interpreted by receivers as a lack of sufficient bandwidth or network congestion. To safeguard the quality of the layers, the algorithm unsubscribes a layer as soon as packets are being missed. Aside from layered protocols, there is also active research in content and applications that would benefit from network functionality such as proposed by McCanne. Examples are audio and video codecs that divide live multimedia content over layers to enhance the user experience over wide area networks

Ex.1014, 50-51.

37. Furthermore, as demonstrated below, prior to the earliest effective filing date of the 372 Patent, it was well-known in the prior art for routers to implement a scalable architecture to facilitate transmission of packets containing video data over the Internet, *e.g.*, by dropping lower priority packets or otherwise selectively forwarding certain packets.

VI. CLAIM CONSTRUCTION

38. It is my understanding that in order to properly evaluate the 372 Patent, the terms of the claims must first be interpreted. It is my understanding that for the purposes of this *inter partes* review, the claims are to be construed under the so-called *Phillips* standard, under which claim terms are given their ordinary and customary meaning as would have been understood by a POSITA in light of the specification and prosecution history, unless the inventor has set forth a special meaning for a term. I have also been informed that claim terms only need to be construed to the extent necessary to resolve the unpatentability inquiry. However, I understand that Patent Owner is asserting in the district court litigation that no terms require construction, so that is the approach I take below, unless otherwise noted.

VII. IDENTIFICATION OF HOW THE CLAIMS ARE UNPATENTABLE

39. The discussion in this Declaration provides a detailed analysis of how the asserted prior art teaches each limitation of the Challenged Claims.

40. As part of my analysis, I have considered, and discuss in detail, the scope and content of the prior art and any differences between the alleged invention and the prior art.

41. It is my opinion that the alleged invention recited in the Challenged Claims would have been obvious in view of the teachings of the asserted prior art and the knowledge of a POSITA, as I demonstrate in detail below.

VIII. TECHNOLOGY BACKGROUND

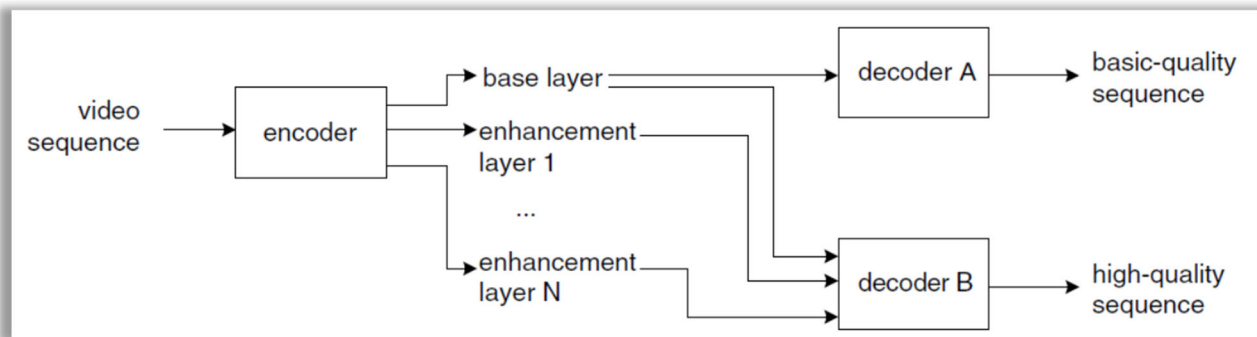
42. As I explain next, the technology disclosed and claimed in the '372 Patent was well-known to a POSITA by the earliest possible priority date of the '372 Patent, January 26, 2005.

1. Scalable Video Coding Was Already Part of the MPEG-4 Video Coding Standard

43. On or around July 1993, the Moving Picture Experts Group (MPEG), set up by the International Standards Organization (ISO), launched a project to develop the MPEG-4 video coding standard covering compression techniques for audio and video, and subsequently published the H.264/MPEG-4 Part 10 ('Advanced Video Coding') standard in 2003. Ex.1015, Table 4.2, see also *id.*, pp. 86-88.

44. The MPEG-4 standard specified scalable encoding¹⁴ of video data that “enables a decoder to decode selectively only part of the coded bitstream. The coded stream is arranged in a number of layers, including a ‘base’ layer and one or more ‘enhancement’ layers.” Ex.1015, p. 142. As illustrated in the figure below, according to MPEG-4, the coded bitstream at the output of the encoder is arranged in a number of layers, including a “base” layer and one or more “enhancement” layers, labeled enhancement layer 1, enhancement layer 2, ... enhancement layer N. In this example, decoder A receives only the base layer and can decode a “basic” quality version of the video scene, whereas “decoder B receives all layers [(i.e., the base layer and all of the enhancement layers)] and decodes a high-quality version of the scene.” Ex.1015, p. 142. This has a number of applications. In one application, for example, “a low-complexity decoder may only be capable of decoding the base layer.” Ex.1015, p. 142. In another application, “a low-rate bitstream may be extracted for transmission over a network segment with limited capacity.” Ex.1015, p. 142. And in yet another application, “an error-sensitive base layer may be transmitted with higher priority than enhancement layers.” Ex.1015, p. 142.

¹⁴ Scalable video encoding was available in earlier MPEG standards, such as MPEG-2. See, e.g., Ex.1016, p. 10.



Ex.1015, Fig. 5.57. The MPEG-4 standard supports a number of scalable coding modes. Ex.1015, p. 142. *See also, e.g.,* Ex.1019, 1103, 1104, 1113. Spatial scalability enables a (rectangular) VOP¹⁵ to be coded at a hierarchy of spatial resolutions. Decoding the base layer produces a low-resolution version of the VOP and decoding successive enhancement layers produces a progressively higher-resolution image. Temporal scalability provides a low frame-rate base layer and enhancement layer(s) that build up to a higher frame rate. The standard also supports quality scalability, in which the enhancement layers improve the visual quality of the VOP and complexity scalability, in which the successive layers are progressively more complex to decode. Further, Fine Grain Scalability (FGS) enables the quality of the sequence to be increased in small steps. An application of FGS is streaming

¹⁵ The MPEG-4 video coding standard treats a video sequence as a collection of one or more video objects. MPEG-4 defines a video object as a flexible entity that a user is allowed to access (seek, browse) and manipulate (cut and paste). A video object (VO) is an area of the video scene that may occupy an arbitrarily-shaped region and may exist for an arbitrary length of time. An instance of a VO at a particular point in time is a video object plane (VOP). Ex.1015, p. 103.

video across a network connection, in which FGS is advantageously used to scale the coded video stream to match the available bit rate as closely as possible. Ex.1015, p. 142.

45. More specifically, FGS is a method of encoding a sequence as a base layer and enhancement layer. The enhancement layer can be truncated during or after encoding (reducing the bitrate and the decoded quality) to give highly flexible control over the transmitted bitrate. FGS may be useful for video streaming applications, in which the available transmission bandwidth may not be known in advance. Ex.1015, p. 145. In a typical FGS application, a sequence is coded as a base layer and a high-quality enhancement layer. Upon receiving a request to send the sequence at a particular bitrate, a streaming server transmits the base layer and a truncated version of the enhancement layer. The amount of truncation is chosen to match the available transmission bitrate, which facilitates maximizing the quality of the decoded video sequence without the need to re-encode the video clip. Ex.1015, p. 145.

46. Furthermore, as confirmed by the ISO/IEC 14496-2 International Standard (Ex.1022), MPEG-4 video using FGS (which I explain above encodes a video sequence as a base layer and enhancement layer) included functionality similar to the “*layer identifier*” in the claims. Specifically, this document (published in June 2004) states that FGS-encoded video using “unique codes” defined for “FGS Object

Type” for indicating enhancement layers and a “unique code” defined for “AS Object Type” for indicating the base layer. And, therefore, a POSITA would have recognized that such “unique codes” in MPEG-4 are “*based upon ... layer[s]*” and therefore provided functionality as described by the “*layer identifier*.”

The code value of **profile_and_level_indication** in VisualObjectSequence() has been extended to include the profile and level indications for AS Profile and FGS Profile. The identifier for an enhancement layer is the syntax **video_object_type_indication** in VideoObjectLayer(). A unique code is defined for FGS Object Type to indicate that this VOL contains fgs vops. Another unique code is defined for AS Object Type to indicate that this VOL is the base-layer. There is a syntax **fgs_layer_type** in VideoObjectLayer() to indicate whether this VOL is an FGS layer as shown in Figure 0-6 and Figure 0-7, or an FGST layer as shown in Figure 0-7, or an FGS-FGST layer as shown in Figure 0-8. Similar to the syntax structure in subclause 6.2, under each VOL for FGS, there is a hierarchy of fgs vop, fgs macroblock, and fgs block. An fgs vop starts with a unique **fgs_vop_start_code**. Within each fgs vop, there are multiple vop-bps. Each vop-bp in an fgs vop starts with an **fgs_bp_start_code** whose last 5 bits indicate the ID of the vop-bp. In each fgs macroblock, there are 4 block-bps for the luminance component (Y), 2 block-bps for the two chrominance components (U and V) for the 4:2:0 chrominance format. Each block-bp is coded by VLC.

Ex.1022, p. 17; *see also infra* ¶159; US Pub No 2005/0141610 to “Isu” (Ex.1021).

2. Transcoding Video at Network Routers Was Known

47. Transcoding of streaming video to multiple users was a common application prior to the earliest possible priority date of the '372 Patent. In fact, around this time, network connection speeds ranged from a few tens of Kilobits per second to more than 100 Megabit per second, and the media that comprised these channels ranged from optical fiber and coaxial cable through copper wire pairs and free space. The terminals were high-end workstations with large displays, desktop personal computers, battery-powered laptops, and personal digital assistants that had small black-and-white displays. Ex.1016, p. 9.

48. For streaming video to multiple users, the differences in network bandwidth and heterogeneity of devices are important considerations. For example, to directly stream a video stored in MPEG-2 format would require the network to support a rate of 4-10 Megabits per second, which would not be compatible with many of the network connections discussed above. Ex.1016, p. 10.

49. One approach to streaming video to multiple users that was known prior to the earliest possible priority date of the '372 Patent was “to use a layered coder ... [t]hat is, you would choose a video coder that allows multiple compression rates that can be obtained by incrementally improving the base layer. Coders that have this capability are sometimes said to be *scalable*. MPEG-2 has several scalability options, including signal-to-noise ratio (SNR), spatial, and frame rate scalability.” Ex.1016, p. 10. For example, one or more of these options could be used and combined with multicasting¹⁶ to create (say) three multicast groups. The first group would be the baseline coded layer, and the other two would use scalability to create incremental improvements in output quality as users join the remaining two multicast groups. Essentially, users on congested links could reduce the rate by reducing the number of multicast groups that they join. Ex.1016, p. 10.

¹⁶ The term “multicast” is generally understood to mean: “[t]he process of sending a message simultaneously to more than one destination on a network.” Ex.1018, p. 352.

50. Alternatively, another approach to establishing interoperability between networks having different bandwidth capabilities was to “transcode at network gateways.”¹⁷ Ex.1016, p. 11. A POSITA would have understood a “network gateway” to include a “router.”¹⁸ In fact, Figure 1.3 accompanying the above passage depicts “routers” connecting networks with different bandwidth capabilities. Ex.1016, Figure 1.3.

51. Transcoding at “network gateways” is different from the multicast example above. In the multicast example, client devices choose to join one or more multicast groups based on their determination of network bandwidth. For transcoding at network gateways (including routers), the gateway determines the network bandwidth and transcodes the video stream appropriately. For example,

¹⁷ The term “gateway” is generally understood to mean: “[a] device that connects networks using different communications protocols so that information can be passed from one to the other. A gateway both transfers information and converts it to a form compatible with the protocols used by the receiving network.” Ex.1018, p. 232.

¹⁸ The term “router” is generally understood to mean: “[a]n intermediary device on a communications network that expedites message delivery. On a single network linking many computers through a mesh of possible connections, a router receives transmitted messages and forwards them to their correct destinations over the most efficient available route. On an interconnected set of LANs (local area networks)—including those based on differing architectures and protocols—using the same communications protocols, a router serves the somewhat different function of acting as a link between LANs, enabling messages to be sent from one to another.” Ex.1018, p. 458.

“transcoding to a lower rate will yield lower quality, smaller frame size, and/or slower frame rate.” This transcoding can be done in multiple ways. One such approach was to “completely decode back to video and then re-encode the video at a lower rate.” Another approach was to “directly map the encoded stream, or at least the decoded parameters, directly into a lower-rate-coded version.” Ex.1016, p. 11.

3. Sequence Number in Packet Headers was known

52. Using sequence numbers in headers of IP packets was known. For instance, Transmission Control Protocol (TCP), a protocol layer just above the Internet Layer specifies use of the “Synchronize sequence numbers” (SYN) bit set. Upon host A sending a segment with the SYN bit set to Host B, this segment informs host B that host A wishes to set up a connection, and further informs host B what sequence number host A will use as a starting number for its segments.” Ex.1017, pp. 19-20. “Sequence numbers are used to keep data in the proper order.” Ex.1017, p. 20. The Sequence Number field in the SYN segment contains the Initial Sequence Number (ISN), which is the starting point for the byte-numbering system. Ex.1017, p. 20. For example, if the first byte in the data stream was sequence number 1 (ISN=0) and 4000 bytes of data have already been transferred, then the first byte of data in the current segment is byte 4001, and the Sequence Number would be 4001. Ex.1017, p. 21.

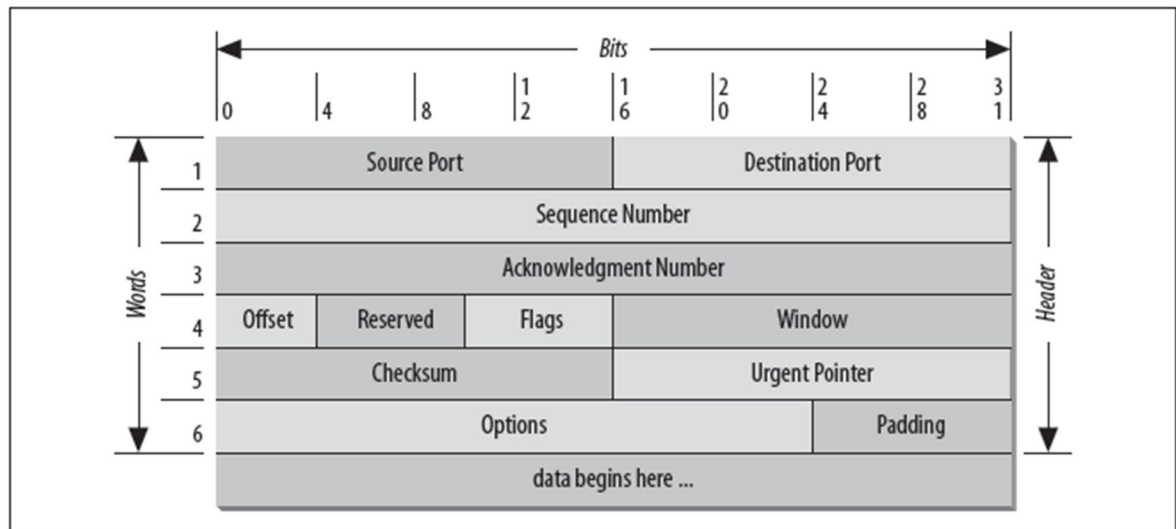


Figure 1-9. TCP segment format

Ex.1017, Figure 1-9.

IX. THE PRINCIPAL PRIOR ART

1. Summary of Shao-028

53. Shao-028, a Microsoft reference, is generally directed to a scalable video transmission scheme for selectively transmitting video data based on the type of information included in the video data in response to dynamically changing network conditions and/or client preferences. Ex.1005, 1:8-12. Shao-028 recognizes that video objects typically include “different types of video object information, such as, *e.g.*, control information, shape information, motion information and texture information,” based upon which, Shao-028 associates a “transmission priority level” to the information. Ex.1005, 2:44-29, 8:30-33.

54. Shao-028 discloses a video transmission agent (VTA), *e.g.*, implemented as a component of a router or gateway, a server or part of a server

Ex.1003

attaching to a router, “receive[s] video data bitstreams, filter[s] the received data bitstream by selectively discarding data packets having lower priorities, and send[s] the resulting filtered data bitstream to a client 13 and/or a next (downstream) VTA 84.” Ex.1005, 13:24-26, 13:10-15. Shao-028 explains that the video data bitstreams comprise media objects encoded “using I, P, B, and enhancement frame layers.” Ex.1005, 5:6-10. “VTAs will filter out data packets from upstream according to downstream requirements (e.g., according to the network link and a particular clients capabilities). For example, data packets containing texture information for a particular video object may be dropped by the VTA.” Ex.1005, 10:26-30. Should the network become congested, as recognized by a router implementing a VTA, “data packets having lower priority levels are selectively dropped” Ex.1005, 3:11-16, 9:12-27, 8:57-60. Further, Shao-028 provides an example in which data packets transmitted using the “Ipv6 protocol.” In Shao-028’s “scalable video ... transmission scheme[,] ... media objects ... in a video frame, or portions thereof, are associated with various differential priorities during transmission.” Ex.1005, 8:26-29. A Network header (NPH) of a data packet identifies the transmission priority level and includes an object identifier, a part number, and a starting position. Ex.1005, 9:32-40. Shao-028 explains the benefit of implementing VTAs by contrasting the filtering functionality of VTAs with a “traditional video filter.” A traditional video filter “needs to implement decoding and re-encoding to complete

the filtering. [H]owever, the VTAs can implement the filtering by only discarding some less important packets in a much simpler and faster fashion than traditional filters.” Ex.1005, 13:62-67. Shao-028 teaches an implementation using “MPEG-4 video encoding/decoding source code and Ipv6 protocol stack source codes.” Ex.1005, 14:1-5.

2. Summary of Shao-423

55. Shao-423, another Microsoft reference by the same inventor as Shao-028, generally relates to “scalable ... multimedia communication techniques within a heterogeneous network and user environment.” Ex.1006, [0016]. Analogous to the teachings in Shao-028, Shao-423 recognizes that “[d]ifferent types of information within a compressed bitstream can have different importance levels” and an encoder implementing layered coding can “output one base layer and several enhancement layers.” The information of the base layer, which has the highest transmission priority, is much more important than that of the enhancement layers. Ex.1006, [0105]-[0106].

56. Shao-423 teaches a “general transport framework architecture ... suitable for use by ... multimedia applications ... using MPEG-4” and further provides “an IPv6 header ... as an example to explain how to define such an identifier.” Ex.1006, [0102]. Specifically, Shao-423’s exemplary IPv6 header includes a “flow label field” (comprising a “layer identifier”) and used as an

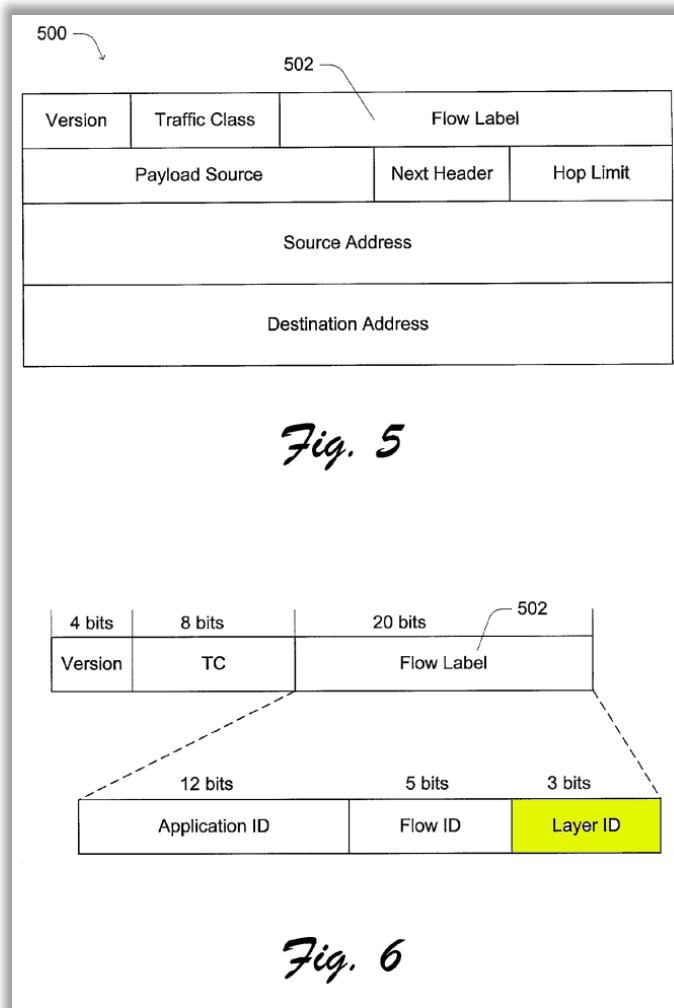
“Application-Flow-Layer Identifier. According to Shao-423, this Application-Flow-Layer Identifier can be used by [application-aware resource controllers] ARCs and [media processing agents] MPAs,” which are network components providing similar functionality as routers. Ex.1006, [0050], [0053]. In Shao-423’s exemplary header, the “flow label field” includes a 3-bit “layer identifier.” Ex.1006, [0102]-[0103]. Shao-423’s methods provide improved multimedia communications, *e.g.*, by achieving optimal playback quality of a video bitstream under resource and cost constraints. Ex.1006, [0010], [0108].

3. The Combination of Shao-028 and Shao-423

57. To the extent one asserts that Shao-028 does not expressly disclose a “*layer identifier*,” it would have been obvious to include that functionality in data packets using the scalable video transmission scheme of Shao-028 in view of Shao-423, as demonstrated below. Initially, Shao-028 and Shao-423 both teach use of Internet Protocol version 6 (IPv6) and MPEG-4 for their video transmission methods over the Internet. Specifically, Shao-028 teaches an implementation using “MPEG-4 video encoding/decoding source code and Ipv6 protocol stack source codes.” And Shao-423 teaches a “general transport framework architecture ... suitable for use by ... multimedia applications ... using MPEG-4” and further provides “an IPv6 header ... as an example to explain how to define such an identifier.” Ex.1005, 14:1-5. Ex.1006, [0102].

58. Shao-423 expressly discloses a “*layer identifier*” as part of an exemplary IPv6 header that includes a “flow label field.” For example, Shao-028 explains that although a “Flow label field 502 has not been defined by IETF,” Shao-423 provides an example of how it can be used as an “Application-Flow-Layer Identifier.” Shao-423 explains that “[a]n application-flow-layer identifier is used in a packet to identify the information within the packet. This Application-Flow-Layer Identifier can be used by ARCs and MPAs.” Ex.1006, [0102]. Shao-423 describes ARCs and MPAs as “application-aware resource controller[s]” and “media processing agent[s],” respectively. Ex.1006, [0050].

59. Shao-423 provides that Figure 5 “illustrates an exemplary header 500. Here, an IPv6 header is provided as an example to explain how to define such an identifier.” Ex.1006, [0102]. Shao-423 also explains that Figure 6 “further illustrates one potential specification of the application-flow-layer identifier within the flow label field 502. Here, the 20-bit flow label field is specified as further including a 12-bit application identifier, a 5-bit flow identifier and a **3-bit layer identifier**.” Ex.1006, [0103] (emphasis added). Figures 5 and 6 of Shao-423 are depicted below:



Ex.1006, Figures 5 and 6 (annotated).

60. In the proposed combination, the data packets used in the scalable video transmission scheme of Shao-028 would be modified based on the teachings of Shao-423, and thus the IPv6 header of Shao-028 would additionally include a flow label field 502 taught in Shao-423 comprising “layer ID” (“*layer identifier*”) as depicted above.

61. Shao-028 and Shao-423 are analogous art to the 372 Patent because each is in the field of “network management,” and specifically, “management of data

packets to support multicasting.” *See, e.g.*, Ex.1001, at 1:20-23; *see also* Ex.1005, 1:3-12 (This invention relates generally to data communications and, more particularly, to prioritization methods and arrangements for selectively transmitting object-based data based on data content in response to dynamically changing network conditions and/or client preferences.”); Ex.1006, [0002] (“The present invention relates generally to data communications, and more particularly to improved methods and arrangements that employ novel differentiation techniques for adaptive multimedia unicast and multicast communications.”). Indeed, both Shao-028 and Shao-423 disclose the use of Internet Protocol version 6 (IPv6) for packet transmissions. Ex.1005, 14:1-5, Ex.1106, [0102].

62. Moreover, Shao-028 and Shao-423 are reasonably pertinent to the problem addressed by the 372 Patent, i.e., the problems associated with a bandwidth bottleneck and congestion or that slowing down data may not be an option for all types of data streams sent over the Internet. Ex.1001, 1:55-2:20. Ex.1005, Abstract, 1:53-63. Ex.1006, Abstract, [0004], [0008]-[0009]. Furthermore, Shao-028 and Shao-423 relate to the same technical field and address the same problem, i.e., support or otherwise enhance the Quality of Service (QoS) of video data streams sent over the Internet. For example, Shao-028 explains that “methods and arrangements are provided to **significantly increase the Quality of Service (QoS)** provided by packet-switched networks [*e.g.*, the Internet] **during the transmission**

of time critical data streams” such as “multimedia (e.g., video, audio, etc.) stream transmissions.” Ex.1005, 2:1-7 (emphasis added), 1:51-52, 1:59-61; *see also* 1:64-67. And Shao-423 describes its solution to the same common problem includes “improved methods and arrangements implement differentiation techniques for adaptive multimedia unicast and multicast communications over heterogeneous user- and network environments,” (Ex.1006, [0011]) for supporting QoS (e.g., “**a QoS enabled application,**” “**an application-aware QoS control layer,**” “**a QoS packet scheduler layer**”) over Internet Protocol (IP) because “multimedia applications/devices would benefit from ... (QoS) support/guarantees from the interconnecting network(s).” Ex.1006, [0058], [0003]. Because they address the same problem of enhancing or otherwise supporting QoS over the Internet, it would have been obvious for data packets using the scalable video transmission scheme of Shao-028 to additionally include the teachings related to the IPv6 header of Shao-423 comprising a flow label field (including “*layer identifier*”). Indeed, a POSITA would have understood that in the system of Shao-028, a mechanism to identify each layer would be necessary to properly decode and combine each layer. Although Shao-028 does not appear to expressly provide the implementation details of such a mechanism, a POSITA would have naturally looked to Shao-423 for such implementation details, as explained herein.

63. It would also have been obvious to combine Shao-028 and Shao-423 so that data packets using the scalable video transmission scheme of Shao-028 would be modified to include the teachings related to Shao-423's flow label field (including “*layer identifier*”) because to do so would have been the arrangement of old elements (a packet-switched network comprising routers, applications, and among other things, use of MPEG4 video data stream, flow label fields, and IPv6 transmission protocol) with each performing the same function it has been known to perform (prioritizing and packetizing video content for transmission over the Internet) and yielding no more than what one would expect from such an arrangement (an improved technique for distributing multimedia content over heterogeneous user- and network-environments using flow label in IPv6 packet headers), as Shao-423 demonstrates. *See* Ex.1005, Abstract, 1:8-12, 14:1-5. Ex.1006, [0011], [0102]. Additionally, a POSITA would have been motivated to use a flow label field, as taught in Shao-423 in view of its benefits. *See, e.g.*, Ex.1009, [0012] (“Flow labels are used in conjunction with a source identifier or source address and destination identifier or destination address to form a triplet **that enables efficient flow classification. . . . Without the flow label, information identifying the flow would need to be extracted from higher-layer headers**, e.g. TCP (transport control protocol) and UDP (user datagram protocol) headers. When cryptographic methods are used, such as IPsec (IP security protocol), higher-layer headers may not be

available in plaintext, thereby removing the ability to identify the flow using the higher-layer headers); *see also* Ex.1011, 1:37-57 (describing improvements such as flow labeling capability: “**To support real-time traffic such as video conference, IPv6 has ‘Flow Label’.** Using flow label, router can know which end-to-end flow a packet belongs to, and then find out the packet which belongs to real-time traffic.”)

64. It would have also been obvious for data packets using the scalable video transmission scheme of Shao-028 to additionally include the teachings related to the IPv6 header of Shao-423 with the flow label field (including “layer identifier”) because a POSITA would have been motivated to do so based on the teachings of Raisanen, Garafolo, and RFC2460, which individually reflect a POSITA’s understanding of the benefits for using a flow label field. For example, Raisanen underscores the importance of the flow label field and Garafolo describes how the flow label field is used by a router. Ex.1009, [0012] (“Without the flow label, information identifying the flow would need to be extracted from higher-layer headers, e.g. TCP (transport control protocol) and UDP (user datagram protocol) headers. When cryptographic methods are used, such as IPsec (IP security protocol), higher-layer headers may not be available in plaintext, thereby removing the ability to identify the flow using the higher-layer headers.”); *see also* Ex.1011, 1:37-57 (describing improvements such as flow labeling capability: “To support real-time traffic such as video conference, IPv6 has ‘Flow Label’. Using flow label,

router can know which end-to-end flow a packet belongs to, and then find out the packet which belongs to real-time traffic.”). Additionally, Raisanen recognizes several benefits of adding flow labels to data packets. A first benefit of adding flow labels to data packets is that it would “identify a traffic flow to which a data packet belongs or to give a data packet some flow-specific treatment,” for example, it would enable a network node to “prioritise the routing of the node so that the QoS defined is maintained for the data flow.” Ex. 1009, [0010]. A second benefit of adding flow labels to data packets is that “only data in the basic IP header” is used, and higher-layer headers are not utilized Ex.1009, [0012]. This would save protocol overhead and thereby consume less network resources. Furthermore, as early as 1998, even the governing Internet Engineering Task Force (IETF) recognized the benefits of using “flow label.” RFC2460¹⁹ (Ex.1012) describes using flow labels in packet headers to signal IPv6 routers to provide “special handling” for certain types of data packets, e.g., packets associated with ““real-time” service,”” such as distance learning or multimedia applications. RFC2460, 2. Thus, RFC2460, published six years before the earliest priority date of the 372 Patent reflects the POSITA’s understanding of the benefits of a flow label field and provides motivation to

¹⁹ This document is available online at <https://datatracker.ietf.org/doc/html/rfc2460> (last accessed August 4, 2024).

combine Shao-028 and Shao-423 to include a flow label field in the IPv6 packet header to support real-time services.

65. A POSITA would have been motivated at least by these disclosures to use a flow label as part of an IPv6 header, *e.g.*, by additionally including in the IPv6 header of Shao-028 the teachings of Shao-423, which includes a flow label comprising a “*layer identifier*” because it would permit packets to be prioritized with respect to forwarding and dropping as needed to provide the QoS-based approach called differentiated services (*i.e.*, Diffserv) supported by modern versions of the Internet Protocol. Indeed, both Shao-028 and Shao-423 anticipate the common need for providing differentiated services for multimedia communications over future versions of the Internet. “Future generations of the Internet Protocol will provide differential service, whereby data packets will be treated as having a specified priority.” Ex.1005, 8:12-14. “To support QoS in the Internet, the governing Internet Engineering Task Force (IETF), which is the main standards organization for the Internet, has defined two architectures that are expected to be implemented in the future, namely an Integrated Services or Intserv, and a Differentiated Services or DiffServ.” Ex.1006, [0005].

66. Moreover, the combination of Shao-028 and Shao-423 would have been obvious to try. A POSITA would have known there were only a finite number of identified, predictable solutions to the bandwidth bottleneck problem address by

Shao-028 and Shao-423. Moreover, a POSITA would have had a reasonable expectation of success in making the combination because it would be a simple substitution well within the skill of a POSITA. For example, modifying the data packet header in Shao-028 based on the teachings of the IPv6 header proposed in Shao-423 to include a flow label field would be akin to adding to a first header type fields from a second header type to obtain the predictable result of generating a resulting header having a different format which still complies with IPv6. In the example of Shao-423, the “layer identifier” is a 3-bit field. Shao-423 further recognizes that “Flow label field 502 has not been defined by IETF” and provides an example of how it can be used as an “Application-Flow-Layer Identifier.” Because the header proposed in Shao-423 still uses the IPv6 protocol, a POSITA would have recognized that modifying the scheme in Shao-028 to include teachings from Shao-423’s IPv6 header would not change the principle of operation of the video transmission scheme proposed in Shao-028. A POSITA would therefore have had good reason to pursue these known options and would have the ability to make the combination cited above.

67. In addition, at the time of the claimed invention, it was within the general knowledge of a POSITA that IPv4 and IPv6 presented a finite number (i.e., two) options of transmission protocols for packets exchanged over the Internet. For example, both Shao-028 and Shao-423 teach specifying the QoS class of each data

packet using a type of service (TOS) byte within the IPv4 header or a traffic class byte within the IPv6 header (IPH) of the data packet. Ex.1005, 8:20-23, Ex.1006, [0007]. Therefore, “to provide an improved multimedia communication environment,” (Ex.1006, [0009]) —*e.g.*, better quality video data with the same bandwidth—which is one goal of Shao-423, a POSITA would have found it obvious to try adding to the standard IPv6 packet header in Shao-028 fields from the exemplary IPv6 packet header taught in Shao-423, and in doing so, a POSITA would have had a reasonable expectation of success in view of Shao-423’s teachings that packets having its exemplary IPv6 header (comprising the “*layer identifier*” included in the flow label field) “can be used” by ARCs and MPAs, which are network components providing similar functionality as routers. Ex.1006, [0050], [0053].

68. Finally, Shao-028 and Shao-423 both share common inventors and the same assignee, and Shao-423 incorporates by reference Shao-028, and that is an additional reason that a POSITA would have looked to the teachings of Shao-423 when considering Shao-028.

X. GROUNDS OF INVALIDITY

A. Ground 1: Shao-028 renders obvious claims 1-3, 5-8, 10-13, and 15

69. Claims 1-2, 6-7, and 11-12 of the 372 Patent are rendered obvious over Shao-028.

B. Ground 2: Shao-028 in view of Shao-423 render obvious claims 1-3, 5-8, 10-13, and 15

70. As stated above, and explained in the analysis below, claims 1-2, 6-7, and 11-12 of the 372 Patent are rendered obvious over Shao-028. To the extent that Patent Owner asserts that Shao-028 does not disclose the “*layer identifier*” limitation, then claims 1-3, 5-8, 10-13, and 15 of the 372 Patent are rendered obvious over Shao-028 in view of Shao-423. See ¶¶161-162 (for analysis of “*layer identifier*”), *see also* §[IX.3] (discussing the combination of Shao-028 and Shao-423).

C. Invalidity Analysis of Independent Claims 1, 6, and 11

1. Preamble

- a. [1.0] A video router, comprising:**
- b. [6.0] A method for transmitting video signals, the method comprising:**
- c. [11.0] A scalable video coding router, comprising:**

71. Shao-028 discloses elements [1.0], [6.0], and [11.0]. Given the similarity in disclosure, the preambles are addressed below simultaneously.

72. Elements [1.0] and [11.0] describe a the “*video router*” / “*scalable video coding router*” used for “*transmitting video signals.*” Shao-028 discloses elements [1.0], [6.0], and [11.0].

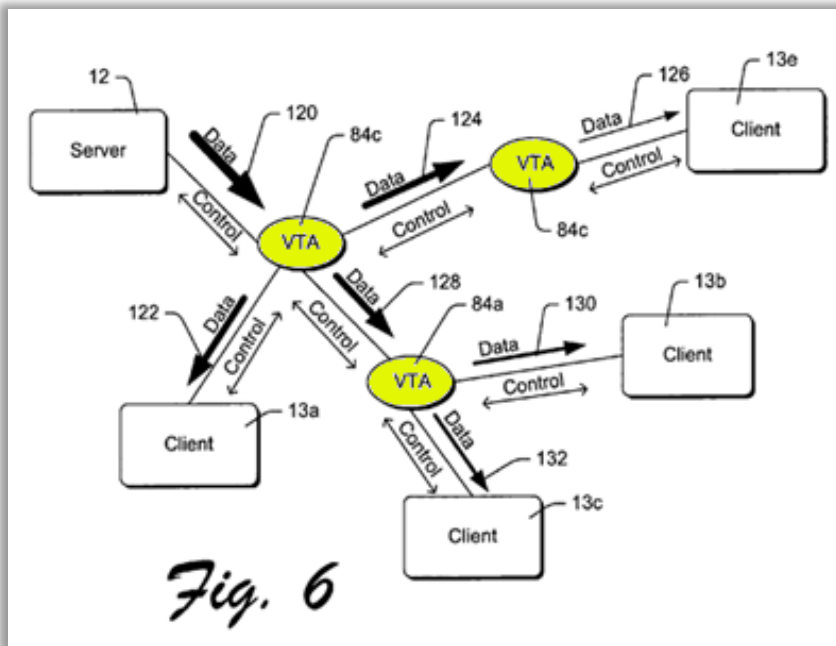
73. The term “*video router*” only appears in the claims of the 372 Patent. Ex.1001, 35:15-37-11. While the 372 Patent mentions “*router*” in multiple passages

of the Specification, for instance in the context of a generic “router,” and specific types of routers such as “software implemented routers,” “software routers,” “TCP/IP routers,” “router daemon,” “software router daemon,” “system router daemon,” “overlay router,” “source router,” “destination router,” “overlay network router,” the term “*video router*” is neither used, nor described, in the specification of the 372 Patent. The 372 Patent states that the inventive system can be used in “audio and video codecs that divide live multimedia content over layers to enhance the user experience over wide area networks” and supports “any data type, including audio/video data and financial data.” Ex.1001, 21:66-22:2, 21:45-47.

74. A router²⁰ implementing a “video transmission agent (VTA)” is a network node identified in Shao-028 that corresponds to the “*video router*” / “*scalable video coding router*” claimed in the 372 Patent. Particularly, Shao-028 discloses implementing a VTA “**as a component of the router or gateway, a server or part of a server attaching to the router**” and also discloses each VTA “**using [a] scalable transmission scheme.**” Ex.1005, 13:24-26, 13:58-62. Therefore, the “VTA Router” of Shao-028 discloses both a “*video router*” and “*scalable video coding router*”

²⁰ For ease of reference, a router implementing a “video transmission agent (VTA)” is termed herein as a “VTA Router.”

75. Additionally, Shao-028's VTA Router is a “scalable video coding router” because the VTA Router handles processing of MPEG-4 video bitstreams. With reference to Fig. 6, Shao-028 describes server device 12 multicasting object-based MPEG-4 video downstream to the four clients 13a, 13b, 13c, and 13e. VTA Routers implementing VTAs (e.g., VTA 84a and VTA 84c²¹) “will filter out data packets from upstream” (i.e., from the direction of server device 12). Ex.1005, 10:18-30. Processing of MPEG-4 video bitstreams at VTAs would encompass, for example, receiving video data bitstreams and filtering of the data packets including MPEG-4 video.



²¹ Fig. 6 in Shao-028 contains a figure numbering error—one of the VTAs should be labeled “84b.” Fig. 3 in Shao-028 confirms this.

Ex.1005, Figure 6 (annotated)

76. Further, as explained in the Technology Background of this document, it is well-known that the MPEG-4 video standard supports multiple “*scalable coding*” modes such as spatial scalability, temporal scalability, quality scalability, Fine Grain Scalability (FGS). Therefore, a VTA Router handling processing of MPEG-4 video bitstreams constitutes a “*scalable video coding router*.”

77. Furthermore, a POSITA would recognize that the term “*coding*” in the context of a “*scalable video coding router*” implies that Shao-028’s VTA Router is configured to handle coded “audio-visual information (e.g., movies, video, music) in a digital compressed format” according to a standard, such as the MPEG-4 standard in the Moving Picture Experts Group (MPEG) family of standards. See Ex.1005, 4:41-45.

78. Shao-028 explains the benefit of using a “scalable transmission scheme” is that it “allows different users to receive different quality levels of video data bitstreams” based on “network conditions and/or client preferences.” Ex.1005, 13:1-5 and 1:8-12. Shao-028 also explains that the “scalable transmission scheme” takes into consideration “client interaction and [the] video content itself” during transmission.” Ex.1005, Abstract. In particular, Shao-028 discloses “[m]ethods ...to prioritize/classify different types of information according to their importance and to packetize or otherwise arrange the prioritized information in a manner such that

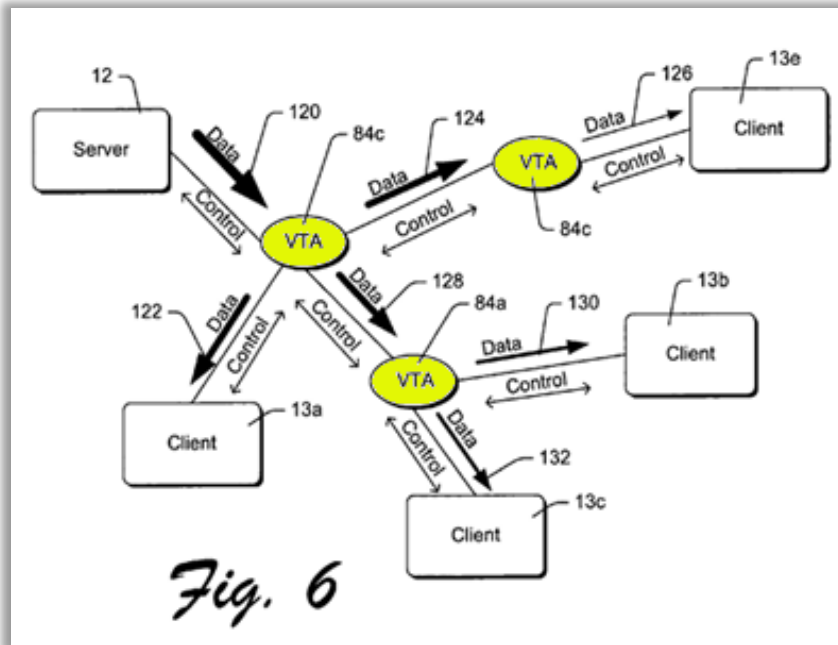
lower priority information may be dropped during transmission. Thus, when network congestion occurs or there is not enough network bandwidth to transmit all of the prioritized information about an object, some (e.g., lower priority) information may be dropped at the server or at an intermediate network node to reduce the bit rate.” Ex.1005, Abstract. For example, “data packets containing texture information for a particular video object may be dropped by the VTA.” Ex.1005, 10:28-30.

79. To the extent that Patent Owner asserts that “VTA” is distinguishable as software, Shao-028’s teachings of implementing a VTA “**as a component of the router or gateway, a server or part of a server attaching to the router**” (*see* Ex.1005, 13:24-31) is analogous to the 372 Patent’s disclosure of “**software implemented routers.**” *See generally* Ex.1001, 3:26-41, 5:33-38, 21:25-26, 21:38-40. From these teachings, a POSITA would have recognized that there are only a finite number of ways a VTA can be implemented within a network component such as router, gateway, or server, which a POSITA would have found it obvious to try. Specifically, a VTA can be implemented in one of the following ways: as a component of a router, as a component of a gateway, as a component of a server, or as a part of a server attaching to the router. Implementing a VTA in a router is one of the aforementioned ways, which a POSITA would have found it obvious to try, especially given the above-mentioned teachings of Shao-028. *See* Ex.1005, 13:24-31.

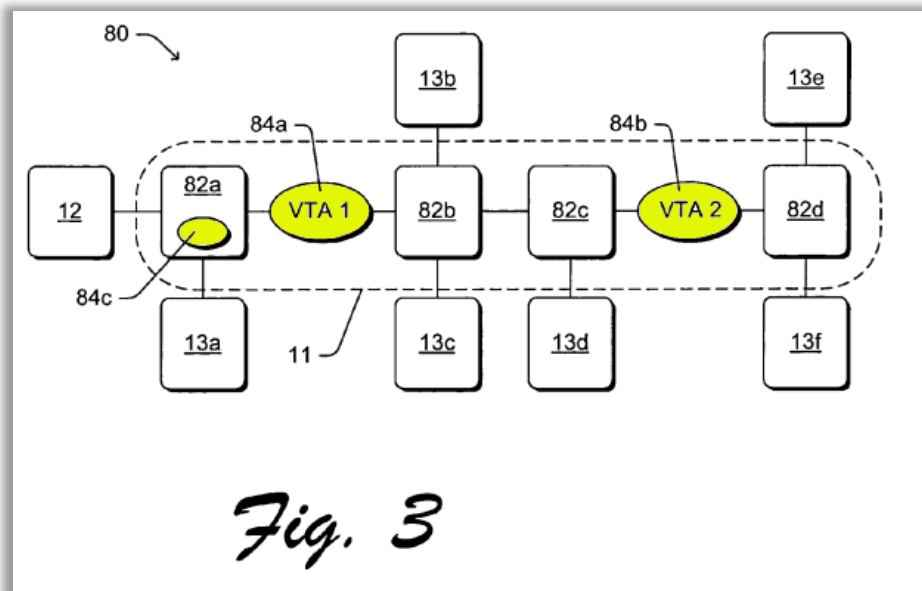
80. As demonstrated below, and depicted in Shao-028's Figs. 3 and 6, a router implementing a "video transmission agent (VTA)" comprises the same components and provides the same functionality as the claimed "*video router*"²² of the 372 Patent (*e.g.*, depicted in Fig. 1).

81. Shao-028 explains that a VTA such as VTA 84 can be implemented "**as a component of the router or gateway, a server or part of a server attaching to the router**" for example, coupled to or included within network nodes 82 a–d (*e.g.*, depicted in Fig. 3) which "can be any type of general purpose and/or special purpose computing/communication device, such as, a server, a gateway, a router, a computer, etc." Ex.1005, 13:24-31, 8:51-54. Shao-028 also discloses various router-like functionalities of its VTA Routers, including capability to watch a known port, intercept requests, and adapt the data bitstream accordingly. Ex.1005, 13:24-31.

²² References to the claimed "*video router*" in this document are for brevity, and encompass the "*scalable video coding router*," unless specifically stated otherwise.



Ex.1005, Figure 6 (annotated)



Ex.1005, Figure 3 (annotated)

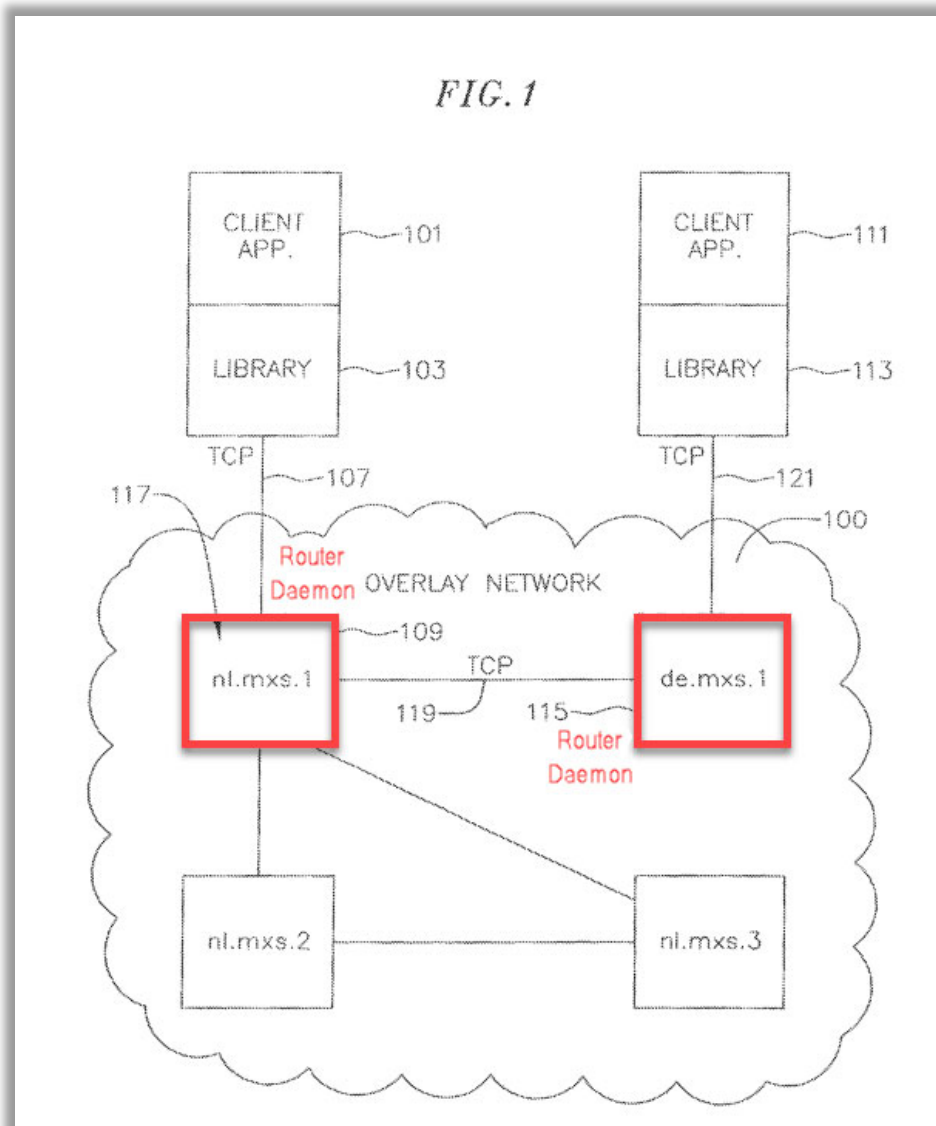
82. Accordingly, Shao-028's "video transmission agent (VTA) Router" discloses the claimed "video router" and "scalable video coding router."

83. The system described in Shao-028 also facilitates transmission of video data over a network (*i.e.*, “*A method for transmitting video signals*”). For example, the architecture depicted in Fig. 3 of Shao-028 corresponds to “a **video multicasting system architecture**” and includes three VTAs (shown in yellow), referenced VTA 84 a, VTA 84 b, VTA 84 c. Ex.1005, 8:46-48. The “output from VTA 84 a is provided to ... network node 82 b” which is “operatively coupled to provide data packets to client devices 13 b, 13 c and ... network node 82 c.” Ex.1005, 8:61-64. Similarly, the “output from VTA 84 b is provided to ... network node 82 d” which is “operatively coupled to provide data packets to client devices 13 e and 13 f.” Ex.1005, 9:2-4. And further, “VTA 84 c ... shown as being included within network node 82 a” “selectively control[s] the data packets that are provided to client device 13 a.” Ex.1005, 9:5-8. Shao-028 teaches “[a] **scalable video transmission scheme ... [which includes] [m]ethods ... to prioritize/classify different types of information according to their importance** and to packetize or otherwise arrange the prioritized information in a manner such that lower priority information may be dropped **during transmission.**” Ex.1005, Abstract. Therefore, Shao-028 discloses a “*method for transmitting video signals.*”

84. Figure 6 depicts “how a plurality of VTAs can be used to control the flow of packetized data between server device 12 and a plurality of clients 13 a, 13 b, 13 c, and 13 e with respect to multicasting of **video data.**” Ex.1005, 9:54-58. For

example, VTAs 84 a, 84 b, 84 c and clients 13 a, 13 b, 13 c, 13 e have bi-directional feedback/control communication capabilities through which client device software is configured to relay user inputs with respect to selected media objects and/or other related interactive features.” Ex.1005, 9:58-62. Therefore, “as depicted in FIGS. 3 and 6, VTAs can be implemented at various nodes within network 11 to provide for multiple filters along the path from server 12 to client 13.” Ex.1005, 13:28-31.

85. The 372 Patent describes some of the networking environment in which software implemented routers can be used. For example, Fig. 1 of the 372 Patent (reproduced below) depicts an overlay multicast system 100 that “includes a number of software router daemons 109, 115 ... interconnected by normal TCP connections 119” and communicating with local client applications 101, 111 via TCP connections 107, 121. Ex.1001, 5:33-35, 5:60-63. Thus, packets can be received either from a neighboring router or from a client application. Ex.1001, 7:21-24.



Ex.1001, Fig. 1 (annotated).

86. The 372 Patent describes some of the characteristics of the routers with respect to managing network congestion: “When an outgoing link of a router has insufficient bandwidth to transmit all pending packets, it forwards only those packets with a designated priority or the highest priority.” Ex.1001, 21:38-47.

87. Likewise, Shao-028 is concerned with VTA Routers managing network congestion. For example, Shao-028 discloses that “should the network become congested,” VTA Routers prioritize transmission of certain data packets “such that prioritized ... data packets having lower priority levels are selectively dropped.” Ex.1005, 3:10-16. For instance, “[t]he VTAs will filter out data packets from upstream according to downstream requirements (e.g., according to the network link and a particular client[’]s capabilities). For example, data packets containing texture information for a particular video object may be dropped by the VTA.” Ex.1005, 10:26-30.

88. Accordingly, Shao-028 also discloses “[a] *method for transmitting video signals*.”

89. Accordingly, Shao-028 discloses elements [1.0], [6.0], and [11.0]

2. Memory

a. [1.1] a memory; and

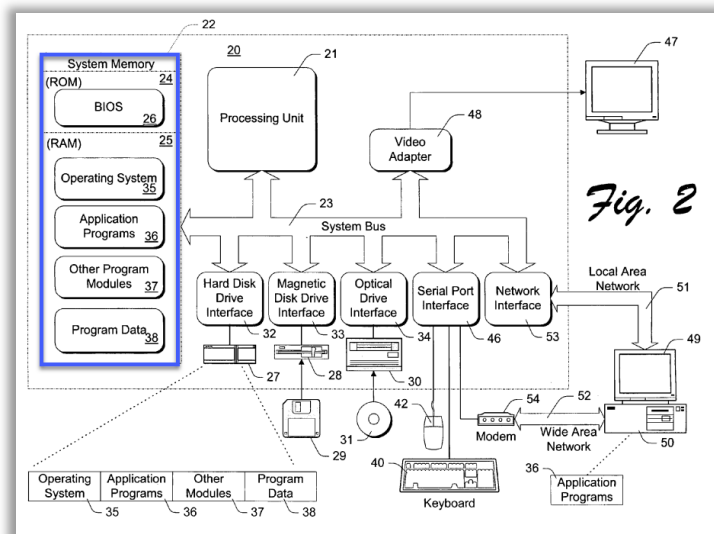
b. [11.1] a memory; and

90. Shao-028 discloses a VTA (the “*video router*”) comprising “*a memory*.”

91. For example, Shao-028 discloses that a VTA can be “implemented as a component of the router or gateway, a server or part of a server attaching to the router” and a POSITA would have understood that “a server, a router, a network PC, a peer device or other common network node” “typically includes many or all of the

elements described ... relative to computer 20.” Ex.1005, 13:24-31, 7:58-61. Thus, a POSITA would have recognized, computer 20 is a generic representation of a VTA Router which implies that the elements (such as “a memory”) included in computer 20 would also be included in a VTA Router. Shao-028 discloses that computer 20 “includes ... a **system memory 22**” which “**includes read only memory (ROM) 24 and random access memory (RAM) 25.**” Ex.1005, 7:5-7, 7:13-14. Shao-028 explains that ROM 24 stores “basic input/output system (BIOS) 26, containing the basic routines that help to transfer information between elements within computer 20, such as during start-up.” Ex.1005, 7:13-17.

92. A VTA Router’s “memory”—i.e., “system memory 22”—including ROM 24 and RAM 22 in Shao-028 is depicted in Figure 2 and annotated in blue below:



Ex.1005, Fig. 2 (annotated).

93. Shao-028 also discloses using “a hard disk,” “a removable magnetic disk,” and “a removable magnetic disk” in computer 20. For example, Shao-028 explains that “[c]omputer 20 further includes a hard disk drive 27 for reading from and writing to a hard disk, not shown, a magnetic disk drive 28 for reading from and writing to a removable magnetic disk 29, and an optical disk drive 30 for reading from or writing to a removable optical disk 31 such as a CD ROM, DVD ROM or other optical media.” Ex.1005, 7:18-23.

94. Shao-028 explains that “[t]he drives and their associated computer-readable media provide nonvolatile storage of computer readable instructions, data structures, program modules and other data for computer 20. Although the exemplary environment described herein employs a hard disk, a removable magnetic disk 29 and a removable optical disk 31, it should be appreciated by those skilled in the art that other types of computer readable media which can store data that is accessible by a computer, such as magnetic cassettes, flash memory cards, digital video disks, random access memories (RAMs) read only memories (ROM), and the like, may also be used.” Ex.1005, 7:27-38. Shao-028 further explains that “the hard disk, magnetic disk 29, optical disk 31, ROM 24, or RAM 25” stores “an operating system 35, one or more application programs 36, other program modules 37, and program data 38.” Ex.1005, 7:39-43.

95. Accordingly, Shao-028 discloses elements [1.1] and [11.1].

3. Processor

- a. [1.2] a processor, wherein the processor executes instructions stored in the memory to cause the video router to:
- b. [11.2] a processor, wherein the processor executes instructions stored in the memory to cause the scalable video coding router to:

96. Shao-028 discloses a VTA Router (*i.e., the “video router” / “scalable video router”*), see ¶¶X.C.1, above, comprising “*a processor, wherein the processor executes instructions stored in the memory.*”

97. As explained above, a POSITA would have recognized that computer 20 is a generic representation of a VTA Router which implies that the elements (such as “*a processor*”) included in computer 20 would be included in a VTA Router. Shao-028 discloses “**computer 20 includes one or more processors or processing units 21.**” A POSITA would have understood that Shao-028’s VTA Router includes a “*processor executes instructions stored in the memory*” based on common knowledge. Indeed, Shao-028 discloses that “ROM 24 stores “**basic input/output system (BIOS) 26**, containing the basic routines that help to transfer information between elements within computer 20, such as during start-up” and further that “[t]he drives [such as a hard disk, a removable magnetic disk 29 and a removable optical disk 31] and their associated computer-readable media

provide nonvolatile storage of computer readable instructions, data structures, program modules and other data for computer 20.” Ex.1005, 7:14-17, 7:27-20.

98. Accordingly, Shao-028 discloses elements [1.2] and [11.2].

4. Receiving a layered video data stream

- a. **[1.3] receive a layered video data stream including a base layer and a set of enhancement layers,**
- b. **[6.1] receiving a layered video data stream comprising a base layer and a set of enhancement layers;**
- c. **[11.3] receive a layered video data stream that comprises a base layer and a set of enhancement layers,**

99. Elements [1.3], [6.1], and [11.3] generally relate to “*receiv[ing] a layered video data stream including a base layer and a set of enhancement layers.*” Shao-028 discloses these elements.

100. As explained earlier (*see* ¶36above), while Prov. App. 60/647,601 (to which the 372 Patent claims priority) admits that the concept of receiving “layered video” transmissions was well-known, the 372 Patent Specification does not expressly describe “*receiv[ing] a layered video data stream including a base layer and a set of enhancement layers.*” The limited descriptions of “*base layer*” and “*enhancement layer*” in the 372 Patent are cursory. For instance, the 372 states “*provid[ing] a set of higher layered protocols as services over the packet oriented base layer*” packet oriented base layer” and cursorily “the base layer encoder.” Ex.1101, 6:64-66, 34:56-57. With reference to “an alternative algorithm ... that

provides another way of thinning a stream of data, such as live market data,” the 372 Patent cursorily states that “[t]his algorithm may be used to produce enhancement layers that form a layered data stream, such as a layered market data stream.” Ex.1001, 33:1-7.

101. Shao-028 discloses “*video router*” that “*receive[s] a layered video data stream.*” For example, Shao-028 discloses that “**VTA 84 is configured to receive video data bitstreams**” (the “*video data stream*”) from server 12 or a previous VTA.” Ex.1005, 13:10-12. In Shao-028, “at least one video transmission agent (VTA) ... receive[s] the prioritized object-based data packets” representing a “video object” from the server device, which a POSITA would have understood are included in a “*video data stream.*” Ex.1005, 3:4-10.

102. The “video data bitstreams” (“*video data stream*”) received at the VTA Router constitutes a “*layered*” video data stream. For example, the techniques in Shao-028 utilize MPEG-4²³ encoding which uses “**I, P, B, and enhancement frame layers**” to encode a media object into a video data stream. Ex.1005, 5:6-10.

For video object, each of these media objects is encoded into a corresponding elementary data bitstream using I, P, B, and enhancement frame layers.

²³ MPEG-4 is an ISO/IEC standard developed by MPEG (Moving Picture Experts Group). <https://www.mpeg.org/standards/MPEG-4/>

Id. A POSITA would have understood that a video data stream formed using I, P, B, and enhancement frame layers is a “*layered*” video data stream as demonstrated below. For example, Shao-028 further describes “Encoder 15 [included within server device 12] ... configured to encode the object data into one or more bitstreams” can be “a Moving Picture Experts Group (MPEG) based encoder” and MPEG allows coding “frames, or ... **objects as separate frame layers.**” Ex.1005, 4:40-43, 4:52-55, Fig. 1. Therefore, based on Shao-028’s disclosure, a POSITA would have understood that the “video data bit streams” received by the VTA Router constitutes a “*layered video data stream.*”

103. Shao-028 also discloses that “*a base layer and a set of enhancement layers*” are included in the “*layered video data stream.*” Shao-028 provides an example identifying “Intra (I) coded frame layers, Predicted (P) frame layers, Bi-directionally (B) predicted frame layers” (*e.g., see items 2-10 annotated in purple below*) as “*base layer[s]*” and “Intra (I) coded frame enhancement layers, Predicted (P) frame enhancement layers, and Bi-directionally (B) predicted frame enhancement layers” (*e.g., see items 11-13 annotated in blue below*) as “*a set of enhancement layers.*”

104. Shao-028 explains that the information in the data bitstream of object-based video coding, such as, MPEG-4, can be divided into the following types of information:

1. Control information, (e.g., Video Object Head, Video Object Layer Head and Video Object Plane head);
2. Shape information of an **Intra (I) coded frame base layer**
3. Texture DC information of an **Intra (I) coded frame base layer**
4. Texture AC information of an **Intra (I) coded frame base layer**
5. Shape information of a **Predicted (P) frame base layer**
6. Motion information of a **Predicted (P) frame base layer**
7. Texture information of a **Predicted (P) frame base layer**
8. Shape information of a **Bi-directionally (B) predicted frame base layer**
9. Motion information of a **Bi-directionally (B) predicted frame base layer**
10. Texture information of a **Bi-directionally (B) predicted frame base layer**
11. **Intra (I) coded frame enhancement layer**
12. **Predicted (P) frame enhancement layer**
13. **Bi-directionally (B) predicted frame enhancement layer**

Ex.1005, 5:39-62.

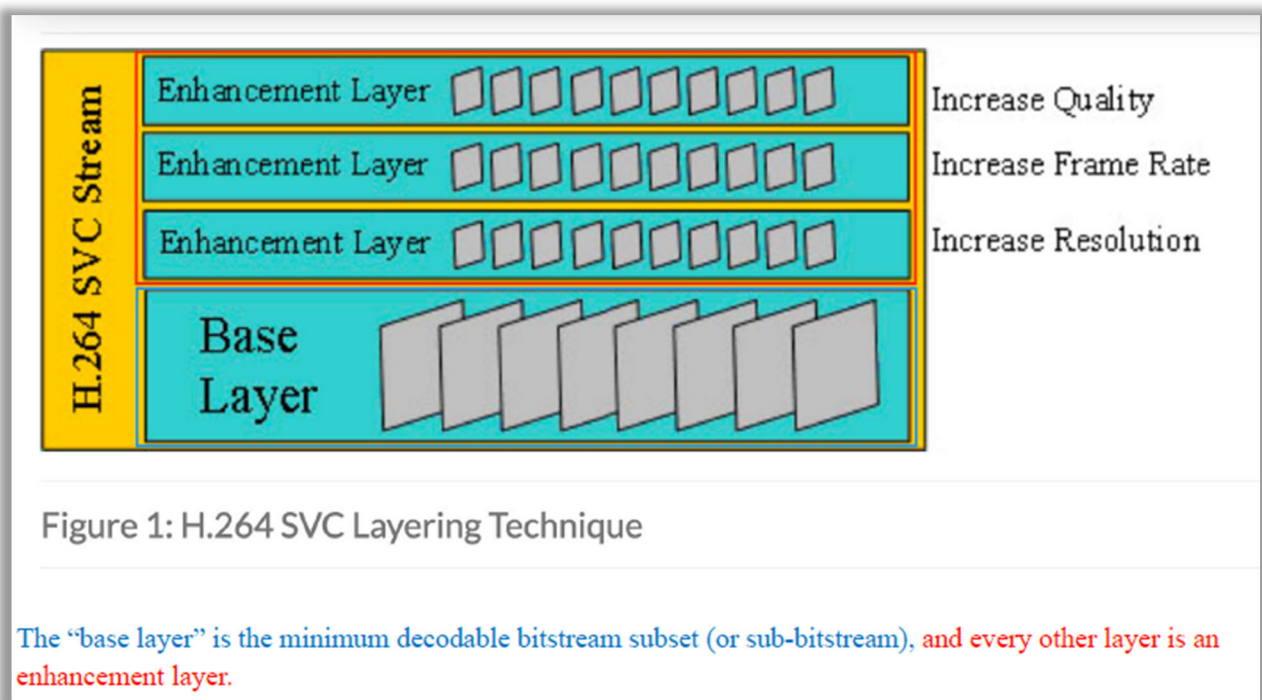
105. Shao-028 also explains that media objects included in MPEG-4 video data “may be represented by Intra (I) coded frame layers, Predicted (P) frame layers, Bi-directionally (B) predicted frame layers, Intra (I) coded frame enhancement layers, Predicted (P) frame enhancement layers, and Bi-directionally (B) predicted frame enhancement layers.” Ex.1005, 2:35-42. The term “*enhancement layer*”

appearing in “Intra (I) coded frame *enhancement layers*,” “Predicted (P) frame *enhancement layers*,” and “Bi-directionally (B) predicted frame *enhancement layers*” indicates that these are “*a set of enhancement layers*.” Therefore, the remaining layers, *i.e.*, “Intra (I) coded frame layers,” “Predicted (P) frame layers,” “Bi-directionally (B) predicted frame layers” are “*base layer[s]*.” Accordingly, the “Intra (I) coded frame layers, Predicted (P) frame layers, Bi-directionally (B) predicted frame layers” are “*base layer[s]*” and “Intra (I) coded frame enhancement layers, Predicted (P) frame enhancement layers, and Bi-directionally (B) predicted frame enhancement layers” are “*a set of enhancement layers*.”

106. Moreover, Shao-028 explains in detail the functionality provided by I, P, B base layer frames: “‘I’ or intra frame ... is a frame coded as a still image without using any past history.” Ex.1005, 4:56-58. “‘P’ or Predicted frame ... is predicted from the most recent I frame or P frame. Each macroblock of data within in a P frame can either come with a vector and difference differential cosine transform (DCT) coefficients for a close match in the last I or P, or it can be “intra” coded (e.g., as in the I frames).” Ex.1005, 4:58-64. “‘B’ or bi-directional frame ... is predicted from the closest two I frames or P frames, e.g., one in the past and one in the future. There are typically 12 frames from 1 [sic:I] frame to I frame.” Ex.1005, 4:65-67. Shao-028 teaches that in addition to I, P, B base layer frames, “**enhancement I, P, or B frame layers may be provided to add additional refinement/detail to the image.**”

Ex.1005, 5:2-5. Indeed, Shao-028 discloses enhancement layers as additional to the base layer because Shao-028 states that “I, P, B, **and** enhancement frame layers” are used for encoding media objects into a video data bitstream.

107. In Patent Owner’s Preliminary Infringement Contentions, Patent Owner has mapped this claim element to generic descriptions of base layer and enhancement layer in H.264 and MPEG-4 video coding standards.



Ex.1007, 9; *see also* Ex.1007, 8-11.

108. Accordingly, Shao-028 discloses elements [1.3], [6.1], and [11.3].

5. Identifying bandwidth-limited conditions

- a. **[1.4] identify bandwidth-limited conditions of an internet protocol network between the video router and a plurality of video receivers,**
- b. **[6.2] identifying bandwidth-limited conditions of an internet protocol network between a video router and a plurality of video receivers;**
- c. **[11.4] identify bandwidth-limited conditions of an internet protocol network between the video router²⁴ and a set of video receivers, and**

109. Elements [1.4], [6.2], and [11.4] generally relate to “*identify[ing] bandwidth-limited conditions of an internet protocol network between the video router and a plurality of video receivers.*” Shao-028 discloses these claim elements.

110. The claims contain no guidance on “*bandwidth-limited conditions.*” The specification is similarly lacking—neither the term “*bandwidth-limited,*” nor the term “*bandwidth-limited conditions*” appear in the specification, nor does “*identifying bandwidth-limited conditions of an internet protocol network between the video router and a plurality of video receivers.*” Instead, the specification describes generic functions related to congestion, bandwidth, connection quality, or capacity, such as “manag[ing] congestion,” “manag[ing] the available bandwidth,” “measur[ing] the quality of [a] connection,” “measur[ing] the quality of its virtual

²⁴ It appears that the use of “*video router*” here instead of “*scalable video coding router*” (as it appears in the preamble) is a typographical error.

connection,” a “throughput monitor interceptor,” “comput[ing] bandwidth statistics,” “detect[ing] when more bandwidth becomes available,” “network ha[ving] insufficient capacity,” “supporting live multicast streams with limited jitter and delay,” “detecting congestion,” “when there is sufficient bandwidth at all times,” “when congestion occurs,” and “bandwidth constraints” See e.g., Ex.1001, 4:8-14, 7:57-63, 10:33-36, 4:29-35, 17:50-57, 29:26-49, 20:65-21:2, 21:12-15, 21:42-45, 21:63-66, 22:63-65. And while the specification describes links / network connections as being “slow” or “fast,” it does not explain or quantify what it means to be “slow” or “fast.” Ex.1001, 4:12-13 (“overloaded links”), 8:16 (“infinitely slow link”), 29:21 (“a router interface with a slow connection”), 32:58-60 (“network saturation slows down the links”), 26:51-52 (“the connection between the routers was not fast enough to transmit all the packets”).

111. In support of Patent Owner’s claim construction positions at the district court, Patent Owner’s expert stated that “*identify bandwidth-limited conditions*” “refers to the action of recognizing or determining situations where the available bandwidth within the network is restricted or constrained” and further that “congestion” and “packet loss” are “key indicators of bandwidth-limited conditions.”

63. Specifically, the phrase “identify bandwidth-limited conditions” refers to the action of recognizing or determining situations where the available bandwidth within the network is restricted or constrained. Bandwidth refers to the maximum data transfer rate of a network connection, typically measured in bits per second. A POSITA would understand that bandwidth limitations can occur due to various factors such as network congestion, hardware limitations, or bandwidth allocation policies.

Ex.1020, ¶63.

77. Further, the setting of a timeout period affects the resilience of the data stream to congestion. A longer timeout period delays the detection of bandwidth constraints by the receivers. This delay in congestion detection, along with the use of timers upon packet loss to detect congestion, suggests that congestion is a key indicator of bandwidth-limited conditions within the network.

Ex.1020, ¶77.

84. First, the excerpt above discusses scenarios where packet loss is difficult to avoid, particularly in live data streams where content cannot be slowed down. (*Id.* at 4:33-35.) When the network has insufficient capacity to handle the data stream, packet loss becomes inevitable. A

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POSITA would understand based on this teaching that bandwidth limitations within the network result in packet loss, which is a key indicator of bandwidth-limited conditions.

Ex.1020, ¶84. As explained in greater detail below, Shao-028 discloses elements [1.4], [6.2], and [11.4] consistent with Patent Owner’s interpretation that “congestion” and “packet loss” are “key indicators of bandwidth-limited conditions.” For instance, Shao-028 describes that “under the same network bandwidth and packet loss conditions,” its “methods and arrangements perform better than traditional approaches.” Ex.1001, 14:9-12; *See also* Ex.1001, 14:13-41 (describing examples that use “network bandwidth” and “packet loss”).

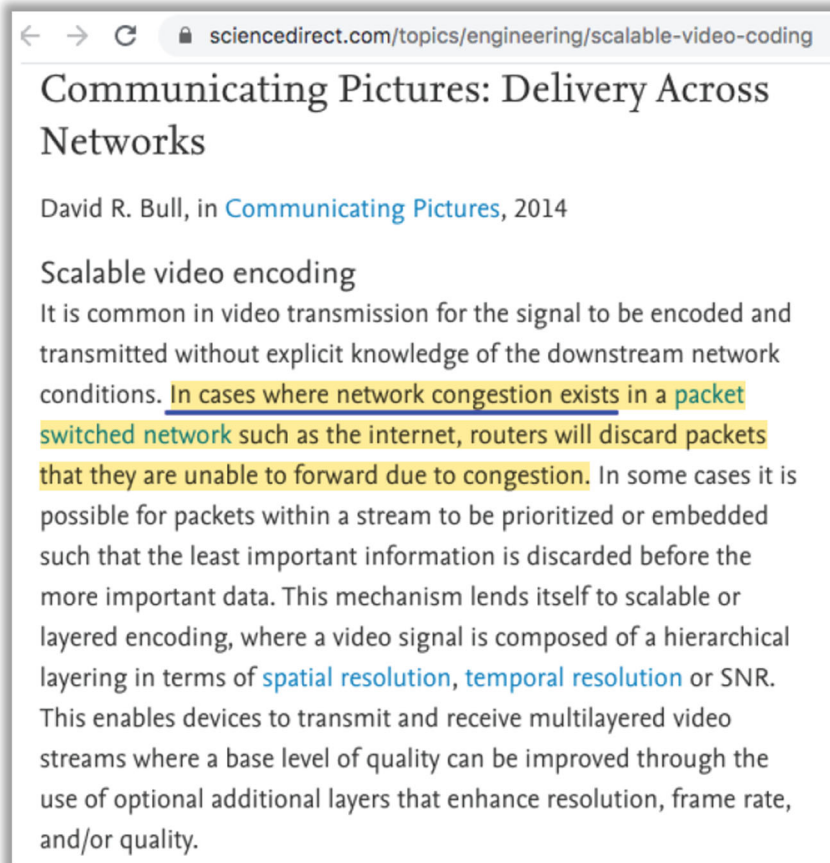
112. First, Shao-028 describes use “*of an internet protocol network between the video router and a [plurality of video receivers / set of video receivers]*” by its VTA Router. For example, Shao-028 discloses transmissions over “a packet-switched network 11” (“an internet protocol network”) with “a plurality of client

devices 13(a) . . . 13(n)” (“*a plurality of video receivers / a set of video receivers*”) and further that “[o]ne example of a packet-switched network is **the Internet.**” Ex.1005, 4:18-22, 1:51-52. Shao-028 “allows for efficient object-based video **transmission over IP based networks.**” Ex.1005, 10:42-44. “**During transmission, the data within a compressed video bitstream is packetized and the packets are sent to the receiver²⁵ over the Internet.**” Ex.1005, 10:62-11:1. See also Ex.1005, claim 23 (“wherein the network is an **Internet Protocol (IP) based network**”); claim 46 (“wherein the network is an **Internet Protocol (IP) based network**”); and claim 63 (“wherein the received data includes **Internet Protocol (IP) data**”). Shao-028 discloses an embodiment using the “[Internet Protocol version 6] IPv6 protocol” for testing its experimental implementation. Ex.1005, 14:1-5 (disclosing “**The test bed included** MPEG-4 video encoding/decoding source code and **Ipv6 protocol**”). See also Ex.1005, 8:19-23 (disclosing “The QoS class of each data packet can be specified, for example, ... within the **Ipv6 header (IPH) of the data packet.**”). Further, as Shao-028 explains with reference to Fig. 6, VTA 84c (“*the video router*”) “**support[s] multicasting**” which provides

²⁵ Shao-028 uses the term “receiver” to refer generally to “client devices 13a, 13c, 13d ...” and “VTAs 84a, 84b” depicted in Figs. 3 and 6. Indeed, Shao-028 encompasses transmitting to “a plurality of receivers” because Shao-028 describes that if a real-time encoded video “needs to be sent to multiple heterogeneous receivers simultaneously, the single bit rate may not satisfy all receivers.” Ex.1005, 11:64-66.

“effective communication **support for multi-party multimedia applications**, such as, **distance learning** and **video broadcasting**” to client devices 13a, 13b, 13c, 13e “a [plurality of video receivers / set of video receivers].” Ex.1005, 13:32-33, 11:16-18. “Multicasting” is “[t]he process of sending a message simultaneously to **more than one destination** on a network.” Ex.1018, 352 (emphasis added). Thus, Shao-028 discloses use “of an internet protocol network between the video router and a [plurality of video receivers / set of video receivers].”

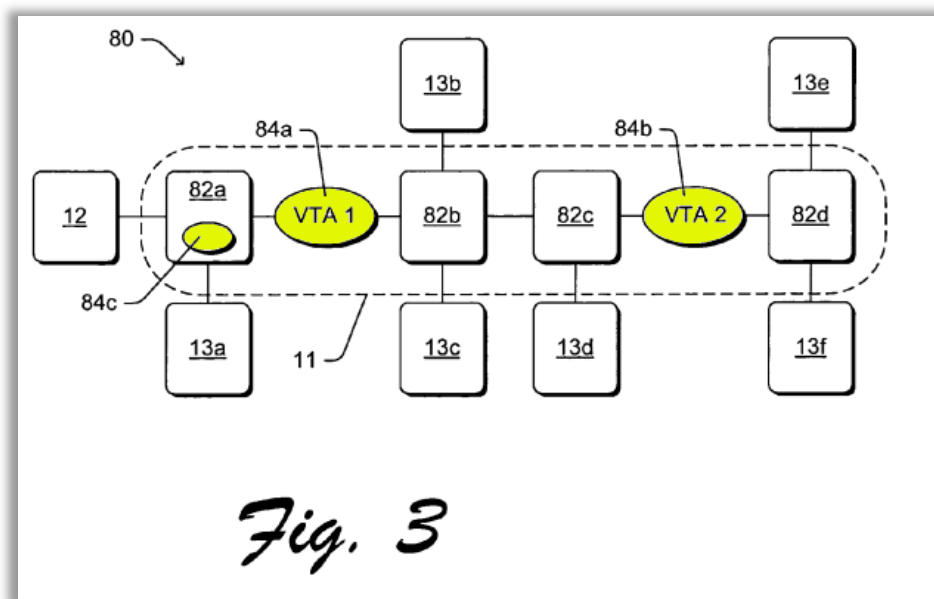
113. Shao-028’s disclosure “of an internet protocol network between the video router and a plurality of video receivers” is also consistent with Patent Owner’s apparent interpretation of this claim limitation in its Preliminary Infringement Contentions in which Patent Owner has mapped this claim limitation to generic packet communications over the internet.



Ex. 1007, 13.

114. For example, Shao-028 recognizes that “due to the heterogeneity of the Internet a single sender transmission rate cannot satisfy the different bandwidth requirements of different clients.” Ex.1005, 11:18-21. During transmissions, for instance, “network congestion” can occur and/or “the receivers [may] require lower bit rates.” Ex.1005, 12:26-29. Therefore, in view of the “network related constraints” and/or “the needs of the client devices” the VTA Routers respond accordingly. Ex.1005, 10:1-5. For example, with reference to Fig. 3 (reproduced below), “VTA 84 a is configured selectively filter out or otherwise drop data packets

according to their respective transmission priority levels **based on network and/or other recognized needs (e.g., downstream feedback/control)**” and “VTA 84 b is configured to selectively filter out or otherwise drop data packets according to their respective transmission priority levels **based, again, on network and/or other recognized needs.**” Ex.1005, 8:57-60, 8:66-9:2.



Ex.1005, Figure 3 (annotated).

115. Shao-028 also discloses “*identify[ing] bandwidth-limited conditions*” of an internet protocol network between the video router and a plurality of video receivers.

116. First, Shao-028 recognizes that communicating over the Internet can cause “congestion” which is a network-related constraint and as a result, VTA Routers drop data packets having lower priority. “[W]hen the Internet or a portion

thereof is congested, **data packets with lower priorities may get dropped/delayed** to better ensure that packets with higher priorities get delivered.” Ex.1005, 8:14-17. “[W]hen network congestion occurs or there is not enough network bandwidth to transmit all of the prioritized information about an object, some (e.g., lower priority) information may be dropped at the server or at an intermediate network node to reduce the bit rate.” Ex.1005, Abstract. “[S]hould the network become congested[,]” “the VTA ... provide[s] differential services to the prioritized object-based data packets, such that prioritized object-based data packets having lower priority levels are selectively dropped.” Ex.1005, 3:10-16. “Should congestion occur within network 11 during transmission, one or more network nodes 82 may need to discard data packets having lower priority levels.” Ex.1005, 10:23-25.

117. Moreover, Shao-028 discloses “*identifying bandwidth-limited conditions*” by “meet[ing] [Quality of Service] QoS requirements.” Ex.1005, 8:43. Shao-028 describes that “when the Internet is congested, some of the data packets may be dropped or otherwise lost during transmission” and “missing data packets can significantly degrade the performance of a multimedia application.” Ex.1005, 1:54-63. Dropping data packets with lower priorities ensures that packets with higher priorities get delivered, which “allows for different QoS’s to be provided based on the importance associated with the user and/or information content.” Ex.1005, 8:14-23. Shao-028 states “lost or untimely receipt of data packets” can

result in failure to meet the expected or required QoS. Ex.1005, 1:45-53. Indeed, the system in Shao-028 is designed to “meet QoS requirements” because Shao-028’s methods and arrangements are “provided to significantly increase the Quality of Service (QoS) provided by packet-switched networks during the transmission of time-critical data streams.” Ex.1005, 8:43, 2:3-7.

118. In Shao-028, a VTA Router “*identifies bandwidth-limited conditions*” (e.g., upstream and downstream congestion) by using a **resource allocation policy** that calculates **available resource** and **required resource** (e.g., “network bandwidth” can be one of the resources) for a network link. And, in doing so, the VTA Routers “*identify bandwidth-limited conditions.*” Shao-028 explains that upstream congestion is “**determined by the link state between the VTA and its next upstream VTA (or the server 12 if it has no upstream VTA)**” and downstream congestion is “**determined by (Capacity, Requirement) of all its next downstream VTAs and the clients connecting directly to this VTA**” Ex.1005, 13:39-47. Shao-028 explains that its **resource allocation policy** is mathematically expressed using the two-element set “(Capacity, Requirement)” and employed at a VTA to determine **available resource** and **required resource** to support a multicasting session. “A resource allocation policy, e.g., (Capacity, Requirement) policy, can be employed within VTA 84 to support multicasting. For example, in a

multicasting session, every VTA and client is associated with a two element set, namely ‘Capacity’ and ‘Requirement.’” Ex.1005, 13:31-35.

119. Shao-028 elaborates about what ‘Capacity’ and ‘Requirement’ represent: “Capacity represents the amount of the resource available for a video object in the VTA or the end system of the user to handle the video object. Requirement represents the amount of the resource for a video object required by the VTA or the user.” Ex.1005, 13:35-39. In other words, ‘Capacity’ and ‘Requirement’ are parameters or metrics for making the assessment of “*bandwidth-limited conditions*.” Moreover, Shao-028 discloses a mathematical equation defining the relationship between “Capacity” and “Requirement.”

Let us assume that the capacity of the sender is the bit rate of the original bitstream, denoted as RATE. However, the Requirement of a VTA is determined by $(\text{Capacity}, \text{Requirement})_s$ of all its next downstream VTAs and the clients connecting directly to this VTA. For example, if a VTA, named V_i , has M next downstream VTAs and clients whose two element set are $(\text{Cap}_{ij}, \text{Req}_{ij})$ ($0 \leq j < M$), then the Requirement of V_i , is calculated as follows:

$$\text{Req}_i = \min \{ \min(\text{Cap}_{ij}), \max(\text{Req}_{ij}), \text{RATE}_s \} \\ (0 \leq j < M) .$$

For a client, Requirement will likely be determined by the user's preference and interactivity behavior.

For a multicasting session, the $(\text{Capacity}, \text{Requirement})_s$ of its VTAs and clients can be calculated following the direction from bottom to top (i.e., moving upstream). And at each VTA_i , the rate of the video object bitstream can be adapted to Req_i by using the scalable transmission scheme proposed herein.

Ex.1005, 13:42-61. Moreover, Shao-28 explains that its **resource allocation policy** used for identifying **available resource** and **required resource** at a VTA pertain to the network links which include “all its next downstream VTAs and the clients connecting directly to this VTA.” Ex.1005, 13:44-47. And, as demonstrated above, see ¶¶ 112-114, Shao-028 discloses use “*of an internet protocol network between the video router and a plurality of video receivers.*” Thus, “*identifying bandwidth-limited conditions*” in the network links between a VTA Router and clients connected to the VTA Router constitute “*identify[ing] bandwidth-limited conditions of an internet protocol network between the video router and a plurality of video receivers.*”

120. In addition, Shao-028’s disclosure of VTA Routers “*identifying bandwidth-limited conditions*” using a **resource allocation policy** is consistent with Patent Owner’s statements during prosecution, in which Patent Owner expressly stated that the claimed “*video router*” “*identifies bandwidth-limited conditions.*”

These claim elements expressly require the router to “identify bandwidth-limited conditions” and to “selectively forward...fewer than all of the set of enhancement layers...based on the bandwidth-limited conditions.” As a result, it is clear that the router identifies the bandwidth-limited conditions and then the router selectively transmits less than all of the layers based on the bandwidth-limited conditions identified by the router.

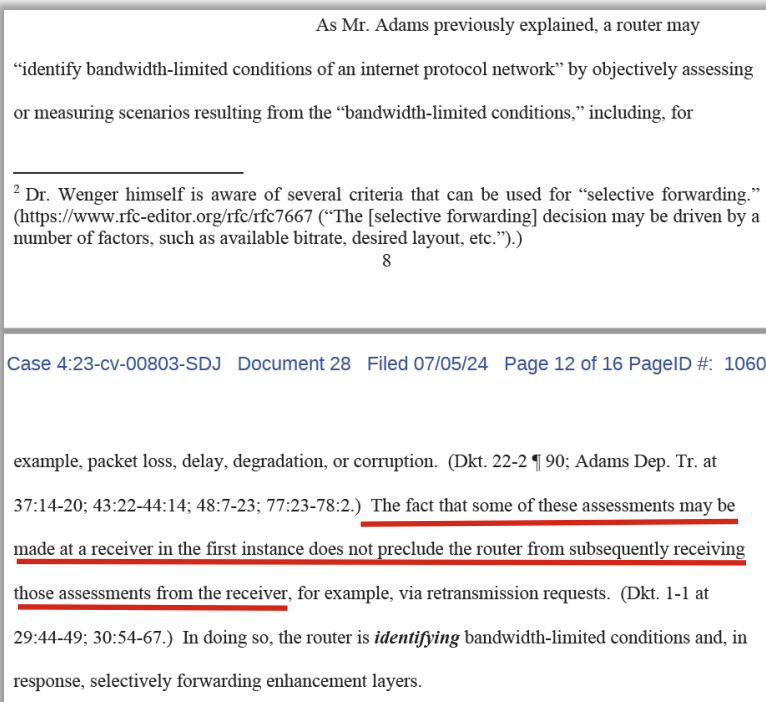
Ex.1002, Amdt dated January 25, 2021 at 8.

121. Shao-028 also demonstrates in detail how “a plurality of VTAs can be used to control the flow of packetized data between server device 12 and a plurality of clients 13a, 13b, 13c, and 13e with respect to multicasting of video data.” Ex.1005, 9:54-58. Referencing Figure 6 and as depicted below, Shao-028 explains that the “various nodes have bi-directional feedback/control communication capabilities,” Ex.1005, 9:54-59, such that “VTAs are able to respond dynamically to the **needs of the client devices**. As mentioned above, the VTA Routers may also respond to network related constraints. Thus, both network and user interactivity behaviors are taken into consideration,” Ex.1005, 10:1-5 (emphasis added). “VTA 84 a ... selectively filter[s] out or otherwise drop[s] data packets according to their respective transmission priority levels based on network and/or **other recognized needs (e.g., downstream feedback/control)**” and “VTA 84 b ... selectively filter[s] out or otherwise drop[s] data packets according to their respective transmission priority levels **based, again, on network and/or other recognized needs**.” Ex.1005, 8:57-60 (emphasis added), 8:66-9:2 (emphasis added). For example, “VTAs will filter out data packets from upstream according to downstream requirements (e.g., according to the network link and **a particular client[']s capabilities**).” Ex.1005, 10:26-28.



Ex.1003

122. In addition, Shao-028's disclosure of a client feeding back to a VTA Router information related to the client's needs/capabilities is consistent with Patent Owner's statements in its Reply Claim Construction Brief in which Patent Owner asserts that receivers may be involved in "*identify[ing] bandwidth-limited conditions.*"



Ex.1010, 8-9.

123. Accordingly, Shao-028 discloses elements [1.4], [6.2], and [11.4].

6. Forwarding the base layer

- a. **[1.5] forward the base layer from the video router to at least two of the plurality of video receivers via the internet protocol network, and**
- b. **[6.3] forwarding the base layer to at least two of the plurality of video receivers via the internet protocol network; and**
- c. **[11.5] forward the base layer from the video router to at least two of the set of video receivers;**

124. Elements [1.5], [6.3], and [11.5] generally relate to “*forward[ing] the base layer from the video router to at least two of the plurality of video receivers via the internet protocol network.*” Shao-028 discloses these elements.

125. First, Shao-028 discloses a VTA Router “*forward[ing] the base layer.*” “VTA 84 is configured to receive video data bitstreams from server 12 or a previous VTA, filter the received data bitstream by selectively discarding data packets having lower priorities, and **sending the resulting filtered data bitstream to a client 13** and/or a next (downstream) VTA 84” and describes an example in which the data bit stream includes:

- 1. Control information, (e.g., Video Object Head, Video Object Layer Head and Video Object Plane head);
- 2. Shape information of an **Intra (I) coded frame base layer**
- 3. Texture DC information of an **Intra (I) coded frame base layer**
- 4. Texture AC information of an **Intra (I) coded frame base layer**
- 5. Shape information of a **Predicted (P) frame base layer**

6. Motion information of a Predicted (P) frame base layer
7. Texture information of a Predicted (P) frame base layer
8. Shape information of a Bi-directionally (B) predicted frame base layer
9. Motion information of a Bi-directionally (B) predicted frame base layer
10. Texture information of a Bi-directionally (B) predicted frame base layer

Ex.1005, 5:39-58. Media objects included in MPEG-4 video data “may be represented by Intra (I) coded frame layers, Predicted (P) frame layers, Bi-directionally (B) predicted frame layers.” Ex.1005, 2:35-39. Thus, Shao-028 discloses “*forward[ing] the base layer*” by the VTA Router.

126. Shao-028 further discloses that information (e.g., the “*base layer*”) is forwarded “*to at least two of the plurality of video receivers via the internet protocol network.*” As Shao-028 explains, a VTA Router can transmit the base layer information to at least two client devices, e.g., during a multicasting session. For example, as depicted in Figures 3 and 6, Shao-028 explains that “VTA 84 ... **support[s] multicasting**” which provides “effective communication **support for multi-party multimedia applications**, such as, **distance learning and video broadcasting** [“*to at least two of the plurality of video receivers.*”]” Ex.1005, 13:32-33, 11:16-18. For example, Fig. 6 depicts VTA 84a transmitting information to client devices 13b and 13c during a multicasting session. “Multicasting” is “[t]he process

of sending a message simultaneously to **more than one destination** on a network.”
Ex.1018, p. 352 (emphasis added). Shao-028 also describes sending a real-time encoded video (comprising a “*base layer*”) “to **multiple heterogeneous receivers simultaneously** [“*to at least two of the plurality of video receivers.*”]” Ex.1005, 11:64-66.

127. Accordingly, Shao-028 discloses elements [1.5], [6.3], and [11.5].

7. Forwarding all of the set of enhancement layers

a. **[11.6] wherein the scalable video coding router forwards all of the set of enhancement layers to at least two of the video receivers in the set of video receivers with bandwidth-sufficient conditions;**

128. Shao-028 discloses or renders obvious this element.

129. Although the term “*bandwidth-sufficient conditions*” does not appear in the 372 Patent specification, it does describe the network as having “sufficient” or “insufficient” bandwidth or capacity. Ex.1001, 1:55-57 (“video stream is transmitted at a fixed high rate and not all **parts of the network are likely to have sufficient bandwidth** available to forward the stream.”); 4:33-37 (“However, when the content is ‘live’ and cannot be slowed down, but **the network has insufficient capacity**, packet loss is difficult to avoid. In fact, even when there is **sufficient bandwidth** at all times, store-and-forward packet switched networks are not able to guarantee the delivery of all packets.”); 21:42-45 (“When an outgoing link of a

router has **insufficient bandwidth** to transmit all pending packets, it forwards only those packets with a designated priority or the highest priority.”); 31:19-23 (“In this example, despite the fact that **the network has insufficient capacity**, having dropped packets from every layer and delivered the packets out of order, the user received a deterministic subset of the stream that is uncorrupted.”).

130. In addition, in support of Patent Owner’s claim construction positions at the district court, Patent Owner’s expert stated that “‘bandwidth sufficient conditions’ describes network conditions where the available bandwidth (traffic capacity) is adequate to support the transmission of all the enhancement layers of the video stream without causing congestion or degradation in quality.”

144. In the context of the claim as a whole, a POSITA would understand that the phrase “bandwidth sufficient conditions” describes network conditions where the available bandwidth (traffic capacity) is adequate to support the transmission of *all* the enhancement layers of the video stream without causing congestion or degradation in quality. In other words, the phrase indicates that the network resources can fully support the higher data rate needed for transmitting all layers concurrently to at least two video receivers capable of handling higher bandwidth requirements, to maximize the video quality and resolution delivered to those receivers.

Ex.1020, ¶ 144. Shao-028 discloses element [11.6] consistent with Patent Owner’s or any reasonable interpretation.

131. First, Shao-028 recognizes that communicating over the Internet can cause “congestion” and as a result, VTA Routers drop data packets having lower

priority: “when the Internet or a portion thereof is congested, **data packets with lower priorities may get dropped/delayed** to better ensure that packets with higher priorities get delivered.” Ex.1005, 8:14-17; *see also* Ex.1005, Abstract (“[W]hen network congestion occurs or there is not **enough network bandwidth to transmit all of the prioritized information about an object**, some (e.g., lower priority) information may be dropped at the server or at an intermediate network node to reduce the bit rate.”); Ex.1005, 3:10-16 (“[S]hould the **network become congested[,]**” “the VTA ... provide[s] differential services to the prioritized object-based data packets, such that prioritized object-based data packets having **lower priority levels are selectively dropped.**”); Ex.1005, 10:23-25. (“**Should congestion occur** within network 11 during transmission, one or more network nodes 82 **may need to discard data packets having lower priority levels.**”)

132. Accordingly, when no packets are discarded, “**all of the prioritized information about an object**”—which would include “*all of the set of enhancement layers*”—are forwarded because there is no network congestion, *i.e.*, the network has “enough bandwidth” or otherwise has “*bandwidth-sufficient conditions*” Ex.1005, Abstract. Moreover, as explained above (see ¶44), Ex.1015, p. 142 shows an example of “receiv[ing] all layers” at a decoder)). *See also* Ex.1015, Fig. 5.57. Therefore, if the network has sufficient bandwidth, a POSITA would have understood that all available enhancement layers would be transmitted.

133. In addition, for the reasons already demonstrated above, Shao-028 also discloses forwarding information “*to at least two of the plurality of video receivers.*” See ¶126, above.

134. Accordingly, Shao-028 discloses element [11.6].

8. Selectively Forwarding

- a. [1.6] selectively forward one or more of the set of enhancement layers, but fewer than all of the set of enhancement layers, to at least two of the plurality of video receivers through the internet protocol network based upon the identified bandwidth-limited conditions, and**
- b. [6.4] selectively forwarding one or more of the set of enhancement layers, but fewer than all of the set of enhancement layers, to at least two of the plurality of video receivers through the internet protocol network based upon the identified bandwidth-limited conditions;**
- c. [11.7] wherein the scalable video coding router selectively forwards one or more of the set of enhancement layers, but fewer than all of the set of enhancement layers, to at least two of the remaining video receivers in the set of video receivers based upon the identified bandwidth-limited conditions;**

135. Elements [1.6] recites “*selectively forward[ing] one or more of the set of enhancement layers, but fewer than all of the set of enhancement layers, to at least two of the plurality of video receivers through the internet protocol network based upon the identified bandwidth-limited conditions.*” Elements [1.6] and [6.4] generally recite the same limitations. Shao-028 discloses these elements.

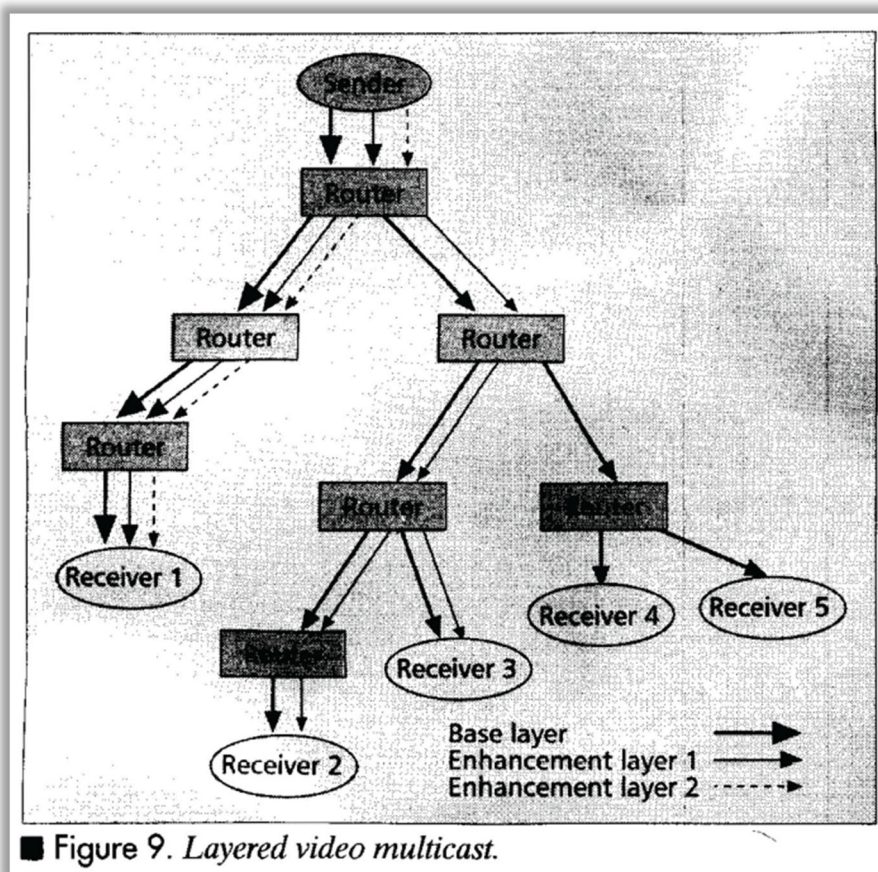
136. Initially, “*the remaining video receivers*” claim term in claim element [11.7] appears to apply selectively to certain receivers that do not receive all of the enhancement layers. Elements [1.6] and [6.4] reference “*the plurality of video receivers*” claim term. Shao-028 satisfies both claim terms its teachings of “selective filtering” capability of VTA Routers which “allows **different users** to receive different quality levels of video data bitstreams.” Ex.1005, 13:1-5 (emphasis added).

137. First, Shao-028 discloses “selectively forward[ing] one or more of the set of enhancement layers, but fewer than all of the set of enhancement layers based upon the identified bandwidth-limited conditions.” Shao-028 states that its techniques include “**selective transmission processes that drop data packets as needed** to take advantage of differentiated classes.” Ex.1005, 10:46-51. The scheme described in Shao-028 “**selectively transmit[s]** object-based data based on data content” (“selectively forward[ing] one or more of the set of enhancement layers”) **in response “to dynamically changing network conditions** and/or client preferences” (“based upon the identified bandwidth-limited conditions”). Ex.1005, 1:10-12 (emphasis added). The “object-based data” in Shao-028 includes “one or more of the set of enhancement layers” because Shao-028 teaches states that “each of these media objects is encoded into a corresponding elementary data bitstream using I, P, B, and enhancement frame layers.” Ex.1005, 5:6-10; see also Ex.1005, 5:39-62 (listing the enhancement layers included in the object-based data).

138. Referencing Figure 6, Shao-028 discloses that “**VTA 84 a ... selectively filter[s]** out or otherwise drop data packets according to their respective transmission priority levels based on network and/or other recognized needs (e.g., downstream feedback/control).” Ex.1005, 8:57-60; *see also* 8:66-9:2. In particular, Shao-028 teaches that a VTA “**filter[s] the received data bitstream by selectively discarding data packets having lower priorities**, and sending the resulting filtered data bitstream to a client 13 and/or a next (downstream) VTA 84.” Ex.1005, 13:10-15. Shao-028 is therefore explaining that by “discarding data packets having lower priorities,” “the **resulting filtered data bitstream**” sent to clients is “*fewer than all of the set of enhancement layers.*”

139. Moreover, Shao-028 states that certain enhancement layers have lower priority than others. *See, e.g.*, Ex.1005, claim 11 (“setting the transmission priority levels ... includes **causing Intra (I) coded frame enhancement layer data to have a higher transmission priority level than Predicted (P) frame enhancement layer data**”). Thus, Predicted (P) frame enhancement layer has a lower priority than Intra (I) coded frame enhancement layer, and as explained earlier, *see* ¶¶103-105, *above*, “Intra (I) coded frame enhancement layer” and “Predicted (P) frame enhancement layer” are enhancement layers. Because Predicted (P) frame enhancement layer has a lower priority than Intra (I) coded frame enhancement layer, the Predicted (P) frame enhancement layer would be dropped before the Intra (I)

coded frame enhancement layer. Shao-028 thus demonstrates that the Intra (I) coded frame enhancement layer is “*selectively forwarded*” because the Predicted (P) frame enhancement layer would be dropped “*based upon the identified bandwidth-limited conditions.*” Indeed, this technique was well-known to POSITAs at the time. For example, Ex.1013, entitled “Video multicast over the Internet,” published in 1999, states that “the sender sends out video in multiple layers, and **each receiver receives a subset of the video layers commensurate with** its processing power and **network bandwidth availability**. Video layering can be supported by many video compression techniques.” Ex.1013, 7.



Ex.1013, Fig. 9. This figure depicts, for example, Receiver 1 getting base layer, enhancement layer 1, and enhancement layer 2; and Receiver 2 getting base layer and enhancement layer 1. This figure also depicts at least one of the routers getting base layer, enhancement layer 1, and enhancement layer 2; and at least one of the routers getting base layer and enhancement layer 1.

140. Accordingly, Shao-028 discloses “*selectively forward[ing] one or more of the set of enhancement layers, but fewer than all of the set of enhancement layers based upon the identified bandwidth-limited conditions.*”

141. Accordingly, Shao-028 discloses [1.6], [6.4], and [11.7].

9. Transmitting according to an Internet Protocol

- a. [1.7] wherein the video router transmits the layered video data stream according to an internet protocol;**
- b. [6.5] wherein the layered video data stream is transmitted according to an internet protocol; and**
- c. [11.8] wherein the layered video data stream is transmitted according to an internet protocol; and**

142. Elements [1.7], [6.5], and [11.8] generally relate to “*the video router transmit[ting] the layered video data stream according to an internet protocol.*”

Shao-028 discloses these elements for the same reasons addressed above with respect to claim limitations [1.3], [6.1], [11.3] (*i.e.*, receiving “*a layered video data stream*” at a VTA Router) and [1.4], [6.2], [11.4] (*i.e.*, use “*of an internet protocol network between the video router and a plurality of video receivers*”). And, as

demonstrated below, Shao-028 discloses the VTA Router “*transmitting a layered video data stream.*” For instance, “VTA 84 is configured to receive video data bitstreams from server 12 or a previous VTA, filter the received data bitstream by selectively discarding data packets having lower priorities, and **sending the resulting filtered data bitstream to a client 13** and/or a next (downstream) VTA 84” such that the resulting filtered data bit stream is formed using “**I, P, B, and enhancement frame layers.**” Ex.1005, 5:6-10. The techniques in Shao-028 “allows for efficient object-based **video transmission over IP based networks.**” Ex.1005, 10:42-44. “**During transmission, the data within a compressed video bitstream is packetized and the packets are sent to the receiver over the Internet.**” Ex.1005, 10:62-11:1. In view of the aforementioned passages in Shao-028, a POSITA would have understood a VTA Router transmitting the filtered bitstream (formed using I, P, B, and enhancement frame layers) over IP-based networks constitutes “*the video router transmitting the layered video data stream according to an internet protocol.*”

143. Accordingly, Shao-028 discloses elements [1.7], [6.5], and [11.8].

10. Sequence Number of Packets

- a. [1.8] wherein each layer of the layered video data stream comprises data packets, each of which is encoded with a sequence number and**
- b. [6.6] wherein each layer of the layered video data stream comprises data packets, each of which is encoded with a sequence number and**
- c. [11.9] wherein each layer of the layered video data stream comprises data packets, each of which is encoded with a sequence number and**

144. Shao-028 discloses or renders obvious “*wherein each layer of the layered video data stream comprises data packets, each of which is encoded with a sequence number.*”

145. The 372 Patent explains that “[a]side from carrying its own sequence number, each packet contains the current sequence number of all the other layers as well. By inspecting these sequence numbers each time a packet arrives, the receiver determines whether it has missed any packets from the layers it marked as reliable.” Ex.1001, 28:61-66. “Not only are the packets inside the individual layers restored to their natural order using their sequence numbers, but the total ordering across the layers may also be restored.” Ex.1001, 30:14-17. The 372 Patent thus explains that “*sequence numbers*” are used for restoring the natural ordering of the packets. Moreover, at the time of filing of the 372 Patent, as explained above (see [VIII.3])

using sequence numbers in IP packet headers was known in the art. Ex.1017, 20 (“Sequence numbers are used to keep data in the proper order.”).

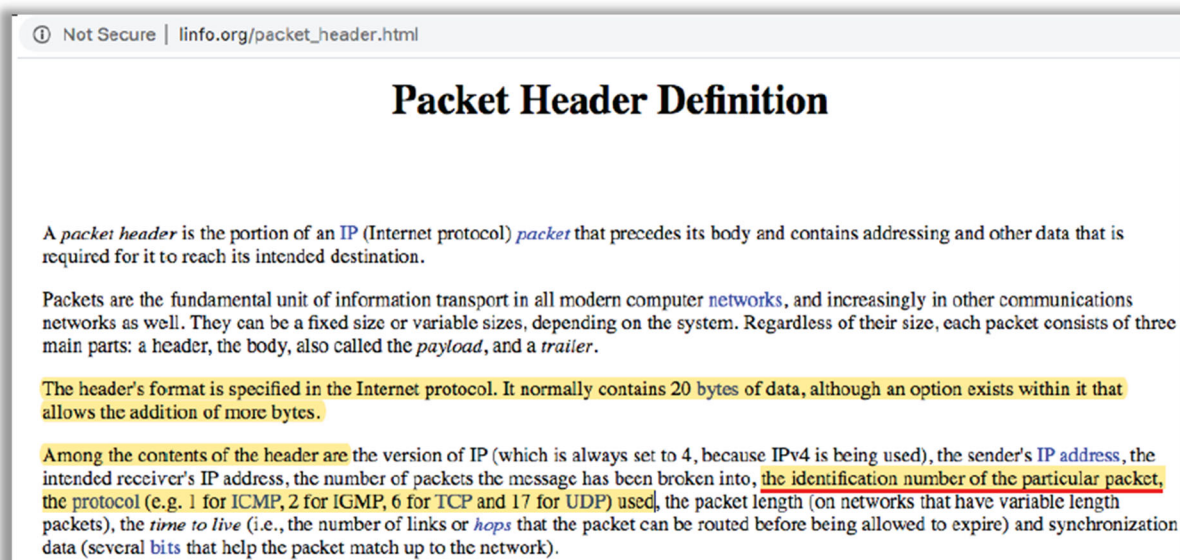
146. As demonstrated below, Shao-028 discloses “*wherein each layer of the layered video data stream comprises data packets, each of which is encoded with a sequence number*” as claimed in the 372 Patent.

147. Shao-028 discloses “Data packets [*i.e., “wherein each layer of the layered video data stream comprises data packets”*] 106a-c are ... configured for transmission over network 11, for example, by adding a Network header (NPH) 114[.] NPH may be TCP Header+ IP Header, UDP header+IP Header, IP Header, or other format.” Ex.1005, 9:32-37.

148. Additionally, Shao-028 explains, “[a]n exemplary data packet 106a is depicted in FIG. 5,” and “[a]s shown, **VPH 110 includes** an object identifier (OI) 110a, **a part number (PN) 110b and a starting position (SP) 110c for the first portion (or contiguous portions) of data in data packet 106a (i.e., here, portion 104a).**” Ex.1005, 9:39-41. Shao-028 further explains that “a length (LEN) 112a is provided to establish the length of the first portion (or contiguous portions). **Additional SP 110c** and LEN 112b data are provided following identifying bits 107 to further define portion 104e. **The identifying information in 106a can be used to reconstruct the data bitstream 100,** or remaining portion thereof, after

transmission over network 11.” Accordingly, as in the 372 Patent, “**part number (PN) 110b**” provides the same functionality as the “*sequence number*.”

149. Moreover, Shao-028 discloses or renders obvious this limitation consistent with Patent Owner’s apparent interpretation of this claim limitation in its PIC in which Patent Owner has mapped this claim limitation to generic “identification number of the particular packet” included in the packet header.



Ex.1007, 21.

150. In addition, the IPv6 protocol from Internet Engineering Task Force (IETF), described in RFC2507 entitled “IP Header Compression²⁶,” published February 1999 describes the “*sequence number*” field in the header of a packet.

²⁶ This document is available online at <https://datatracker.ietf.org/doc/html/rfc2507#section-11.2> (last accessed August 4, 2024).

7.12. TCP Header

The TCP header is described in [RFC-793].

The Next Header field (IPv6) or Protocol field (IPv4) in the preceding subheader is DEF.

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Standards Track

[Page 30]

[RFC 2507](#)

IP Header Compression

February 1999

```

+-----+-----+-----+-----+-----+-----+-----+-----+
|           Source Port           |           Destination Port           |
+-----+-----+-----+-----+-----+-----+-----+-----+
|                               Sequence Number                               |
+-----+-----+-----+-----+-----+-----+-----+-----+
|           Acknowledgment Number           |
+-----+-----+-----+-----+-----+-----+-----+-----+
| Offset| Reserved |U|A|P|R|S|F|           Window           |
+-----+-----+-----+-----+-----+-----+-----+-----+
|           Checksum           |           Urgent Pointer           |
+-----+-----+-----+-----+-----+-----+-----+-----+
|           Options           |           Padding           |
+-----+-----+-----+-----+-----+-----+-----+-----+

```

Ex.1008, 28.

11.2. Reordering in TCP packet streams

A compressor may avoid sending COMPRESSED_TCP headers and only send COMPRESSED_TCP_NODELTA headers when there is reordering over the link. Compressed headers will typically be 17 octets with that method, significantly larger than the usual 4-7 octets.

To achieve better compression rates the following method, adding only two octets to the compressed header for a total of 6-9 octets, may be used. A packet sequence number, incremented by one for every packet in the TCP stream, is then associated with each compressed and full header. This allows the decompressor to place the packets in the correct sequence and apply their deltas to the context in the correct order. A simple sliding window scheme is used to place the packets in the correct order.

Ex.1008, 36. Thus, a POSITA would have known that a “sequence number” is associated with each packet in the video data stream and used for re-ordering the

packets i.e., “place the packets in the correct order.” *Id.* Indeed, Shao-028 discloses that a packet’s “identifying information” (i.e., “*sequence number*”) is used “to reconstruct the data bitstream ... or remaining portion thereof, after transmission over [the] network,” and a packet’s “*sequence number*” would be used for the reconstruction. Ex.1005, 9:46-49.

151. Accordingly, Shao-028 discloses or renders obvious “*wherein each layer of the layered video data stream comprises data packets, each of which is encoded with a sequence number.*”

11. Layer Identifier of Packets

- a. **[1.9] a layer identifier, and wherein the layer identifier for each data packet is based upon a layer to which the packet belongs.**
- b. **[6.7] a layer identifier, and wherein the layer identifier for each data packet is based upon a layer to which the packet belongs.**
- c. **[11.10] a layer identifier, and wherein the layer identifier for each data packet is based upon a layer to which the packet belongs.**

152. Shao-028 discloses or renders obvious “*a layer identifier, and wherein the layer identifier for each data packet is based upon a layer to which the packet belongs.*”

153. The 372 Patent specification has only one reference to “*layer identifier.*” Ex.1001, 26:62-66 (“To this end it inspects the packet, looks up the

multicast group, **the stream layer identifier** and the layer's sequence number and then checks the inbound packet buffer 935 to see if it contains the packet.”) In its infringement allegations, however, Patent Owner points to “layer identifier” as specified in the H.264 standard, comprised of the set of values including `priority_id`, `dependency_id`, `quality_id`, and `temporal_id`. See Ex.1007, 45.

Each scalable layer is associated with a unique layer identifier as specified later in this clause. The representation of a particular scalable layer with a particular layer identifier `layerId` does not include any scalable layer with a layer identifier greater than `layerId`, but it may include scalable layers with layer identifiers less than `layerId`. The scalable layers on which a particular scalable layer depends may be indicated in the scalability information SEI message as specified later in this clause.

NOTE 3 – When all scalable layers for which scalability information is provided in the scalability information SEI message have `sub_pic_layer_flag[i]` equal to 0, the unique layer identifier values may be set equal to $(128 * \text{dependency_id} + 8 * \text{quality_id} + \text{temporal_id})$, with `dependency_id`, `quality_id`, and `temporal_id` being the corresponding syntax elements that are associated with the VCL NAL units of a scalable layer.

See ITU-T H.264 at 624.

NAL unit headers for scalable bitstreams that comply with the H.264 standard comprise a layer identifier, which is comprised of the set of values including `priority_id`, `dependency_id`, `quality_id`, and `temporal_id`, according to the standard.

dependency_id specifies a dependency identifier for the NAL unit. `dependency_id` shall be equal to 0 in prefix NAL units. The assignment of values to `dependency_id` is constrained by the sub-bitstream extraction process as specified in clause G.8.8.1.

See ITU-T H.264 at 459.

priority_id specifies a priority identifier for the NAL unit. The assignment of values to `priority_id` is constrained by the sub-bitstream extraction process as specified in clause G.8.8.1.

See ITU-T H.264 at 458.

quality_id specifies a quality identifier for the NAL unit. `quality_id` shall be equal to 0 in prefix NAL units. The assignment of values to `quality_id` is constrained by the sub-bitstream extraction process as specified in clause G.8.8.1.

The variable `DQId` is derived by

$$\text{DQId} = (\text{dependency_id} \ll 4) + \text{quality_id} \quad (\text{G-63})$$

When `nal_unit_type` is equal to 20, the bitstream shall not contain data that result in `DQId` equal to 0.

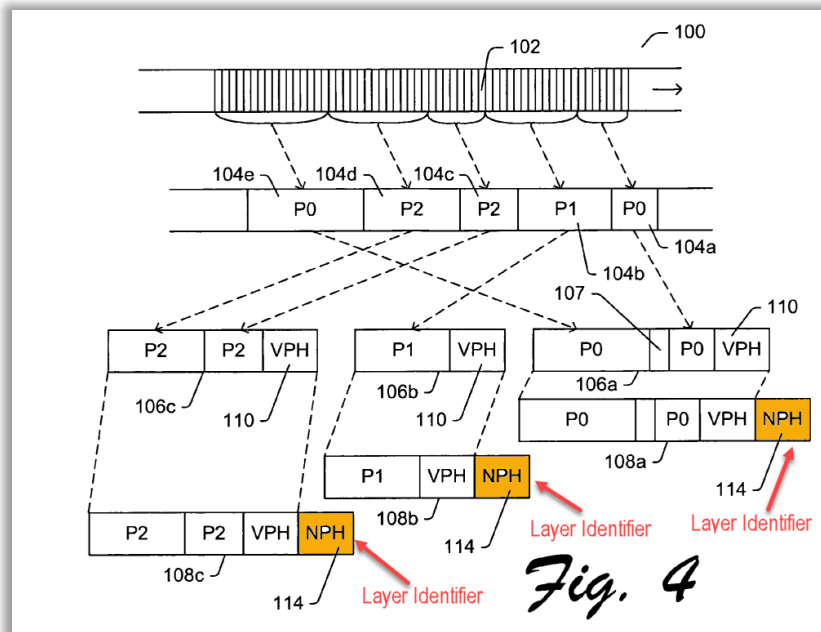
See ITU-T H.264 at 459.

Ex.1007, 45 (annotated).

154. The “Network Header (NPH)” in Shao-028 discloses the “*layer identifier*” element in the 372 Patent. As explained above, Shao-028 teaches using

the “Ipv6 protocol.” Ex.1005, 14:1-5. “Data packets 106a-c are then each further configured for transmission over network 11, for example, by adding a Network header (NPH) 114 to create data packets 108a–c. respectively. By way of example, NPH may be TCP Header+ **IP Header**, UDP header+**IP Header**, **IP Header**, or other format. NPH 114 identifies the transmission priority level.” Ex.1005, 9:32-37. Shao-028 explains how the transmission priority level (identified by the “NPH”) is used in transmitting media information. Shao-028’s method includes “associating portions of the object-based media information [included in a data bitstream] with a plurality of different transmission priority levels” and further “based at least on the plurality of different transmission priority levels,” “selectively transmitting the portions of the object-based media information over a network.” Ex.1005, 2:12-21.

155. Fig. 4 (reproduced below) shows Shao-028’s “Network header (NPH)” for each data packet.



Ex.1005, Fig. 4 (annotated). With reference to Fig. 4, Shao-028 explains that in the bitstream 100, each of portions 104 a-e, is “associated with a specific transmission priority level” and placed in data packets 106 a–c such that “portion 104 a has a priority level of “P0”, portion 104 a has a priority level of “P0”, portion 104 b has a priority level of “P1”, portion 104 c has a priority level of “P2”, portion 104 d has a priority level of “P2”, and portion 104 e has a priority level of “P0”. Ex.1005, 9:12-22. Thus, data packet 106 a includes “portions 104 a and 104 e, each of which has a transmission priority level of P0... Similarly, data packet 106 b includes portion 104 b, which has a transmission priority level of P1, and data packet 106 c includes portions 104 c and 104 d, each of which has a transmission priority level of P2.” Ex.1005, 9:22-31.

156. Further, Shao-028 describes that “base layers” and “enhancement layers” “**can be selectively classified as having different transmission priority levels**” and consequently the “**Network header (NPH)**” (the “*layer identifier*”), which identifies transmission priority levels, “***is based upon a layer to which the packet belongs.***” Ex.1005, 5:39-64. For example, “the information in the data bitstream of object-based video coding, such as, MPEG-4, can be divided into the following types of information:

1. Control information, (e.g., Video Object Head, Video Object Layer Head and Video Object Plane head);
2. Shape information of an Intra (I) coded frame base layer
3. Texture DC information of an Intra (I) coded frame base layer
4. Texture AC information of an Intra (I) coded frame base layer
5. Shape information of a Predicted (P) frame base layer
6. Motion information of a Predicted (P) frame base layer
7. Texture information of a Predicted (P) frame base layer
8. Shape information of a Bi-directionally (B) predicted frame base layer
9. Motion information of a Bi-directionally (B) predicted frame base layer
10. Texture information of a Bi-directionally (B) predicted frame base layer
11. Intra (I) coded frame enhancement layer
12. Predicted (P) frame enhancement layer
13. Bi-directionally (B) predicted frame enhancement layer

The preceding types of information can be selectively classified as having different transmission priority levels.” Ex.1005, 5:39-64. Shao-028 further explains that “based at least on the plurality of different transmission priority levels,” “selectively transmitting the portions of the object-based media information over a network.” Ex.1005, 2:12-21. Thus, in Shao-028, a packet’s “Network header (NPH),” which identifies transmission priority levels for base layers and enhancement layers ***“is based upon a layer to which the packet belongs.”***

157. In addition, Shao-028’s disclosure of “Network header (NPH)” identifying a transmission priority level of enhancement layers and used for selectively transmitting media information is consistent with Patent Owner’s statements in its Reply Claim Construction Brief in which Patent Owner asserts that the “*layer identifier*” is a criterion for selectively forwarding enhancement layers.

It is undisputed that

besides a “layer identifier,” the specification teaches using at least a “priority value” as another criteria for selectively forwarding enhancement layers. (Opp. at 20 (“the specification . . . describes identifying layers to forward using a priority value, which is akin to the claimed ‘layer identifier’”).)

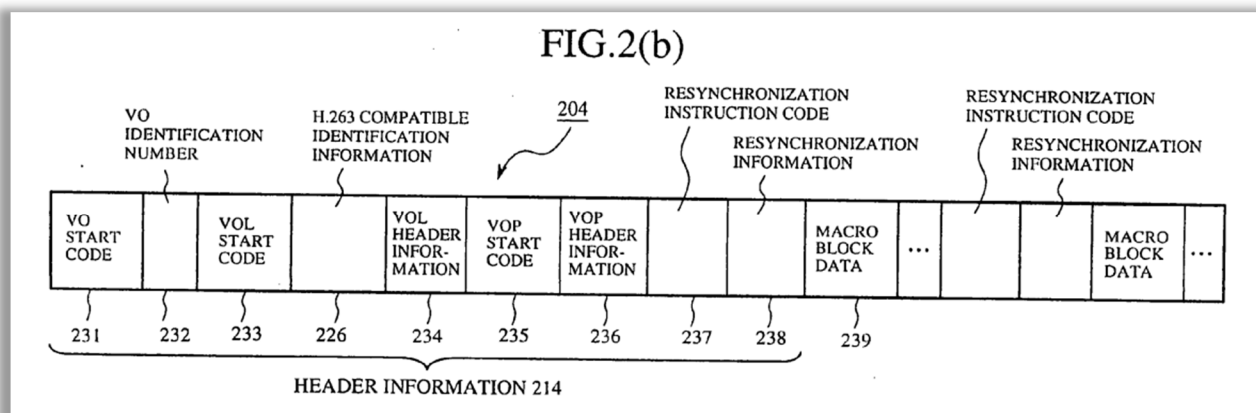
Ex.1010, 9.

158. Although Shao-028 does not expressly disclose the term “*layer identifier*,” a POSITA would have recognized that a data packet in Shao-028 necessarily includes a “*layer identifier*” because Shao-028 teaches that media objects in MPEG-4 video data “may be represented by Intra (I) coded frame layers, Predicted (P) frame layers, Bi-directionally (B) predicted frame layers, Intra (I) coded frame enhancement layers, Predicted (P) frame enhancement layers, and Bi-directionally (B) predicted frame enhancement layers,” and to “regenerate at least a portion of the encoded data bitstream, decode the resulting data bitstream, and output all or part of object data,” a decoder (*e.g.*, at a client) would use the “*layer identifier*” to determine which portions of the bit stream are to be regenerated and provided as output. Ex.1005, 2:35-42. “[T]he necessary multimedia information” about an encoded media object that is provided to “a client device/application,” would include “*layer identifier[s]*” because Shao-028 teaches encoding media objects “using I, P, B, and enhancement frame layers”—which would necessarily be identified by “*layer identifier[s]*.” See also §VIII (Technology Background).

159. Additionally, as I explained earlier (*see* ¶46), a POSITA would have understood that the MPEG-4²⁷ video coding standard supports a functionality as

²⁷ References related to MPEG-4 video coding are relevant because Shao-028 uses MPEG-4 video (*see e.g.*, Ex.1005, 2:35-36, 4:46-49, 5:6-14, 10:18-20, 14:1-5) and a POSITA would have turned to such references as reflecting the knowledge of a POSITA at the time of the claimed invention in support of Shao-028’s teachings.

described in the claimed “*layer identifier*.” As another example, US Pub No 2005/0141610 to “Isu” (Ex.1021) discloses a “Video Object Layer (VOL) start code” field for “each layer” comprising “**a fixed length (5-bit) start code [that is] unique to the layer**” and included as part of the “header information” of an MPEG-4 video bitstream. Ex.1021, [0134], [0056], Fig. 2(b). Isu explains the use of the VOL start code 233 by a VOL start code detector that “detects the VOL start code 233 in the coded bit stream.” Ex.1021, [0066]. Therefore, a POSITA would have understood that the VOL start code comprising “start code ... unique to the layer” in Isu “*is based upon a layer*” and therefore provided functionality as described by the “*layer identifier*.”



Ex.1021, Fig. 2(b) (depicting “Video Object Layer (VOL) start code” field 233 included in header information 214 of MPEG-4 video bit stream 204).

160. Accordingly, Shao-028 discloses and/or renders obvious elements [1.9], [6.7], and [11.10].

161. To the extent Patent Owner contends that Shao-028 does not expressly disclose a “*layer identifier*” in the IP header of its data packets, this is taught by Shao-028 as modified by Shao-423 because Shao-423 expressly discloses a 3-bit “*layer identifier*” included within a “flow label field” in the exemplary IPv6 header of a data packet, and it would have been obvious for a POSA that data packets used in the scalable video transmission scheme of Shao-028 would be modified based on the teachings of Shao-423, and thus the IPv6 header of Shao-028 would additionally include a flow label field taught in Shao-423 comprising “layer ID” (“*layer identifier*”) for the reasons explained above. See §[IX.3]. Shao-423 recognizes that at the time of its invention, “Flow label field 502 has not been defined by IETF” and provides an example of how it can be used as an “Application-Flow-Layer Identifier.”

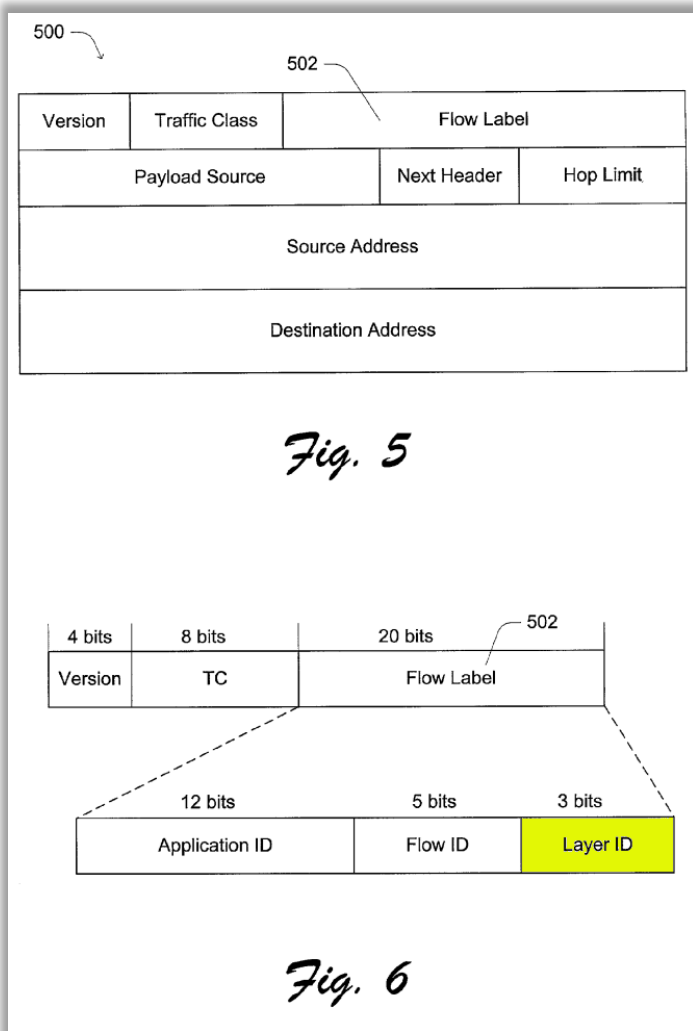
162. 1.5 Application-Flow-Layer Identifiers

An application-flow-layer identifier is used in a packet to identify the information within the packet. This Application-Flow-Layer Identifier can be used by ARCs and MPAs. FIG. 5 illustrates an exemplary header **500**. Here, an IPv6 header is provided as an example to explain how to define such an identifier. Of particular interest in this example, is the (20-bit) flow label field **502**. **Flow label field 502 has not been defined by IETF and as such is used herein as an Application-Flow-Layer Identifier.**

FIG. 6 further illustrates one potential specification of the application-flow-layer identifier within the flow label field **502**. **Here, the 20-bit**

flow label field is specified as further including a 12-bit application identifier, a 5-bit flow identifier and a 3-bit layer identifier.

Ex.1006, [0101]-[0106]. Figs. 5 and 6 (reproduced below) of Shao-423 depict the “application layer identifier” (the “*layer identifier*”) with respect to the “Flow Label” field in the IPv6 packet header.



Ex.1006, Figs. 5 and 6 (annotated).

163. Accordingly, Shao-028 in view of Shao-423 renders obvious elements [1.9], [6.7], and [11.10].

164. Accordingly, Shao-028 in view of Shao-423 render obvious independent claims 1, 6, and 11.

D. Invalidity Analysis of Dependent Claims 2-3, 5, 7-8, 10, 12-13, and 15

1. Video processing capabilities of the video receiver (Claims 2, 7, and 12)
 - a. **[2.0] The video router of claim 1, wherein the video router further selectively forwards the one or more of the set of enhancement layers based on video processing capabilities of the video receiver²⁸.**
 - b. **[7.0] The method of claim 6, wherein the selectively forwarding step further comprises: selectively forwarding the one or more of the set of enhancement layers based on video processing capabilities of the video receiver¹⁴.**
 - c. **[12.0] The video router of claim 11, wherein the video router further selectively forwards the one or more of the set of enhancement layers based on video processing capabilities of each of the set of video receivers.**

165. Elements [2.0], [7.0], and [12.0] generally relate to “*the video router ... selectively forward[ing] the one or more of the set of enhancement layers based on*

²⁸The term “**the** video receiver” first appears in dependent claims 2 and 7 with the article “**the**” indicating that it is referencing an earlier instance of “the video receiver.” But the claims contain no such earlier use of the term “video receiver” either in dependent claims 2, and 7, nor independent claims 1 and 6 upon which

video processing capabilities of the video receiver.” Shao-028 discloses these elements or renders them obvious for the same reasons I discuss above with respect to claim limitation [1.6], [6.4], and [11.7] which relate to the VTA Router (the “*video router*”) “selectively forward[ing] one or more of the set of enhancement layers.” And, explained in further detail below, the “*selectively forward[ing]* ...” in Shao-028 is based on “*video processing capabilities of the video receiver.*”

166. “The VTAs will filter out data packets from upstream according to downstream requirements (e.g., according to the network link and a particular clients [sic: client’s] capabilities). For example, data packets containing texture information for a particular video object may be dropped by the VTA.” Ex.1005, 10:26-30. Shao-028 explains the varying capabilities of clients diagrammatically. The varying capability of different clients is graphically depicted in Fig. 6 (reproduced below) “by the varying width of data flow arrows 120, 122, 124, 126, 128, 130, and 132; here, wider data arrows represent more data packets being transmitted. Thus, for example, VTA 84 c (and possibly other network resources) has dropped some of the

claims 2 and 7 depend from respectively. Putting aside the antecedent basis issue, for purposes of this proceeding, I have assumed “**the** video receiver” is intended to be one of the video receivers that the router is selectively forwarding to, consistent with Patent Owner’s statement in its Reply Claim Construction Brief. See Ex.1010, 10.

data packets received from server device 12 prior to providing the remaining data packets to VTA 84 c, since arrow 120 is wider than arrow 124.” Ex.1005, 10:31-38.

167. The methods and arrangements in Shao-028 are configured “to control and respond to the **communication needs of the clients.**” Ex.1005, 11:66-12:2. “[T]he VTAs are able to respond dynamically to the **needs of the client devices,**” which, for example, can be in the form of “control requests from the client device.” Ex.1005, 10:1-5, 3:4-10. For instance, “the receivers [may] require lower bit rates” which a POSITA would have understood are “*based on video processing capabilities of the video receiver.*” Ex.1005, 12:26-29. Further, as explained above, *see* ¶¶118-120, Shao-028 describes that its **resource allocation policy** *e.g.*, (Capacity, Requirement) policy, associated with every VTA and client, is based on “**the amount of the resource available for a video object in the VTA or the end system of the user to handle the video object**” and “**the amount of the resource for a video object required by the VTA or the user.**” Ex.1005, 13:30-38.

168. Accordingly, Shao-028 discloses elements [2.0], [7.0], and [12.0].

2. Dividing bandwidth and Prioritizing Enhancement Layer Forwarding (Claims 3, 8, and 13)
 - a. **[3.0] The video router of claim 1, wherein the video router divides available bandwidth among a plurality of data streams, and wherein the video router prioritizes forwarding of the set of enhancement layers.**

- b. **[8.0] The method of claim 6, further comprising: dividing available bandwidth among a plurality of data streams; and prioritizing the set of enhancement layers for the selectively forwarding step.**
- c. **[13.0] The video router of claim 11, wherein the video router divides available bandwidth among a plurality of data streams, and wherein the video router prioritizes forwarding of the set of enhancement layers.**

169. Elements [3.0], [8.0], and [13.0] generally relate to “*dividing available bandwidth among a plurality of data streams; and prioritizing the set of enhancement layers for the selectively forwarding step.*” Shao-028 discloses these elements.

170. First, for the same reasons I discuss above with respect to claim limitation [1.6], [6.4], and [11.7] which relate to the VTA Router (the “*video router*”) “*selectively forward[ing] one or more of the set of enhancement layers,*” Shao-028 discloses “*prioritizing the set of enhancement layers for the selectively forwarding step.*” Additionally, within “*the set of enhancement layers,*” Shao-028 discloses “**data packets with lower priorities may get dropped/delayed** to better ensure that packets with higher priorities get delivered.” Ex.1005, 8:14-17. And furthermore, Shao-028 discloses “*dividing available bandwidth among a plurality of data streams*” because in Shao-028, “**VTA 84 may also be configured to ... provide bandwidth allocation coordination among multiple data bitstreams, and/or even provide dynamic bandwidth re-allocation.**” Ex.1005, 13:10-21, *see also*

Abstract (Methods . . . to **prioritize/classify different types of information according to their importance** and to packetize or otherwise arrange the prioritized information in a manner such that lower priority information may be dropped during transmission. Thus, **when network congestion occurs or there is not enough network bandwidth to transmit all of the prioritized information about an object, some (e.g., lower priority) information may be dropped** at the server or at an intermediate network node to reduce the bit rate.).

171. Accordingly, Shao-028 discloses elements [3.0], [8.0], and [13.0].

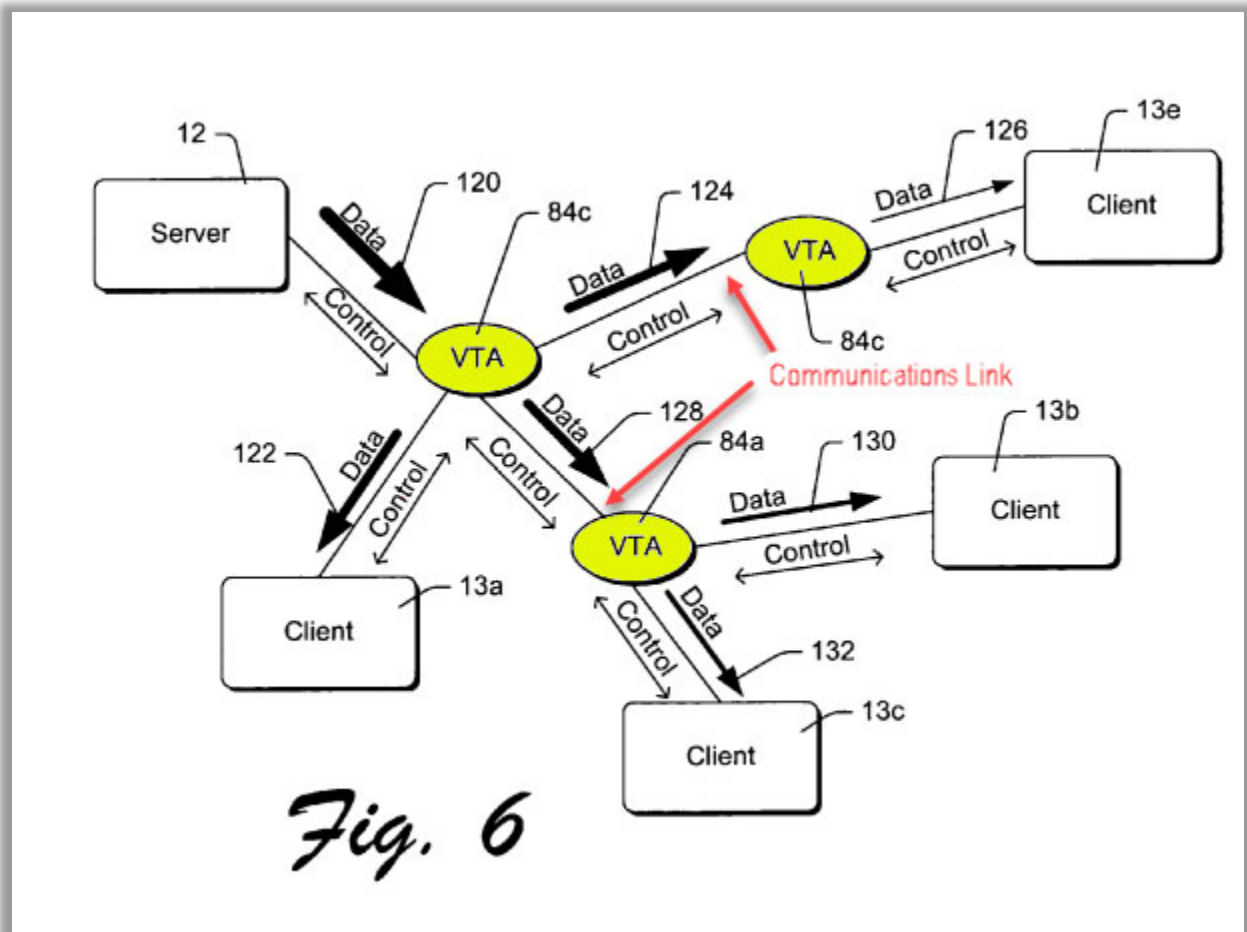
3. Transmitting the layered video stream to another video router over a communications link (Claims 5, 10, and 15)

- a. **[5.0] The video router of claim 1, further comprising: a communications link connecting the video router with at least a second video router, wherein the layered video data stream is transmitted over the communications link between the video router and the second video router.**
- b. **[10.0] The method of claim 6, wherein the layered video data stream is received from another video router.**
- c. **[15.0] The video router of claim 11, further comprising: a communications link connecting the video router with at least a second video router, wherein the layered video data stream is transmitted over the communications link between the video router and the second video router.**

172. Elements [5.0], [10.0], and [15.0] generally relate to “*transmit[ting] the layered video data stream over [a] communications link between the video router*”

and [a] second video router.” Shao-028 discloses these elements or renders them obvious.

173. First, for the same reasons I discuss above with respect to claim limitation [1.6], [6.4], and [11.7] which relate to the VTA Router (the “*video router*”) “*selectively forward[ing] one or more of the set of enhancement layers,*” Shao-028 discloses “transmit[ing] the layered video data stream,” which would be over “[*a communications link between the video router and [a] second video router*” because Shao-028 teaches using “the link state between the VTA and its next upstream VTA” and “all [of a VTA’s] next downstream VTAs” to determine the resource allocation policy, e.g., (Capacity, Requirement) and depicted in Fig. 6 (reproduced below). Ex.1005, 13:39-41, 44-46. In particular, the example in Fig. 6 depicts “*a communications link between*” VTA Router 84c (“*the video router*”) and VTA 84a (“*a second video router*”). “[E]stablishing a communications link between the computers” in Shao-028’s system. Ex.1005, 8:10-11, *see also* Ex.1005, 8:1-4.



Ex.1005, Fig. 6 (annotated).

174. Accordingly, Shao-028 discloses elements [5.0], [10.0], and [15.0].

XI. Objective Indicia of Non-Obviousness

175. I am not aware of any objective indicia of non-obviousness that would change my opinion that the challenged claims of the 372 Patent are obvious in view of the prior art discussed above in this declaration. It is my opinion that any potential objective indicia of non-obviousness would not overcome the clear disclosures in the prior art showing that the subject matter of these claims would have been obvious

to a POSITA as of January 26, 2005. However, I reserve the right to supplement my opinions Patent Owner alleges or offers any purported evidence of objective indicia of non-obviousness.

XII. CONCLUSION

176. I declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true, and that these statements were made with knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code.

Dated: September 5, 2024



Sandeep Chatterjee

CLAIM LISTING

Claim 1
[1.0] A video router, comprising:
[1.1] a memory; and
[1.2] a processor, wherein the processor executes instructions stored in the memory to cause the video router to:
[1.3] receive a layered video data stream including a base layer and a set of enhancement layers,
[1.4] identify bandwidth-limited conditions of an internet protocol network between the video router and a plurality of video receivers,
[1.5] forward the base layer from the video router to at least two of the plurality of video receivers via the internet protocol network, and
[1.6] selectively forward one or more of the set of enhancement layers, but fewer than all of the set of enhancement layers, to at least two of the plurality of video receivers through the internet protocol network based upon the identified bandwidth-limited conditions, and
[1.7] wherein the video router transmits the layered video data stream according to an internet protocol;
[1.8] wherein each layer of the layered video data stream comprises data packets, each of which is encoded with a sequence number and
[1.9] a layer identifier, and wherein the layer identifier for each data packet is based upon a layer to which the packet belongs.
Claim 2
[2.0] The video router of claim 1, wherein the video router further selectively forwards the one or more of the set of enhancement layers based on video processing capabilities of the video receiver.
Claim 3
[3] The video router of claim 1, wherein the video router divides available bandwidth among a plurality of data streams, and wherein the video router prioritizes forwarding of the set of enhancement layers.
Claim 5
[5] The video router of claim 1, further comprising: a communications link connecting the video router with at least a second video router, wherein the layered video data stream is transmitted over the communications link between the video router and the second video router.
Claim 6
[6.0] A method for transmitting video signals, the method comprising:

[6.1] receiving a layered video data stream comprising a base layer and a set of enhancement layers;
[6.2] identifying bandwidth-limited conditions of an internet protocol network between a video router and a plurality of video receivers;
[6.3] forwarding the base layer to at least two of the plurality of video receivers via the internet protocol network; and
[6.4] selectively forwarding one or more of the set of enhancement layers, but fewer than all of the set of enhancement layers, to at least two of the plurality of video receivers through the internet protocol network based upon the identified bandwidth-limited conditions;
[6.5] wherein the layered video data stream is transmitted according to an internet protocol; and
[6.6] wherein each layer of the layered video data stream comprises data packets, each of which is encoded with a sequence number and
[6.7] a layer identifier, and wherein the layer identifier for each data packet is based upon a layer to which the packet belongs.
Claim 7
[7.0] The method of claim 6, wherein the selectively forwarding step further comprises: selectively forwarding the one or more of the set of enhancement layers based on video processing capabilities of the video receiver.
Claim 8
[8.0] The method of claim 6, further comprising: dividing available bandwidth among a plurality of data streams; and prioritizing the set of enhancement layers for the selectively forwarding step.
Claim 10
[10] The method of claim 6, wherein the layered video data stream is received from another video router.
Claim 11
[11.0] A scalable video coding router, comprising:
[11.1] a memory; and
[11.2] a processor, wherein the processor executes instructions stored in the memory to cause the scalable video coding router to:
[11.3] receive a layered video data stream that comprises a base layer and a set of enhancement layers,
[11.4] identify bandwidth-limited conditions of an internet protocol network between the video router and a set of video receivers, and

[11.5] forward the base layer from the video router to at least two of the set of video receivers;
[11.6] wherein the scalable video coding router forwards all of the set of enhancement layers to at least two of the video receivers in the set of video receivers with bandwidth-sufficient conditions;
[11.7] wherein the scalable video coding router selectively forwards one or more of the set of enhancement layers, but fewer than all of the set of enhancement layers, to at least two of the remaining video receivers in the set of video receivers based upon the identified bandwidth-limited conditions;
[11.8] wherein the layered video data stream is transmitted according to an internet protocol; and
[11.9] wherein each layer of the layered video data stream comprises data packets, each of which is encoded with a sequence number and
[11.10] a layer identifier, and wherein the layer identifier for each data packet is based upon a layer to which the packet belongs.
Claim 12
[12.0] The video router of claim 11, wherein the video router further selectively forwards the one or more of the set of enhancement layers based on video processing capabilities of each of the set of video receivers.
Claim 13
[13] The video router of claim 11, wherein the video router divides available bandwidth among a plurality of data streams, and wherein the video router prioritizes forwarding of the set of enhancement layers.
Claim 15
[15] The video router of claim 11, further comprising: a communications link connecting the video router with at least a second video router, wherein the layered video data stream is transmitted over the communications link between the video router and the second video router.