

EXHIBIT 1

**IN THE UNITED STATES DISTRICT COURT
THE EASTERN DISTRICT OF TEXAS
SHERMAN DIVISION**

SCALE VIDEO CODING LLC,

Plaintiff,

v.

CISCO SYSTEMS INC.,

Defendant.

Civil Action No. 4:23-cv-00803-SDJ

JURY TRIAL DEMANDED

**DECLARATION OF MICHAEL ADAMS IN SUPPORT OF PLAINTIFF'S OPENING
CLAIM CONSTRUCTION BRIEF**

I have personal knowledge of the facts set forth in this declaration and, if called to testify as a witness, would testify under oath as follows:

1. I have been retained as an expert on behalf of Scale Video Coding, LLC (“Scale Video” or “Plaintiff”) in the above-captioned matter.

2. I have been asked by Scale Video to provide my expert opinion regarding the constructions of disputed terms in the asserted claims (claims 1, 2, 6, 7, 11, 12) of U.S. Pat. No. 11,019,372 (the “372 Patent”), specifically, to opine on whether the disputed terms are indefinite or whether they would have informed, with reasonable certainty, those skilled in the art about the scope of the invention.

3. I am the President/Founder of Broadband Semantics Consulting LLC, a company that provides consulting services for systems architecture, product and test environment design for communications companies.

4. In 1979, I received my Bachelor of Science with Honors in Electrical and Electronic Engineering from University of Bristol, England.

5. I have over 25 years of professional industry and research experience in telecommunications, software development, and systems architecture. During this time, I have invented, developed, and implemented broadband/video products and services with companies such as Digital Equipment, Northern Telecom, Time Warner Cable, Terayon, and Tandberg/Ericsson TV.

6. From 1993 to 2003, I worked as an engineer for Time Warner Cable (TWC). As part of my work, I developed the network architecture for the Time Warner Full Service Network (FSN), which was the first video-on-demand system, including an electronic program guide, home-shopping, and multiplayer games. The Time Warner FSN was an IP over ATM-based system that

delivered video-on demand via media streams to a client device. I was responsible for the development of network architecture, including video compression, network adaptation functions and network management. I also worked as a Principal Network Architect on TWC's Pegasus digital cable system. The Pegasus system was an MPEG-2 systems layer system combined with IP signaling that was ultimately deployed with over 30 million client devices to TWC (now Charter Communications). I was responsible for developing the detailed network architecture and STB requirements for the system.

7. I have also served as the Head of Software Strategy at Ericsson TV and Vice President of Systems Architecture at Tandberg Television. In those positions, I provided subject matter expertise and technical sales support for digital compression products and standards including MPEG-2, MPEG-4 (H.264), and HEVC/H.265. I also developed multi-screen video product-prototypes, including the first public demonstration of "screen-shifting" from STB to PC to smartphone at CableLabs innovation showcase in February 2010.

8. In the late 1990s, I served as the Chair of the SCTE Digital Video Standards sub-committee for Working Group 3. The sub-committee included representatives from consumer electronics companies that sold products for use in the cable, satellite and broadcast (off-air or over-the-air terrestrial broadcast) television industries. During this time, I also served as the Co-Chair of the Joint Engineering Committee (JEC) of the Consumer Electronics Manufacturers Association (CEMA) and the National Cable Television Association (NCTA).

9. I am a Senior Member of the Institute of Electrical and Electronic Engineers (IEEE), a position I have held since 2003, and have been a member since 1993. I am also a Senior Member of the Society of Cable Telecommunications Engineers (SCTE), a position I have held since 2003, having been a member since 1993.

10. I am the author of OpenCable Architecture, which was published by Cisco Press in 2000 and won the 2001 Cable Book Award given by the Cable Center in association with the University of Denver. I am also a co-author of the second edition of Modern Cable Television Technology, which is considered one of the leading treatises on Cable Television technologies.

11. I am a named inventor on 9 patents in the fields of digital video and cable networks.

12. Based on my experience in the telecommunications industry, I have a detailed understanding of streaming and HTTP-related technology, including devices, protocols, standards/specifications, platforms, networks, and video architectures.

13. Further details on various aspects of my professional experience, qualifications, and a list of my publications can be found in my curriculum vitae, which is provided as Exhibit 1. My CV also includes a list of the cases during the last five years in which I have offered expert testimony.

14. I have considered the following materials in preparing the opinions set forth in this Report:

- the '372 patents, including the abstract, specification, claims, and figures;
- the patent prosecution history of the '372 patents in the United States Patent & Trademark Office (“the USPTO” or “PTO”); and
- the Declaration of Defendant’s expert Dr. Stephan Wenger;
- Respondents’ and Staff’s opening and responsive claim construction briefs.

15. I have also relied on my knowledge, education, and professional expertise of over 25 years in the areas of telecommunications, software development, and systems architecture, and more particularly with specifically distributed network systems and media streaming.

16. I am not a lawyer and am not offering any opinions regarding legal matters. However, the legal principles relevant to my opinion herein have been explained to me by Plaintiff's counsel. In this section, I summarize these legal principles as they have been explained to me.

17. I reserve the right to change or formulate new opinions in the event there is a change in the law concerning my opinions provided in this Declaration.

18. For the purposes of this Declaration, counsel has instructed me to make the following assumptions:

a. Claim construction is solely a matter for the Court to decide and, in general, the ordinary meaning of the claim terms used in the patent to one of ordinary skill in the art is determined in the context of the patent's specification and the file history.

b. A "person of ordinary skill in the art" is a hypothetical person who is presumed to have known the relevant art at the time of the invention. Factors that may be considered in determining the level of ordinary skill in the art may include: (1) type of problems encountered in the art; (2) prior art solutions to those problems; (3) how quickly innovations are made; (4) sophistication of the technology; and (5) educational level of active workers in the field. In a given case, every factor may not be present, and one or more factors may predominate. A person of ordinary skill in the art is a person of ordinary creativity. A person of ordinary skill in the art would have the capability of understanding the scientific principles applicable to the pertinent art.

c. Claims are construed from the perspective of a person of ordinary skill as of the effective filing date of the patent application.

d. Persons of ordinary skill in the art are deemed to read the claims in the context of the entire patent, including the specification and prosecution history. In other words, the terms are not considered in a vacuum. In the context of claim construction, the specification has been called “the single best guide” to the meaning of the claim terms.

e. Claim terms should be given their ordinary and customary meaning within the context of the patent in which the terms are used, *i.e.*, the meaning that the term would have to a person of ordinary skill in the art in question at the time of the invention in light of what the patent teaches.

f. The plain and ordinary meaning is determined from the language of the claims, the specification, and the prosecution history of the patent at issue.

g. In construing a claim term, one looks primarily to the intrinsic patent evidence, which includes the patent abstract, specification, claims, and figures, and its prosecution history.

h. Extrinsic evidence may also be useful in interpreting patent claims when the intrinsic evidence itself is insufficient.

i. The usual and customary meaning of a claim term can be altered by the patent applicant if they choose to act as their own “lexicographer” and clearly set forth in the patent a different meaning of a claim term.

j. The meaning of a claim term can also be altered during the patent examination process by a clear and unequivocal disclaims and disavowals by the patent applicant about the meaning or scope of the term, and that such statements are recorded in the prosecution history of the patent application.

k. I have been informed that sometimes the ordinary meaning of claim language as understood by a person of ordinary skill in the art may be readily apparent even to lay persons. I understand that claim construction in such cases involves little more than the application of the widely accepted meaning of commonly understood words

l. If a claim term is ambiguous or unclear, the term must be construed according to how a person of ordinary skill in the art would have understood it in light of the rest of the patent specification, patent claims, and the application's prosecution history.

m. A claim is not indefinite, as long as it, having been read in light of the intrinsic evidence, informs one of skill in the art at the time of the invention about the scope of the invention with reasonable certainty.

n. To answer this question, the court must consider not only the claim language, but also whether “the intrinsic record—the patent's claims, written description, and prosecution history—along with any relevant extrinsic evidence” provides or help identifies the necessary objective boundaries for claim scope.

o. It is improper to import limitations from embodiments in the specification.

p. It is also improper to import limitations from other parts of the claims thus rendering a claim term duplicative.

q. It is also improper to import additional or different language from other independent claims that would render such claims superfluous.

OPINIONS

A. Person of Ordinary Skill

19. In my opinion, a POSITA with respect to the '372 patent would have (a) a Bachelor of Science degree in computer science, electrical engineering, or computer engineering (or a related academic field), and at least two additional years of work experience in the design and

development of distributed network systems and/or media streaming, or (b) at least five years of work experience and training in the design and development of distributed network systems and/or media streaming.

20. In view of my qualifications, experience, and understanding of the subject matter of the claimed invention, I believe that I meet the above-mentioned criteria and consider myself a person with at least ordinary skill in the art pertaining to the '372 patent. Specifically, as of the time of the inventions of the '372 patent in or around January 2005, I met or exceeded this level of ordinary skill.

B. Technology Background

21. The '372 patent is directed to scalable video coding (SVC), a video coding standard that enables efficient video transmission and decoding over various network conditions and device capabilities. Unlike traditional video codecs that provide a fixed resolution and quality, SVC allows for the encoding of video data into multiple layers or streams, each representing different levels of quality or resolution. These layers are typically referred to as spatial, temporal, and quality layers

22. The concept of video compression dates back to the 1920s when R.D. Kell proposed transmitting only the portions of a scene that changed between frames. In the 1950s, researchers at Bell Labs proposed differential pulse-code modulation (DPCM) for video coding. The idea of inter-frame motion compensation was introduced in 1959 by NHK researchers.

23. One of the initial motivations for video coding standards was to fit compressed video within the limited bandwidth available for telecommunication networks at the time. Another goal was to address all aspects of practical video transmission, storage, or broadcast within a single standard.

24. As video applications diversified, the need arose for scalable coding techniques that could adapt video quality to varying network conditions and device capabilities. Scalable coding allows encoding a video bitstream with multiple layers, each providing a different level of quality or resolution.

25. The H.264/AVC video coding standard, also known as Advanced Video Coding, is a highly efficient video compression standard widely used for various applications, including broadcasting, streaming, and video conferencing. H.264/AVC video coding standard, finalized in 2003, included support for temporal, spatial, and quality scalability. However, H.264/AVC lacked scalability features primarily because it was designed to optimize compression efficiency while maintaining a fixed set of parameters.

26. H.264/AVC employs a fixed set of compression parameters during encoding, such as frame size, frame rate, and picture quality. Once the video is encoded with these parameters, it cannot easily adapt to changes in network conditions, device capabilities, or user preferences. This lack of flexibility makes it challenging to deliver the same video content efficiently across different platforms and network environments.

27. H.264/AVC uses a single layer encoding approach, where the entire video sequence is encoded as a single data stream. This means that all the information necessary for decoding the video is contained within this single layer. Without the concept of scalability layers, it was not possible to selectively decode portions of the video stream to adapt to varying network bandwidths or device capabilities.

28. Since H.264/AVC did not support scalability features like temporal, spatial, or quality scalability, it could not adapt dynamically to changing network conditions or display

resolutions. This limitation becomes particularly problematic in scenarios where network bandwidth fluctuates or where the end-user devices have varying display capabilities.

29. In H.264/AVC, the quality of the encoded video is uniform throughout the entire sequence. There was no mechanism to prioritize certain parts of the video for higher quality encoding or to allocate more bits to critical regions of the frame. As a result, it may not be optimal for scenarios where some parts of the video require higher fidelity than others.

30. Adding scalability features to a video coding standard like H.264/AVC introduces additional complexity in both the encoding and decoding processes. Since H.264/AVC was already a highly complex standard, introducing scalability features would have significantly increased its complexity, potentially affecting its widespread adoption and implementation.

31. It was the H.264/SVC extension, standardized in 2007 (after the priority date of the '372 patent) that provided full-fledged scalable video coding capabilities.

32. In or around 2007, and prior to the introduction of H.264/SVC, network bandwidth was a significant issue affecting streaming video. Internet speeds then were much slower compared to today. Broadband internet was still emerging, and most users relied on dial-up connections or early broadband technologies like DSL or cable internet, which offered much lower bandwidth compared to modern standards.

33. With the rise of online video streaming, multimedia-rich websites, and peer-to-peer file sharing, the demand for bandwidth-intensive content was increasing rapidly. However, the available network infrastructure struggled to keep up with this demand, leading to congestion and slowdowns, particularly during peak usage hours.

34. Conventional H.264 video coding generates a fixed quality and bitrate video stream. video compression standards lacked scalability features, which meant that video streams

were typically encoded at a fixed resolution, frame rate, and quality level. This lack of adaptability meant that video content could not be efficiently transmitted over networks with varying bandwidth capacities, leading to buffering, stuttering, and reduced video quality.

35. The variety of devices accessing online content was increasing, ranging from desktop computers to laptops, smartphones, and early iterations of tablets. These devices had different screen sizes, resolutions, and processing capabilities, further complicating the challenge of delivering video content optimized for each device over limited network bandwidth.

36. Building and maintaining high-capacity network infrastructure was costly, especially for internet service providers (ISPs). Limited resources and competing priorities meant that network upgrades were often incremental and lagged behind the rapidly growing demand for bandwidth.

37. These challenges with network bandwidth affected unicast, simulcast, and multicast transmissions.

38. Unicast refers to a one-to-one communication model, where data is transmitted from a single sender to a single receiver. Bandwidth limitations impacted unicast transmissions significantly because each viewer required a separate stream from the server. With limited network bandwidth, delivering individual video streams to each viewer simultaneously could strain network resources and lead to congestion, buffering, and reduced video quality.

39. Simulcast involves transmitting multiple versions of the same video content simultaneously, each optimized for different network conditions or device capabilities. Bandwidth constraints affected simulcast transmissions by limiting the number of versions that could be delivered efficiently. With limited bandwidth, it was challenging to maintain multiple

simultaneous streams at different quality levels without overloading the network or compromising the viewing experience.

40. Multicast enables the efficient distribution of data to multiple recipients simultaneously by replicating data packets only when necessary, reducing network bandwidth usage. However, multicast transmission relies on network infrastructure support, and its effectiveness can be limited by network configuration, router capabilities, and compatibility with end-user devices. Bandwidth limitations could still impact multicast transmissions if the network infrastructure was insufficient to handle the volume of multicast traffic or if network paths were congested.

41. In recent years, the proliferation of video streaming, conferencing, and real-time communication applications has driven the adoption of SVC. H.264 SVC offers several technical benefits that helped reduce network bandwidth consumption.

42. First, SVC uses a layered coding approach where the video is encoded into a base layer with lower resolution/frame rate, and one or more enhancement layers that add higher resolution/frame rate data. This allows receivers to decode only the layers they can support based on their bandwidth constraints, reducing unnecessary transmission of high-quality layers over limited bandwidth links. Moreover, encoding the video into a single, multi-layered bitstream that can be adapted by dropping packets/layers as needed avoids the need for separate encoding of multiple bitstreams for different bandwidth conditions, significantly reducing overall bandwidth requirements compared to simulcasting multiple streams.

43. Specifically, the base layer of the SVC bitstream is encoded at a relatively low bit rate, providing a basic low-resolution and low-frame-rate video stream. This base layer can be transmitted even over low bandwidth networks, ensuring at least a minimal video quality for all

receivers. On top of the base layer, one or more enhancement layers are encoded at progressively higher bit rates, adding higher resolutions, frame rates, and quality levels to the video stream. Each enhancement layer incrementally increases the bit rate and quality. The key benefit of the layered approach is that receivers can adapt to their available network bandwidth by decoding only the base layer and as many enhancement layers as their bandwidth allows. Receivers with limited bandwidth simply drop the higher bit rate enhancement layers, reducing the effective bit rate and bandwidth consumption while still receiving a usable video stream.

44. The SVC bitstream can be truncated within the network itself as it traverses from high to low bandwidth links. By dropping the higher bit rate enhancement layers at network nodes, the effective bit rate is reduced to match the available bandwidth on the lower bandwidth links, without requiring full decoding and re-encoding of the stream.

45. The bit rates of the base and enhancement layers can also be carefully chosen to balance video quality and bandwidth requirements across diverse network conditions and device capabilities. Lower bit rates reduce bandwidth consumption but also lower video quality, while higher bit rates provide better quality at the cost of increased bandwidth usage.

46. Second, SVC provides three types of scalability: Temporal scalability, which allows dropping complete frames from the bitstream, reducing the frame rate and hence bandwidth for low-bandwidth receivers; spatial scalability, which enables transmitting lower spatial resolutions by dropping enhancement layers, reducing bandwidth for smaller displays; and quality scalability, which allows dropping quality enhancement layers, lowering the video quality but also bandwidth requirements. This fine-grained scalability across multiple dimensions optimizes bandwidth utilization for diverse receivers.

47. Third, the SVC bitstream can be truncated within the network itself as it traverses from high to low bandwidth links. This in-network adaptation eliminates the need to fully decode and re-encode the stream at intermediate nodes, reducing computational overhead and enabling more efficient bandwidth utilization.

48. Prior to the inventions of the '372 patent, the most widely implemented technology to address network management in video streaming routers was to discard data packets that could not be immediately forwarded to the data recipient. In that type of system, the data stream (that is eventually received by one or more receivers further down the network) is corrupted and network congestion also has a negative impact on communication sessions of other nodes that communicate through a "bottleneck" router. The '372 patent describe sending data packets from a data source to more than one receiver, ideally without putting extra stress on the network or source when the number of receivers increases.

49. For example, the '372 patent describes a method whereby receivers tell the network which data streams each receiver wants to receive and allows the network compute data distribution paths to deliver only the required packets to each receiver. As an additional example, the '372 patent describes a method of letting the source encode the list of receivers in each data packet, thereby freeing the network from the potentially computationally intensive task of maintaining multicast distribution paths. As a further example, the '372 patent describes a method in which the network is configured apply a full broadcast mechanism (i.e. each packet is delivered to every connected node), and in which each receiver uses some defined logic to select only desired packets.

50. As such, routers implementing the inventions of the '372 patent must implement the capability to tell the network which data streams are to be delivered to each receiver and utilize

the network-computed data distribution paths to deliver only the desired packets to each receiver. (See '372 patent at 3:11-15.) Prior to the patented inventions, data packets would be discarded if bandwidth bottlenecks prevented the data packet from being forwarded. By allowing the network to compute distribution paths, the path of the data packet could be adjusted to bypass the bottleneck, allowing the data packet to be delivered.

51. This method of a source delivering data packets to all receivers and allowing the receivers to select only the packets needed at the receiver avoids bottlenecks because the flow of data packets over the distribution paths is more predictable and the network data paths time-invariant with respect to the number of receivers.

C. Disputed Terms of the '372 Patent

1. “identify[ing] bandwidth-limited conditions [of an internet protocol network] between [the/a] video router and a [plurality/set] of video receivers” (claims 1, 6, 11)

Plaintiff's Proposal	Defendant's Proposal
No construction necessary	Indefinite

52. As an initial matter, I note that Defendant misstates the claim term at issue. The term as identified by Defendant is missing the phrase “of an internet protocol network,” which, as I will explain, is necessary to understand the term in the context of the claim as a whole.

53. When read in the context of the claim—as required—this term’s plain language confirms it is not indefinite. I agree with Plaintiff’s position.

54. I understand that claim construction begins with the plain language of the claims.

55. Claim 1 of the '372 patent recites:

1. A video router, comprising:

a memory; and

a processor, wherein the processor executes instructions stored in the memory to cause the video router to:

receive a layered video data stream including a base layer and a set of enhancement layers,

identify bandwidth-limited conditions of an internet protocol network between the video router and a plurality of video receivers,

forward the base layer from the video router to at least two of the plurality of video receivers via the internet protocol network, and

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 wherein the video router transmits the layered video data stream according to an internet protocol;

wherein each layer of the layered video data stream comprises data packets, each of which is encoded with a sequence number and a layer identifier, and wherein the layer identifier for each data packet is based upon a layer to which the packet belongs.

56. Claim 1 is directed to a video router system. The video router is capable of receiving a layered video data stream. This stream consists of a base layer and a set of enhancement layers. A POSITA would understand that when read in light of the specification, each layer likely contains different levels of detail or quality to enhance the video viewing experience.

57. The claim further recites that the video router system can analyze the conditions of the internet protocol network between the video router and the multiple video receivers. This includes identifying situations where bandwidth is limited, which a POSITA would understand could result in degraded video quality or interruptions in streaming.

58. Despite any such bandwidth limitations, the system ensures the base layer, which would contain essential video data for basic viewing, is forwarded to at least two of the multiple video receivers via the internet protocol network. To optimize bandwidth usage and ensure the best possible viewing experience, the system selectively forwards one or more enhancement layers

(but not necessarily all of them) to at least two of the multiple video receivers. The decision on which enhancement layers to forward is based on the identified bandwidth-limited conditions.

59. The system operates within the framework of the internet protocol, indicating compatibility with existing networking standards and technologies.

60. Further, each layer of the video data stream is composed of data packets. Each packet is encoded with a sequence number and a layer identifier. A layer identifier is one way for the system to distinguish between packets belonging to different layers within the stream. Each layer, or individual data packets within the layer, may also have an associated priority number or priority value, which indicates the relative importance of the packet (or layer) to the stream as a whole. The priority value may identify, for example, critical segments of the video (such as intracoded frames at scene changes) that must be delivered to a receiver to ensure quality and coherence in viewing.

61. The disputed term “identify[ing] bandwidth- limited conditions between [the/a] video router and a [plurality/set] of video receivers,” in the context of the claim as a whole, refers to the capability of the video router system to analyze the network between itself and multiple video receivers to determine if there are any constraints on the available bandwidth, and make informed decisions about how to transmit the layered video data stream effectively, considering the limitations of the network bandwidth i.e. its capacity to carry traffic.

62. Here, bandwidth-limited conditions imply situations where the network’s available bandwidth is restricted or insufficient to transmit the entire layered video data stream to all video receivers without potential issues such as packet loss, delay, or degradation in video quality. The system analyzes these conditions to determine the optimal strategy for transmitting the video data

stream, ensuring that the available bandwidth is utilized efficiently while maintaining an acceptable level of video quality for the receivers.

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.

64. The phrase “internet protocol network” specifies the type of network being discussed, namely an internet protocol (IP) network. An IP network is a network that uses the Internet Protocol suite for communication between devices. This suite includes protocols such as IP, TCP (Transmission Control Protocol), and UDP (User Datagram Protocol), which are fundamental for data transmission over the internet and other networks.

65. Further, the phrase “between the video router and a plurality of video receivers” delineates the scope of the network under consideration, indicating that the bandwidth-limited conditions exist within the segment of the network connecting the video router (the source of the video data) and the multiple video receivers (the destinations of the video data) to which the stream is being distributed simultaneously.

66. The ’372 patent specification provides further context and background regarding this term.

67. First, the specification provides insights into the challenges posed by bandwidth limitations in multicast transmission over IP networks and acknowledges the consequences of such limitations on data transmission quality and network performance. (Dkt. 1-1 at 1:50-67.) By

discussing the impact of bandwidth bottlenecks on packet discard and communication sessions, a POSITA would understand the specification addresses the identification of bandwidth-limited conditions within the network. For example, when a bandwidth bottleneck (or limit) is reached, routers discard packets that cannot be immediately forwarded. (*Id.* at 1:59-60.) A POSITA would understand this to indicate that the network is experiencing bandwidth limitations, where the available bandwidth is insufficient to accommodate the transmission of all packets in the data stream. The act of discarding packets serves as an indicator of bandwidth-limited conditions within the network.

68. The specification also identifies corruption of the data stream received by receivers downstream from the bottleneck router as a consequence of bandwidth limitations. (*Id.* at 1:61-65.) Corruption of the data stream indicates a degradation in the quality of data transmission due to bandwidth constraints. Additionally, the congestion caused by packet discard negatively impacts communication sessions of other nodes that communicate through the bottleneck router, further underscoring the significance of bandwidth limitations in network performance.

69. In a standard multicast using the Internet Protocol, the only way to avoid the problems caused by bandwidth limitations is to find a transmission rate that is supported by all parts of the network. (*Id.* at 1:65-2:1.) This suggests to a POSITA that identifying bandwidth-limited conditions involves assessing whether the network can support the transmission rate required for multicast without encountering congestion and packet loss.

70. In an exemplary embodiment, the specification elaborates on how bandwidth-limited conditions manifest as congestion in the network, leading to the need for prioritization and careful management of data transmission to ensure the delivery of essential information. A

POSITA would understand the below excerpt to provide clarity on how congestion and the use of packet priority numbers are indicative of bandwidth limitations within the network:

In one embodiment of the overlay multicast system, priority numbers are associated with data packets. The priority numbers represent a logical layer inside a data stream. Data provided by a multicast application may be in the form of a stream of data. This data is subdivided into categories or priorities based on the nature of the data. When packets in a data stream are labeled with priorities in the range 0 to 3, the stream is said to have 4 layers. Also, the convention is to treat 0 as the highest priority and 3 as the lowest. Any other system of identifying priority levels may be utilized including alpha numeric indicators or similar identifiers. If a stream only contains a single layer, all packets are labeled with priority 0.

To software router daemons, a priority value of a packet is relative to the stream and becomes relevant when a decision to discard data at a congested router is made. The priority value has no meaning other than as a criterion for discarding packets on congested links. 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. This technique is also applied to any data type, including audio/video data and financial data. Using this system, the packet priority numbers cannot be misused by sources to give their data packets a greater chance of prioritized transmission by giving them the highest priority to gain advantage over other sources. Packet priorities are only compared between packets that are part of the same data stream.

In one embodiment, knowing that routers will 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. This system is especially useful when multicasting a live data stream with a high data rate to a large number of receivers, scattered over a heterogeneous wide area network. Receivers that are on congested parts of the network will then receive the highest priority parts of the data only. This 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. Example applications of the system include audio and video codecs that divide live multimedia content over layers to enhance the user experience over wide area networks.

(Dkt. 1-1 at 21:25-22:5.)

71. Here, the specification describes how data packets are labeled with priority numbers based on their importance or significance within the data stream. This indicates that the network may encounter limitations in bandwidth, where not all packets can be transmitted simultaneously due to insufficient capacity. The packet priority numbers are used when making

forwarding decisions on congested parts of the network. A POSITA would understand that the existence of congestion, which is indicative of bandwidth limitations, prompts the routers to prioritize packets based on their assigned priority numbers.

72. When routers face insufficient bandwidth to transmit all pending packets, they forward only those packets with a designated priority or the highest priority. A POSITA would understand this teaching to indicate that bandwidth limitations result in congestion, where the network infrastructure struggles to accommodate the volume of data being transmitted. A POSITA would further understand that this selective forwarding strategy is employed as a response to bandwidth limitations, indicating that congestion serves as an indicator of such limitations.

73. The specification further explains that sources carefully divide their data packets over different layers or priorities in anticipation of routers using packet priority numbers for forwarding selections on congested parts of the network. A POSITA would understand that the decision to divide data packets strategically is informed by the expectation of encountering bandwidth limitations and congestion in the network.

74. The specification describes an exemplary “Congestion Control Interceptor” (CCI), which implements “bandwidth allocation rules.” (Dkt. 1-1 at 26:23-24.) This description further suggests that the system is designed to manage and allocate available bandwidth efficiently. Here, the CCI is aware of bandwidth limitations and the need for systematic allocation to ensure optimal performance. Specifically, a POSITA would understand, from the fact that the CCI is responsible for discarding packets, that in situations where bandwidth is limited and congestion occurs, the system may need to discard packets to alleviate the congestion, ensure that the available bandwidth is allocated efficiently, and prioritize essential data transmission. This understanding is further confirmed by the teaching of an optimization strategy aimed at reducing the storage space required

within the system by storing only those packets that were explicitly discarded by the CCI due to bandwidth constraints. (*Id.* at 27:51-54.)

75. The specification further describes various techniques and considerations employed to manage bandwidth-limited conditions within the network, including intentional packet reordering, timeout settings, congestion detection mechanisms, and their impacts on packet delivery and network performance. These mechanisms aid in the identification and mitigation of bandwidth constraints, ensuring efficient utilization of available bandwidth and optimal data transmission within the network:

In an overlay multicast network that uses packet prioritization, routers explicitly introduce out of order delivery when a burst of packets queues in the outbound interceptor pipeline of a router interface with a slow connection. The time-out may be large enough to allow for this. Setting the time-out to a long period makes the stream much more resilient to congestion, but also increases the time for the receiver to discover that a layer must be dropped due to bandwidth constraints. Until congestion is finally detected, delivery of the previously received packets that causally depend on missed packets is postponed. Starting timers when packet loss is detected allows for congestion detection. However, it cannot be used to guarantee low end-to-end latency.

(*Id.* at 29:18-31.)

76. Here, the intentional introduction of out-of-order delivery by routers in response to burst of packets queues indicates that bandwidth constraints are encountered when the outbound interceptor pipeline of a router interface with a slow connection becomes overwhelmed. This introduces delays and disruptions in the delivery of packets, serving as an indicator of bandwidth limitations.

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.

78. The postponement of delivery for previously received packets that depend causally on missed packets due to delayed congestion detection further emphasizes the significance of congestion as an indicator of bandwidth limitations.

79. Moreover, in an exemplary embodiment, the specification recites examples of dynamic management of data transmission and bandwidth allocation within the network. By discussing algorithms for detecting changes in bandwidth availability and monitoring packet reception, a POSITA would understand these teachings address the identification of bandwidth-limited conditions and highlight strategies for managing bandwidth constraints effectively.

(*Id.* at 29:32-49.)

80. For example, the specification explains that in scenarios where no packets are lost and all are received according to their global order, the receiver cannot measure the total transmission delay. (*Id.* at 29:32-34.) Consequently, the receiver cannot distinguish between an idle and a crashed source. This suggests to a POSITA that the absence of packet loss may not accurately reflect the status of the data source and may not provide sufficient information to assess bandwidth-limited conditions. (*Id.* at 29:32-34.)

81. The above excerpt describes an algorithm that actively manages the transmission of data packets and monitors bandwidth availability. (*Id.* at 29:35-39.) This algorithm is capable of dynamically adjusting the list of layers considered reliable based on the availability of bandwidth. For example, when more bandwidth becomes available, the algorithm detects this change and adds new higher layers to the reliable list, allowing for the delivery of a higher quality stream to the user. (*Id.* at 29:35-39.)

82. The algorithm passively or actively monitors layers that are not currently in the reliable list and not under repair. (*Id.* at 29:39-41.) When packets are received from these layers,

this information is stored for a period equal to the repair time-out. Additionally, when a packet from a layer is received indicating a loss from a higher layer not in the reliable list, this information is recorded and stored for the same repair time-out period. (*Id.* at 29:42-49.)

83. In an exemplary embodiment, the specification further describes various mechanisms for managing packet loss and compensating for bandwidth constraints within the network:

In one embodiment, an overlay multicast system also implements or manages delivery of packets including an option for guaranteed delivery. It would be ideal if every receiver would receive the data stream without loss or corruption. 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. For example, when a router crashes, all packets in its buffers may be irrecoverably lost. If a network uses dynamic routing, packets are also dropped when routing policies change or packets are trapped in an occasional, temporary routing loop. In cases where packets are 'accidentally' lost, an end-to-end mechanism of retransmissions can be applied that can compensate for the loss. However, since this requires a form of feedback information, it is beneficial for reasons of scalability that the overhead involved with retransmissions is not linearly related to the size of the audience.

End-to-end retransmission feedback may be avoided in at least two ways. First, it is possible to let the network components keep a copy of the most recently forwarded packets and let them participate in retransmissions by intercepting the retransmission requests and servicing them locally. This approach often utilizes greater storage and increased processing power requirements at the network components.

The second alternative to end-to-end retransmission requests is that of encoding redundant information in the data packets. If enough redundancy is encoded, a lost packet's content may be entirely recovered from the extra information in the other packets. The downside of this system is that it comes with a constant level of bandwidth overhead that is related to the level of packet loss tolerance, regardless of whether packets are actually lost. Each of these approaches to packet loss fail in the case of a live data stream that produces more bytes than the network can forward.

(*Id.* at 4:29-67.)

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

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.

85. The excerpt above also mentions that even in scenarios where there is sufficient bandwidth at all times, store-and-forward packet-switched networks are unable to guarantee the delivery of all packets. (*Id.* at 4:35-37.) A POSITA would understand this inability to guarantee packet delivery underscores the challenges posed by bandwidth limitations, as packet loss can occur due to various factors such as router crashes, changes in routing policies, or temporary routing loops.

86. Further, the excerpt above describes mechanisms for compensating for packet loss, such as end-to-end retransmissions or encoding redundant information in data packets. (*Id.* at 4:42-44, 4:57-59.) However, both approaches have their drawbacks in terms of scalability and bandwidth overhead. End-to-end retransmission mechanisms require feedback information and may not scale efficiently with the size of the audience, (*id.* at 4:44-48), while encoding redundant information incurs a constant level of bandwidth overhead regardless of actual packet loss. (*Id.* at 4:61-64.)

87. Importantly, the excerpt above acknowledges that each of these approaches to packet loss fails in the case of a live data stream that produces more bytes than the network can forward. (*Id.* at 4:64-66.) A POSITA would understand from this statement that identifying bandwidth limitations and adjusting for them can have a significant impact on the delivery of live data streams.

88. Finally, in another exemplary embodiment, the specification describes strategies for managing bandwidth-limited conditions within the context of transmitting data streams with varying bandwidth requirements. (*Id.* at 33:1-19.) For example, a POSITA would understand,

that bandwidth limitations may necessitate the thinning of data streams to a fixed maximum rate to ensure efficient transmission within the available bandwidth capacity. (*Id.* at 33:1-5.) Further, the specification teaches producing enhancement layers that form a layered data stream, allowing for the transmission of data at varying qualities or levels of detail. (*Id.* at 33:5-7.) A POSITA would understand this layered approach enables the system to adapt to varying bandwidth conditions and prioritize the delivery of essential information while mitigating the risk of providing stale data. Similarly, the specification explains that the process of encoding the entire stream in different qualities and sending them to clients concurrently to meet their individual bandwidth capacities is referred to as simulcasting. (*Id.* at 33:16-19.) A POSITA would understand this approach enables the system to cater to the diverse bandwidth requirements of different clients, ensuring optimal data transmission while managing bandwidth-limited conditions.

89. Therefore, by describing alternative algorithms, layering techniques, and simulcasting approaches, the specification explains that the system can adapt to fluctuating bandwidth conditions and ensure efficient data transmission while meeting the diverse needs of clients.

90. Based on the plain language of the claim and the teachings from the specification I have identified above, the meaning of the phrase “bandwidth-limited conditions” is reasonably certain to a POSITA. Specifically, as I explain, the phrase refers to situations where the available bandwidth within a network is constrained, resulting in challenges related to data transmission, such as packet loss, congestion, and the inability to guarantee the delivery of all packets. Bandwidth-limited conditions can occur due to various factors, including network congestion, router crashes, changes in routing policies, or temporary routing loops.

91. The specification describes other exemplary algorithms for identifying bandwidth limited conditions within a network, such as by measuring delay and packet loss. For example, the specification teaches that the system may control the delay introduced by buffering packets within a network by enforcing a maximum total queue size, handling incoming packets, checking the total queue size, and iteratively removing packets from queues. (*Id.* at 23:45-59.) The system may manage the size of queues to maintain fairness in resource division among streams while promoting the use of larger packets to increase network efficiency. (*Id.* at 23:60-24:20; *see also id.* at 24:21-67.) A POSITA would understand that doing so may mitigate some bandwidth-limited conditions.

92. The specification also describes with particularity several layer repair techniques. For example, the specification describes a receiver-side multicast socket responsible for receiving raw packets from the multicast stream and repairing damaged stream layers before forwarding them to the user application. (*Id.* at 25:18-22.) The specification also describes that when the receiver detects a missing packet in a layer that needs repair, it sends a retransmission request for that packet towards the source. (*Id.* at 25:23-26.) The system may detect packet loss by sequencing each packet with an incrementing number. Additionally, each layer has its own sequence number, allowing packet loss to be detected independently in each layer. (*Id.* at 25:27-31.) To avoid a cascade of retransmission requests, a tree-based negative acknowledgment technique is used. Intermediate routers respond to retransmission requests by sending the requested packet again if it's available in their buffer. (*Id.* at 25:34-40.) When layers are dropped due to congestion, the programming API notifies the user application through exceptions or special return values, indicating a change in stream quality. (*Id.* at 25:47-52.) Each router daemon stores a window of transmitted packets for localized repair. Packets are stored either for a fixed period of time or until

a fixed amount of buffer space is filled. (*Id.* at 25:53-57.) Packets are copied to be stored for retransmission by buffer interceptors. These interceptors are added to both interceptor pipelines of each interface and store a copy of each packet for potential retransmission. (*Id.* at 25:65-26:11.) A POSITA would understand that the aforementioned are all examples of how the router identifies bandwidth-limited conditions and takes further action.

93. In another exemplary embodiment, the specification teaches that the system records the state of each packet from every layer, creating a packet arrival history. This history is used to determine the reception quality and decide whether to add a higher layer to the reliable-list and repair any further packet loss. (*Id.* at 29:52-57.) The reception history, or similar data, is used to calculate a moving average describing the amount of packet loss over the last x seconds, where x equals the repair time-out. A small moving average history allows for quick response to increased network capacity, while a longer history considers sustained network conditions over time. (*Id.* at 29:57-63.) The receiver keeps track of the reception quality of each layer by inspecting the list of sequence numbers attached to each data packet. This allows for real-time monitoring of packet reception and the identification of potential packet loss. (*Id.* at 29:64-67.) A POSITA would understand that the aforementioned are further examples of how the router identifies bandwidth-limited conditions and takes further action.

94. Therefore, in my opinion, the specification offers reasonable certainty to a POSITA as to the meaning of “bandwidth-limited conditions” and how to identify bandwidth-limited conditions within the network. For example, the phrase “bandwidth-limited conditions” refers to situations where the available bandwidth within a network is constrained, resulting in challenges related to data transmission, such as packet loss, congestion, and the inability to guarantee the delivery of all packets. Additionally, as I explained, the specification describes that exemplary

techniques for detecting and mitigating bandwidth-limited conditions include identifying packet loss and corruption; identifying congestion through various techniques such as packet discard, router crashes, or changes in routing policies; and through dynamic algorithms and mechanisms for monitoring packet reception, adjusting packet prioritization, and managing bandwidth allocation.

95. The plain language of the term “identify[ing] bandwidth-limited conditions [of an internet protocol network] between [the/a] video router and a [plurality/set] of video receivers” is easily understood by a POSITA in the context of the claims and specification. Therefore, no construction is necessary and Plaintiff’s position is correct.

2. “selectively [forward/forwards/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” (claims 1, 6, 11)

Plaintiff’s Proposal	Defendant’s Proposal
No construction necessary	Indefinite. Alternatively, if not indefinite, “selecting using a layer identifier of one or more of the set of enhancement layers and forwarding the 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.”

96. When read in the context of the claim—as required—this term’s plain language confirms it is not indefinite. I agree with Plaintiff’s position.

97. The plain language of this term, in the context of the claim as a whole, describes that the video router does not transmit all available enhancement layers to every video receiver due to limited network bandwidth. Instead, it selectively chooses which enhancement layers to forward. Specifically, the video router forwards the base layer to all receivers because it forms the foundation of the video stream. The decision on which enhancement layers to forward is based on the identified bandwidth-limited conditions. This means the router assesses the current network conditions and makes a determination on how many enhancement layers can be transmitted without exceeding the available bandwidth or causing congestion.

98. As I previously explained, the ’372 patent teaches that a video data stream consists of a base layer and multiple enhancement layers. Enhancement layers typically contain additional data that improves the quality or resolution of the video. Enhancement layers provide extra details or higher resolution, improving the viewing experience.

99. A POSITA would understand that selective forwarding of enhancement layers in the context of the video router involves making decisions based on various criteria to optimize bandwidth usage and ensure efficient delivery of video content. Specifically, a POSITA would understand that the primary criterion is the current bandwidth capacity of the network segment between the video router and the receivers. Available bandwidth can fluctuate due to network congestion, varying traffic loads, or temporary limitations. Therefore, if the router detects congestion on the network, it may choose to forward fewer enhancement layers to avoid exacerbating congestion, which could lead to packet loss or delay.

100. A POSITA would also understand that different video receivers may have varying capabilities in terms of bandwidth reception and processing power. The router may therefore take into account the capabilities of each receiver to determine how many enhancement layers can be reliably forwarded without causing performance issues.

101. As another example, some receivers may require higher quality video streams due to their display capabilities or user requirements. The router might prioritize forwarding more enhancement layers to these receivers if bandwidth allows, to meet higher QoS expectations.

102. Further, a POSITA would recognize that the router may continuously monitor the network conditions and adapt its forwarding strategy dynamically. For example, during periods of lower bandwidth availability, it may reduce the number of enhancement layers forwarded. Conversely, when bandwidth improves, it may increase the number of layers forwarded to enhance video quality. The router may also adjust its strategy if packet loss occurs due to network conditions. A POSITA would understand that in that scenario, the router may prioritize forwarding essential layers (like the base layer) first to maintain basic video playback, while selectively forwarding enhancement layers that are less critical or can tolerate delayed delivery.

103. A POSITA would also understand that efficient buffer management may play a role in selective forwarding, especially in view of bandwidth-limited conditions between the router and one or more receivers. For example, the router may prioritize forwarding layers that are already buffered or can be buffered quickly at the receiver end, minimizing delays and ensuring smooth playback.

104. The '372 patent specification provides further context and background regarding this term.

105. In some embodiments, the specification describes that the system utilizes a layered multicast approach where data streams are subdivided into layers. (Dkt. 1-1 at 5:17-21.) This subdivision allows receivers to subscribe to only those layers that the network can handle. In the context of video streaming, a POSITA would understand that receivers with higher bandwidth capabilities or closer network proximity may receive more enhancement layers (higher quality video) compared to receivers with limited bandwidth.

106. The specification also describes an enhanced form of layered multicast that guarantees complete delivery for certain critical layers, such as market data. (*Id.* at 5:22-25.) A POSITA would understand this concept can be extended to video streaming where critical segments of the video (such as intracoded frames at scene changes) are guaranteed delivery to ensure quality and coherence in viewing.

107. In an exemplary embodiment, the specification describes a system where data streams are layered and prioritized, allowing for selective forwarding of enhancement layers based on network conditions. This strategy ensures efficient use of network resources while maintaining quality of service, which is essential in scenarios such as multicast video delivery over heterogeneous networks:

In one embodiment of the overlay multicast system, priority numbers are associated with data packets. The priority numbers represent a logical layer inside a data stream. Data provided by a multicast application may be in the form of a stream of data. This data is subdivided into categories or priorities based on the nature of the data. When packets in a data stream are labeled with priorities in the range 0 to 3, the stream is said to have 4 layers. Also, the convention is to treat 0 as the highest priority and 3 as the lowest. Any other system of identifying priority levels may be utilized including alpha numeric indicators or similar identifiers. If a stream only contains a single layer, all packets are labeled with priority 0.

To software router daemons, a priority value of a packet is relative to the stream and becomes relevant when a decision to discard data at a congested router is made. The priority value has no meaning other than as a criterion for discarding packets on congested links. 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. This technique is also applied to any data type, including audio/video data and financial data. Using this system, the packet priority numbers cannot be misused by sources to give their data packets a greater chance of prioritized transmission by giving them the highest priority to gain advantage over other sources. Packet priorities are only compared between packets that are part of the same data stream.

In one embodiment, knowing that routers will 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. This system is especially useful when multicasting a live data stream with a high data rate to a large number of receivers, scattered over a heterogeneous wide area network. Receivers that are on congested parts of the network will then receive the highest priority parts of the data only. This 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. Example applications of the system include audio and video codecs that divide live multimedia content over layers to enhance the user experience over wide area networks.

(Dkt. 1-1 at 21:25-22:5.)

108. Specifically, the above excerpt describes a system where data streams, such as audio or video codecs, are divided into layers based on priority numbers (or levels). (*Id.* at 21:25-28.) A POSITA would understand this division allows for different levels of data granularity or quality, where higher priority layers that contain critical data (e.g. intracoded frames at scene changes), where loss cannot be tolerated by the receiver decoder, resulting in visible artifacts such as frame-freeze or macro-blocking (tiling) and lower priority layers that contain less critical data (e.g. predictively encoded data), where loss can be tolerated and mitigated by strategies implemented by the receiver decoder.

109. The above excerpt also describes that data packets within a stream are labeled with priority numbers (0 to 3 in this example), with 0 being the highest priority and 3 being the lowest. (*Id.* at 21:30-37.) This prioritization scheme ensures that during congestion, routers can make decisions to forward packets based on their priority levels. (*Id.* at 21:38-52.) A POSITA would understand this is crucial in ensuring that critical data, such as financial data or high-quality video frames, are prioritized over less critical data when network resources are limited. A POSITA

would also understand that the system dynamically adjusts its delivery strategy based on real-time network conditions and receiver capabilities.

110. Furthermore, by using layered multicast and prioritization, the system ensures that receivers on congested parts of the network receive the most critical or highest priority parts of the data stream. (*Id.* at 21:61-63.) This approach avoids the need to lower the overall data publishing rate to match the slowest receiver, thereby maintaining a high-quality, real-time data stream experience.

111. In another exemplary embodiment, the specification describes that data is dropped if the total amount stored in all queues exceeds a threshold value. (*Id.* at 22:59-60.) A POSITA would understand this indicates a mechanism to manage congestion by selectively discarding data when the system is overloaded. Alternatively, this mechanism can be seen as a form of selective forwarding in reverse: instead of forwarding packets selectively, the router drops packets selectively based on certain conditions (in this case, when the buffer threshold is exceeded).

112. The system enforces fair bandwidth allocation between data streams and implements prioritization of logical layers. (*Id.* at 22:62-63.) This prioritization can be relevant when deciding which packets or layers to drop during congestion. (*Id.* at 22:63-65.) A POSITA would understand that higher priority layers may be protected from dropping, ensuring critical data or higher-quality streams are maintained.

113. In another exemplary embodiment, the specification describes that the system employs a layered multicast approach combined with a scalable selective packet retransmission mechanism. (*Id.* at 25:1-5.) This combination ensures that subscribers receive intact layers, particularly high-priority layers, even if occasional packets are missed. (*Id.* at 25:5-7.)

114. In another exemplary embodiment, the specification describes a system where packet recovery (retransmission) is applied selectively to layers that can be delivered within the current bandwidth capacity of the network. (*Id.* at 28:37-40.) Moreover, receivers use a mechanism to receive feedback about the current network capacity. This feedback helps them decide which layers to prioritize for packet recovery. If the network lacks resources to deliver all layers, receivers focus on recovering packets from layers deemed feasible under current conditions. (*Id.* at 28:40-46.) An algorithm monitors the overall status of the stream and determines how many layers can be reliably delivered without stressing the network. It marks these layers as intact or reliable. (*Id.* at 28:46-52.) The described system therefore ensures efficient use of network resources by selectively prioritizing and forwarding enhancement layers based on the current bandwidth conditions and the criticality of the data within those layers. A POSITA would understand this decision-making process aligns with the idea of selectively forwarding layers based on identified bandwidth limitations and layer reliability.

115. In another exemplary embodiment, the specification describes the management of data streams divided into layers, similar to enhancement layers in video streaming. (*Id.* at 30:1-11.) A POSITA would understand these layers correspond to different priorities or qualities of data. In this embodiment, the system monitors network capacity and adjusts transmission strategies accordingly. (*Id.* at 29:11-17.) The specification also explains how the system selectively forwards layers based on real-time network conditions. For example, during periods of limited bandwidth, it prioritizes forwarding the base layer (essential for basic content) and selectively forwards fewer enhancement layers (which require more bandwidth but enhance quality). (*Id.* at 30:12-33; 29:57-64 (“In the overlay multicast system, the reception history or similar data may be used to calculate a moving average that describes the amount of packet loss

over the last x seconds, where x is equal to the repair time-out. With a small moving average history, the receiver will quickly respond to increased network capacity, while a longer history will only add layers when the network's capacity was sufficiently high for a longer period of time.”.) Here, the specification describes building a packet arrival history to assess reception quality and decide when to add higher layers to the reliable-list (layers guaranteed to be delivered reliably). A POSITA would understand that this teaching aligns with ensuring that only the necessary layers are forwarded based on bandwidth availability to maintain quality and reliability.

116. Based on the above disclosures, a POSITA would understand that the specification teaches the following exemplary criteria for selectively forwarding one or more of the set of enhancement layers, but fewer than all, to video receivers based on identified bandwidth-limited conditions: (1) real-time bandwidth monitoring, where the system continuously monitors the available bandwidth in the network and dynamically adjusts the transmission strategy based on fluctuations in bandwidth conditions (*id.* at 29:11-17); (2) quality and reliability assessment using a packet arrival history to assess the quality of reception, which helps determine whether the network conditions are sufficient to support the delivery of higher layers (enhancement layers) without compromising quality (*id.* at 29:50-57); (3) moving average calculation of packet loss over a period of time, which influences decision-making on whether to add higher layers to the reliable-list based on the network's recent performance (*id.* at 29:57-64); (4) retransmission requests and responses (*id.* at 29:44-49; 30:54-67); (5) and priority and ordering considerations to maintain the order of packets across layers to ensure coherent delivery, including prioritizing the delivery of essential base layers while selectively forwarding enhancement layers based on their priority and available bandwidth (*id.* at 30:13-33.)

117. In another exemplary embodiment, the specification describes creating multiple layers of data (akin to enhancement layers in video streaming) based on different qualities or priorities of the data (in this case, market data updates). These layers are formed using a thinning algorithm that categorizes updates into different layers (or qualities) based on the frequency and importance of the updates. (*Id.* at 33:1-7.) The specification also teaches adjusting the transmission rate of these layers dynamically based on available bandwidth, for example, using a token-based system where each token operates at a different speed within its respective layer (or quality level). (*Id.* at 33:7-15.) This adaptation ensures that higher layers (which may contain more detailed or higher-quality data) are transmitted only when sufficient bandwidth is available to avoid congestion or delays. The specification explains that transmitting different qualities or layers of data concurrently to cater to receivers with varying bandwidth capacities is known as simulcasting. (*Id.* at 33:15-19.) Simulcasting ensures that each receiver gets the best possible data quality based on its bandwidth capabilities without overloading the network.

118. Moreover, while the system may initially introduce redundancy because higher layers could contain updates already present in lower layers, (*id.* at 33:13-15), the algorithm is refined to eliminate redundancy by ensuring that each layer contains unique information not available in lower layers. (*Id.* at 33:20-23.) A POSITA would understand this optimization reduces the overall data transmission volume while maintaining essential content delivery and describes another criterion by which the router selectively forwards enhancement layers to video receivers based on identified network bandwidth.

119. The specification further explains that due to the nature of the algorithm, which allows out-of-order transmission across layers, updates for a single symbol may not be delivered chronologically. (*Id.* at 34:19-27.) To address this, the system employs mechanisms like sequence

numbering and a transmit window to reorder updates before delivery, ensuring that the data received by the receivers maintains logical order despite transmission delays. (*Id.* at 34:28-44.) A POSITA would understand these teachings to describe another method by which the router selectively forwards layers to receivers based on identified bandwidth conditions.

120. Based on the aforementioned teachings from the specification, a POSITA would understand with reasonable certainty the scope of the term “selectively [forward/forwards/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.” Therefore, this term is not indefinite.

121. Defendant’s expert Dr. Wenger also opines that “the claims and the specification do not offer guidance as to how the claimed video router would determine which or how many enhancement layers to selectively forward, or which video receivers to forward them to.” (Wenger Decl. ¶ 67.) I disagree, for at least the following reasons.

122. First, in using the language “one or more . . . but fewer than all of the set of enhancement layers,” the claim explicitly identifies a limited range of values of the number of enhancement layers forwarded. Specifically, if the stream contains n enhancement layers, the number of enhancement layers could be anywhere from 1 to $n-1$. A POSITA would be able to identify this range with reasonable certainty. For example, in a stream containing four enhancement layers, the router may selectively forward between one to three enhancement layers.

123. Second, as I have explained, the decision as to “which” enhancement layers and “how many” to selectively forward can be influenced by current network bandwidth availability and conditions. Layers that require higher bitrates may be skipped or selectively forwarded when

network conditions are limited to ensure smoother transmission of lower layers. The specification teaches assessing network bandwidth to determine which and how many enhancement layers to forward to each receiver. (Dkt. 1-1 at 21:25-22:5; 28:37-52; 29:11-17; 33:7-19; 34:28-44.)

124. Third, the capabilities of the video receivers also play a role. Receivers with higher bandwidth availability or better buffering capabilities may be able to handle more enhancement layers without issues. On the other hand, receivers with lower capabilities or under more constrained network conditions may benefit from receiving fewer enhancement layers to maintain a stable viewing experience. Moreover, receivers with robust decoding capabilities may benefit from receiving more enhancement layers, enhancing the viewing experience.

125. Fourth, the goal of the video router is to optimize the viewing experience while conserving network resources. This involves striking a balance between providing sufficient video quality (through the base layer and selected enhancements) and avoiding network congestion or degradation. Advanced video routers may use sophisticated algorithms based on predictive models, historical network data, or machine learning techniques to predict which enhancement layers will provide the best perceptual quality under current conditions. As I explained above, the specification teaches using such algorithms to determine which and how many enhancement layers to selectively forward to each receiver. (Dkt. 1-1 at 28:40-46, 28:46-52, 29:57-63, 33:1-7, 33:7-15, 33:20-23, 34:28-44.)

126. Fifth, the system continuously monitors the available bandwidth in the network and dynamically adjusts the transmission strategy based on fluctuations in bandwidth conditions. (*Id.* at 29:11-17.) The video router's adaptive algorithms can dynamically determine which specific enhancement layers to forward based on real-time network measurements and receiver capabilities, to ensure that the video quality remains optimal.

127. Therefore, a POSITA would understand this term with reasonable certainty. This term is not indefinite.

128. I understand that in the event this term is found to be not indefinite, Defendant has proposed an alternative construction: “selecting using a layer identifier of one or more of the set of enhancement layers and forwarding the 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.” I disagree with this construction at least because it is overly narrow.

129. Specifically, Defendant’s proposed construction narrows the scope of the term by adding the qualifier “using a layer identifier.” In my opinion, there is no basis for narrowing the claim in this manner. As I have explained above, the specification identifies several criteria by which to select one or more enhancement layers for transmission to video receivers based on bandwidth conditions. These criteria include the capabilities of each receiver (*id.* at 33:15-19), quality information (*id.* at 5:22-25, 30:1-11, 30:12-33; 29:50-57, 29:57-64, 33:1-7, 33:15-19), priority information (*id.* at 21:25-28, 21:30-37, 21:61-63, 22:62-63), and/or buffer/queue status (*id.* at 22:59-60, 29:18-31, 23:45-59, 23:60-24:20, 24:21-67).

130. Therefore, Defendant’s proposal to limit the selective forwarding criteria to a “layer identifier” overlooks all of the other criteria described by the specification and is improperly narrow. Defendant does not identify what it characterizes as a “layer identifier” and which of the above criteria, if any, any such layer identifier relates to.

131. For example, Defendant’s proposal overlooks the fact that one of the criteria described in the specification is a “priority value” (or “priority number”). (*Id.* at 21:25-28, 21:30-37, 21:61-63, 22:62-63.) In his declaration, Defendant’s expert Dr. Wenger equates a “layer

identifier” with a “priority value.” (Wenger Decl. ¶ 69, citing Dkt. 1-1 at 21:38-45, 21:53-22:2, 22:37-41, 22:63-65, 25:5-16.) But none of the cited portions of the specification support Dr. Wenger’s assumption that a “layer identifier” is synonymous with a “priority value,” and I disagree with his assumption.

132. For example, the specification confirms that a “priority value” (or “priority number”) is simply a value identifying the relative importance of data *packets* within each layer. (Dkt. 1-1 at 21:25-28 (“In one embodiment of the overlay multicast system, priority numbers are associated with data packets. The priority numbers represent a logical layer inside a data stream.”).) Each layer may comprise a plurality of packets having sequence numbers. Furthermore, each packet within a layer may have either a common sequence number or unique sequence numbers:

In one embodiment, detecting packet loss is done in the conventional way by sequencing each packet with an incrementing number. In another embodiment, *each layer has its own sequence number, so all packets in one layer are sequenced independent of the other layers*. This way, packet loss is detected in each layer, regardless of the conditions and packet loss in other layers.

(*Id.* at 25:27-33.)

To provide this, every packet contains the number of the most recent packet from all other layers or similar sequence data. *Aside from carrying its own sequence number, each packet contains the current sequence number of all the other layers as well.*

(*Id.* at 28:59-63.)

133. Therefore, a “priority value” alone is not sufficient to identify a layer. I disagree with Dr. Wenger that a priority value would be a sufficient criterion for a router to selectively forward enhancement layers based on bandwidth conditions.

134. Because Defendant’s proposed construction is overly narrow and would read out exemplary embodiments, the term should not be construed to incorporate either a “layer

identifier” or a “priority value.” The plain language of this term would be easily understood by a POSITA in the context of the claims and specification. No construction is necessary.

3. “the video receiver” (claims 2, 7)

Plaintiff’s Proposal	Defendant’s Proposal
No construction necessary	Indefinite.

135. When read in the context of the claim—as required—this term’s plain language confirms it is not indefinite. I agree with Plaintiff’s position.

136. Claim 2 depends from claim 1 and recites that the video router “selectively forwards the one or more of the set of enhancement layers *based on video processing capabilities of the video receiver.*” (Dkt. 1-1, cl. 2.)

137. This additional limitation ensures that enhancement layers are forwarded selectively not only based on available bandwidth but also on whether the receiving device can effectively decode and utilize those layers. For example, devices with higher video processing capabilities may receive more enhancement layers to enhance the viewing experience, while devices with lower capabilities receive fewer layers to prevent performance issues.

138. When viewed in the context of claim 1 (which claim 2 depends from), the meaning and scope of the term “the video receiver” is reasonably certain:

identify bandwidth-limited conditions of an internet protocol network between the video router and *a plurality of video receivers*,

forward the base layer from the video router to *at least two of the plurality of video receivers* via the internet protocol network, and

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,

(*Id.* cl. 1.)

139. Here, a POSITA would understand that the term “the video receiver” refers to *each* of the “at least two” video receivers that the video router selectively forwards layers to. The specification recognizes that each receiver has its own capabilities. (*Id.* 33:15-19.) The claim therefore recites that when forwarding to a specific video receiver, the router considers the capabilities of that receiver. The router therefore considers the capabilities of each video receiver it selectively forwards layers to.

140. This understanding of the claim is consistent with Dr. Wenger’s own admittedly plausible interpretations. (Wenger Decl. ¶ 77.) I disagree with Dr. Wenger’s statement that “if it is instead referring to more than one video receiver, neither the claims nor the specification explain how to determine ‘video processing capabilities’ for more than one video receiver.” (*Id.* ¶ 77.) As set forth, determining capabilities for “more than one video receiver” is not the issue; the claim is properly understood to recite determining capabilities for *each* receiver that layers are selectively being forwarded to. And as I explained above, the specification contemplates transmitting different qualities or layers of data concurrently to receivers with varying bandwidth capacities. (*Id.* at 33:15-19.)

141. Because the meaning of this term can be understood by a POSITA with reasonable certainty, it is not indefinite.

4. “bandwidth-sufficient conditions” (Claim 11)

Plaintiff’s Proposal	Defendant’s Proposal
No construction necessary	Indefinite.

142. When read in the context of the claim—as required—this term’s plain language confirms it is not indefinite. I agree with Plaintiff’s position.

143. Claim 11 recites:

11. A scalable video coding router, comprising:

a memory; and

a processor, wherein the processor executes instructions stored in the memory to cause the scalable video coding router to:

receive a layered video data stream that comprises a base layer and a set of enhancement layers,

identify bandwidth-limited conditions of an internet protocol network between the video router and a set of video receivers, and

forward the base layer from the video router to at least two of the set of video receivers;

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***;

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;

wherein the layered video data stream is transmitted according to an internet protocol; and

wherein each layer of the layered video data stream comprises data packets, each of which is encoded with a sequence number and a layer identifier, and wherein the layer identifier for each data packet is based upon a layer to which the packet belongs.

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.

145. A POSITA would understand that the determination of “bandwidth-sufficient conditions” can depend on various factors: (1) the current network traffic load, (2) the available bandwidth at the time of transmission, (3) the quality of service (QoS) parameters set for video delivery, and (4) any network policies or agreements regarding bandwidth allocation.

146. I contrast this term to the phrase “bandwidth limited conditions” which I previously discussed and is also recited in the claim. Specifically, as I explained above, “bandwidth limited conditions” refer to situations where the available network bandwidth is constrained. In such cases, the router selectively forwards fewer enhancement layers to prevent network congestion and maintain optimal performance. Here, on the other hand, the network segment between the router and the specified receivers has ample capacity to transmit all enhancement layers of the video stream to those receivers without compromise in quality or performance. This is a critical factor in ensuring high-quality video delivery in environments with varying network capabilities.

147. A POSITA would also understand that the determination of whether a network segment between the router and any receiver is “bandwidth sufficient” requires an assessment of the available network bandwidth relative to the requirements of the data being transmitted. This evaluation considers factors such as the current network load, the capacity of the network links, and any quality of service (QoS) agreements in place. If the available bandwidth exceeds or comfortably meets the requirements for transmitting all layers of the video stream (including base and enhancement layers), then the network segment is considered “bandwidth sufficient.” In such cases, the router can transmit all enhancement layers to maximize video quality and resolution without concerns of congestion or degradation.

148. I note that Dr. Wenger himself opines that this term can describe a scenario where “the network connection that couples the receivers to the ‘scalable video router’ . . . as having ‘sufficient’ or ‘insufficient’ bandwidth or capacity.” (Wenger Decl. ¶ 82.) Indeed, the portions of the specification he cites further confirm that this term is reasonably certain to a POSITA. (*Id.* ¶ 82, citing Dkt. 1-1 at 1:55-57, 4:33-37, 21:42-45, 31:19-23.)

149. As I explained above, the specification teaches several techniques and algorithms to assess whether there is sufficient bandwidth on a network segment to a receiver, and determine the number of enhancement layers to forward to the receiver, including all enhancement layers if there is sufficient bandwidth to do so. Accordingly, I incorporate my opinions as to terms (1) and (2) in this section.

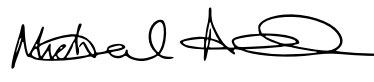
150. Because the meaning of this term can be understood by a POSITA with reasonable certainty, it is not indefinite.

D. Supplementation

I reserve the right to supplement the opinions set forth in this declaration to (a) respond to any arguments that Cisco or its expert raise and/or (b) consider new information that becomes available to me from Cisco, its expert, or otherwise.

I declare under penalty of perjury under the laws of the United States that the foregoing is true and correct.

Dated: June 17, 2024

A handwritten signature in black ink, appearing to read "Michael Adams", written over a horizontal line.

Michael Adams

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Summary

Michael has served as an Expert Witness in the United States and Great Britain.

In 2021, he was inducted into the Cable TV Pioneers in recognition for his contribution to the industry in which he invented, developed and implemented Broadband and Video products and services at Time Warner Cable, Charter Communications, Terayon, and Tandberg/Ericsson TV. He has been granted 9 U.S. patents.

Michael is an accomplished speaker who loves to explain complex technology strategies to a wide range of audiences. He is a co-author of "Modern Cable Television Technology 2nd Edition" and author of "OpenCable Architecture".

Michael is a certified Yoga instructor, and stays active by cycling, skiing and hiking. He also provides pro bono coaching through Everwise.

Experience

President/Founder, Broadband Semantics Consulting LLC

Delivering independent consulting services since 2003:

- Systems architecture, product and test environment design for **Brighthouse Communications**, **Charter Communications**, **Comcast Cable Communications** and **Vidéotron**.
- Expert witness and intellectual property consulting for **Charter Communications**, **Comcast Cable Communications**, **Time Warner Cable**, and **Virgin Media**.
- Technical Advisory Board member for:
 - **Broadband Access Systems** (*acquired by ADC for \$2.25B*)
 - **Entone** (*acquired by Amino for \$73M*)
 - **Everstream** (*acquired by Concurrent for \$15M*)
 - **Jacobs Rimell** (*acquired by Amdocs for \$45M*)
 - **Verivue** (*acquired by Akamai for \$35M*)

Principal Architect, Charter Communications

- Developed the end-to-end test environment architecture for critical product deliverables including **Spectrum Guide**, **Video-on-Demand** and **Dynamic Ad Insertion** by working closely with product, advanced engineering, software engineering and video operations.
- Performed technical assessments of **Charter** markets to identify testing coverage gaps in the lab environments.

Principal, IBB Consulting

- Modeled sizing, performance and scaling of the Dynamic Ad Insertion platform (*originally developed by "This Technology"*) for **Comcast's** Video IP Engineering (**VIPER**) development team.
- Performed a detailed analysis for **Vidéotron**, of a cloud-based, IP video transformation.
- Development of an alignment process for **Comcast Wholesale** to drive the **X1** product feature roadmap being delivered to **Shaw Communications** (*BlueSky TV*) and **Cox Communications** (*Contour*).
- Performed a detailed analysis for **Charter Communications** of broadband IP architecture and infrastructure in support of their acquisition of **TWC** and **Brighthouse Networks**.

(Accenture acquired IBB in 2018)

Vice President of Engineering, Bright House Networks (BHN)

- Led an organizational transformation of the **BHN** software engineering team.
- Analyzed the systems architecture design of an IPv6 hosted-navigation system (**H-Nav**) working closely with the **TWC** development team.
- Advised **BHN** executive management on adapting **H-Nav** to operate against the **BHN** back-office environment.
- Developed a migration strategy for **BHN** SmartTV applications (**BHTV**).

(Charter Communications acquired BHN in 2016)

Head of Software Strategy, Ericsson TV/Vice President of Systems Architecture, Tandberg Television

Managed global strategy for **Ericsson TV's** digital video products, including **OpenStream**, **MDMS**, **eCMS**, **IPTV** and **Converged TV** platforms.

- Provided subject matter expertise and technical sales support for digital compression products and standards including MPEG-2, MPEG-4 (H.264), and HEVC/H.265).
- Developed multi-screen video product-prototypes, including first public demonstration of "screen-shifting" from STB to PC to smartphone at **CableLabs** innovation showcase in February 2010. Apple iPad was added to demo for 2010 **NCTA** conference (only 2 months after its release in April).
- Managed end-to-end solution architectures for advanced TV services across cable, satellite, IPTV, and mobile access networks.
- Authored white papers on multi-screen TV, adaptive bitrate management, IPTV user interface, and content management systems.
- **Ericsson's** corporate spokesperson on all aspects of television at international and domestic conferences.
- Supported standards activities in **SCTE** and **CableLabs**.

Vice President of Video Architecture and Technology, Terayon Communications Systems

Directed technical strategy for **Terayon's** digital video product-line family; **DM Network CherryPicker**, **BP 5100**, and **CAP-1000**.

- Provided subject matter expertise and technical sales support for digital compression and transrating products and standards including MPEG-2 and MPEG-4 (H.264).

- Developed end-to-end system architecture for digital program insertion (DPI), including support for seamless, real-time splicing of MPEG-2 and MPEG-4 (H.264).
- Supplied solutions for DPI, targeted advertising and switched digital solutions to **Comcast** and **TWC**.
- Managed standards representation in **SCTE** and **CableLabs**.
- Authored white papers on IPTV and IP-MPEG network convergence.

(Motorola acquired Terayon in 2007)

Corporate Vice President of Broadband Technology Group, Time Warner Cable

Managed the **Road Runner** high-speed data engineering, product management, and quality assurance organizations:

- Overall responsibility for major engineering initiatives including Multiple ISP, Broadband Provisioning Systems, Regional Networks, IP Address Management, Network Management, Consumption Monitoring, Cable Modem management, National Content Center, and Voice over IP.
- Created a cohesive engineering organization by integrating existing network operations, customer operations, programming and product development teams.

(Charter Communications acquired TWC in 2016)

Corporate Vice President of Network Engineering, Time Warner Cable

Managed technical initiatives on multiple ISP for broadband cable systems.

- Developed multiple ISP requirements, recommendations, program plans and architecture, which was a Justice Department order gating AOL delivery via cable modems.
- Built a cross-functional team to implement a multiple ISP trial in Columbus, Ohio.
- Created and delivered presentations to the **FTC** and **FCC** on Open Access.

(AOL acquired Time Warner in 2001)

Principal Network Architect, Time Warner Cable

Developed the detailed network architecture and STB requirements for the **Pegasus** program, which implemented the systems, network, and software platforms to support digital cable services to 20 million STBs in **TWC** and **Brighthouse Networks** cable systems.

- Developed specifications and requirements for video-on-demand, interactive TV, and digital program insertion.
- Served as co-chair of the **JEC Digital Standards Subcommittee** and chair of **Working Group 3** for the **SCTE Digital Video Standards Committee**, which created key **OpenCable** specifications for the **Cable Card** security module.
- Delivered numerous papers, presentations and tutorials at industry conferences.
- Awarded 9 U.S. patents in the fields of digital video and cable networks.

Senior Project Engineer, Time Warner Cable

Developed the network architecture for the **Time Warner** Full Service Network (FSN), which was the first video-on-demand system, including an electronic program guide, home-shopping, and multi-player games.

- Developed network architecture, including video compression, network adaptation functions and network management.
- Project management of a multi-disciplinary team of engineers from **AT&T**, **Silicon Graphics**, **Scientific Atlanta**, **Time Warner Interactive**, **Hitachi**, **Objective Systems Integrators**, and **BBN Hark**.
- Managed digital set-top box integration by **Scientific Atlanta** and **Silicon Graphics** personnel in Atlanta, GA.

Software Development Manager, BNR/Northern Telecom

Managed and implemented communications software projects, including:

- Systems architecture and software development for **Magellan Concorde** ATM switch.
- Designed and implemented core frame relay processing for **DataSPAN** product on **LPP** platform.
- Specified an automatic logical link connection protocol for T3 ATM trunks.
- Created an SMDS router architecture, which was adopted by the **MSS 6400 Passport** switch.
- Developed 'c' control software for a fiber-to-the-home TV distribution system in Heathrow, Florida.

Senior Design Engineer, Digital Equipment Company (DEC)

- Designed, and coded in 'c' and assembler, LAP-D firmware for a **DECnet** to **ISDN** network adaptor for the **MicroVAX II**, which was demonstrated in trials with **Deutsche Telekom** in Mannheim, Germany and **Swisscom** in Geneva, Switzerland.
- Developed a manufacturing diagnostic test-suite for a **V22.bis** modem.
- Developed customer and field service diagnostics for **DPV-11** synchronous communications network adapter for the **MicroVAX II**.
- Specified, designed, and coded the user-interface for **VAX/VMS NTR**.

Design Engineer, Kent Process Control

- Hardware evaluation and testing of **LSI-11** based systems for process control.
- Provided on-site support for customers in Netherlands and Italy.
- Firmware design for a token-passing bus LAN for process control (**6809** assembler).

Education

BSc with honours in Electrical and Electronic Engineering, Bristol University, England (1979)

Books and other Publications

- **Modern Cable Television Technology** 2nd edition, 2004 (Morgan Kaufmann)
- **OpenCable Architecture**, 1999 (Cisco Press)
- "Optimizing Fairness of HTTP Adaptive Streaming in Cable Networks" April 15, 2012, Spring Technical Forum; CableLabs, NCTA, & SCTE.
- "Will HTTP Adaptive Streaming become the Dominant Mode of Video Delivery in Cable Networks?" June 14, 2011, Spring Technical Forum; joint CableLabs, NCTA, & SCTE.
- "The Use of Scalable Vector Graphics in Flexible, Thin-Client Architectures for TV Navigation" May 11, 2010, Spring Technical Forum; joint CableLabs, NCTA, & SCTE.
- "Taking Advantage of the Back-Office to Provide Scalable Multiplatform TV Services" October 28, 2009, SCTE CableTec Expo.
- "Content Management Systems versus Content Delivery Networks" April 3, 2009, NCTA Technical Papers.
- "IPTV in Cable and Mobile Applications" October 1, 2005, Terayon Communications Systems.
- "Intelligent Edge Devices in Converged IP/MPEG Networks" June 14, 2005, SCTE CableTec Expo.
- "Intelligence from the Edge: Six steps to successful migration to a Converged IP network" April 16, 2005, NAB Broadcast Engineering.
- "Planning for Multiple ISP Deployment," January 8, 2001, SCTE Emerging Technologies.
- "Multiple Conditional Access Systems," October 1, 1997, Communications Technology.
- "A Broadband Interactive Cable Gateway," April 28, 1996, NCTA Technical Papers.
- "Traffic Management for Highly Interactive Transactional System," May 7, 1995 NCTA Technical Papers.
- "Fault Tolerance in the Orlando Full Service Network" May 7, 1995, NCTA Technical Papers.
- "Real time MPEG Asset Delivery over ATM", May 7, 1995 NCTA Technical Papers.
- "Real Time MPEG Asset Delivery over ATM" March 7, 1995, MPEG over ATM Seminar, Nikkei Business Publications.
- "Network Design and Implementation of a large-scale, ATM, Multimedia Network", NetWorld+Interop March 27-31, 1995, Las Vegas.
- "FSN Tutorial" January 4, 1995 SCTE Emerging Technologies.

Industry Memberships

- Senior Member of SCTE (member since 1993)

- Senior Member of IEEE (member since 1993)
- Cable TV Pioneers (inducted in 2021)

Patents

1. *“Methods using base content and additive content and related client devices and network server devices” Issued Feb 28, 2017. US 9,584,602*
2. *“Media server interconnect architecture” Issued Apr 23, 2002 US 6,378,130 B1*
3. *“Optimum bandwidth utilization in a shared cable system data channel” Issued Sep 26, 2000 US 6,124,878*
4. *“Method and apparatus for utilizing the available bit rate in a constrained variable bit rate channel” Issued Mar 28, 2000 US 6,044,396*
5. *“Video inversion detection apparatus and method” Issued Jul 27, 1999 US 5,930,361*
6. *“Digital serialization of program events” Issued Oct 13, 1998 US 5,822,676*
7. *“Method for message addressing in a full service network” Issued Oct 6, 1998 US 5,819,036*
8. *“Asymmetric ATM switch” Issued Oct 6, 1998 US 5,818,840*
9. *“Scalable communications network employing shared logical nodes” Issued Sep 23, 1997 US 5,671,217*

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Litigation History

The following matters have been resolved and my engagement in them has concluded.

1. From 2013 to 2015 I was retained as an expert witness in the field of electronic guide technology by the defendants, and testified in court in *Rovi v. Virgin Media* (British High Court, London).
2. From 2015 to 2018 I was retained as an expert witness in the field of video on demand systems by the defendants, and was deposed, in *Broadband iTV, Inc. v. Ocean Time Warner Cable, LLC and Time Warner Cable, Inc.*, (D. Hawaii).
3. In 2017 I was deposed a fact witness in the field of video on demand systems in *Custom Media Technologies, LLC v. Dish Network LLC* (E.D. Texas).
4. In 2018 I was retained as an expert witness by the defendants, Bell Canada and TELUS, in *Rovi v. Bell Canada and TELUS Communications Inc.* (Canadian Federal Court).
5. In 2019 I was retained as an expert witness field of video on demand systems by the defendants, DISH Network LLC, in *Multimedia Content Management, LLC v. DISH Network LLC* (W.D. Texas).
6. In 2020 I was retained as an expert witness field of voice recognition technologies by the defendants, SKY UK LIMITED, in *PROMPTU SYSTEMS CORPORATION v (1) SKY UK LIMITED (2) SKY IN-HOME SERVICE LIMITED (3) SKY SUBSCRIBERS SERVICES LIMITED (4) SKY LIMITED (5) COMCAST CORPORATION* (British High Court, London).
7. In 2020 - 2021 I was retained as an expert witness in the field of streaming media by the Plaintiff and Patent Owner, Helios Streaming, and was deposed, in *Ideahub, Inc. and Helios Streaming, LLC (Helios Streaming, LLC et al) v. Crackle, Inc. et al DDE-1-19-cv-01818, Helios Streaming, LLC et al v. Showtime Digital, Inc. et al DDE-1-19-cv-01978, Helios Streaming, LLC et al v. Starz Entertainment, LLC et al CDCA-8-19-cv-02140, Unified Patents, LLC f/k/a Unified Patents Inc. v. Ideahub, Inc. PTAB-IPR2020-01338, Vudu, LLC v. Ideahub, Inc., PTAB-IPR2020-01688, and Vudu, LLC v. Ideahub, Inc., PTAB-IPR2020-01689.*
8. In 2020 - 2021, I was retained as an expert witness in the field of video coding by the Plaintiff and Patent Owner, Nokia Corporation, and was deposed, in *Nokia Corporation and its subsidiaries ("Nokia") v. Lenovo Group Limited and its subsidiaries (including its subsidiary Motorola Mobility) (together "Lenovo") and Google.* (This was an ITC matter.)
9. In 2021 I was retained as an expert witness in the field of streaming media by the Patent Owner, SITO MOBILE, in *Hulu LLC. v. SITO MOBILE R&D IP, LLC and SITO MOBILE, LTD.*, and was deposed three times, on a series of seven IPR actions.

11. In October 2021 I was retained as a fact witness by the defendant, Amazon, in Broadband iTV, Inc. v. Amazon.com, Inc., Amazon.com Services LLC, Amazon Web Services, Inc., Civil Action No. 6:29-cv-00921ADA. *In September 2022, the judge ruled that the patents are invalid.*
12. In June 2022 I was retained as an expert witness by the defendant, Charter Communications, in Broadband iTV, Inc. v Charter Communications in “Re Certain Digital Set-Top Boxes and Systems and Services Including the Same, Inv. No. 6:21-cv-1315 (U.S.I.T.C.)”. (This was an ITC matter.) *As of October 2020, BBiTV has terminated its action against Charter.*

The following matters are ongoing and my engagement in them is ongoing.

13. In 2018 I was retained as an expert witness field of voice recognition technologies by defendants, Comcast Corporation, in *Promptu Systems Corporation v. Comcast Corporation* (E.D. Pennsylvania).
14. In January, 2022 I was retained as an expert witness by the defendant, HP, in Consulting and Video Processing Devices and Products Containing the Same; Inv. No. 337-TA-1341 (Violation), ITC-337-TA-1341 and VideoLabs, Inc. v. HP Inc., WDTX-6-22-cv-01086, as well as potential matters, including all appeals and during any litigation, ITC and/or PTAB matters arising out of or relating to same in all venues.
15. In May, 2024 I was retained as an expert witness for Assistance with Certain Patent Asserted by Scale Video Coding, LLC in *Scale Video Coding LLC v. Cisco Systems, Inc.*, No. 4:23-cv-00803-SDJ (E.D. Tex.)