UNITED STATES DISTRICT COURT
WESTERN DISTRICT OF TEXAS
WACO DIVISION

VIDEOLABS, INC., and VL COLLECTIVE IP LLC Plaintiffs, v. AMAZON.COM, INC., and AMAZON WEB SERVICES, INC. Defendants.	Civil Action No. 6:22-cv-00079-ADA JURY TRIAL DEMANDED

FIRST AMENDED COMPLAINT FOR PATENT INFRINGEMENT

Plaintiffs VideoLabs, Inc. ("VL") and VL Collective IP LLC ("VL IP") (collectively "VideoLabs" or "Plaintiffs") file this First Amended Complaint against Defendants Amazon.com, Inc. ("Amazon.com") and Amazon Web Services, Inc. ("AWS") (collectively "Amazon" or "Defendants"), and in support thereof alleges as follows:

NATURE OF THE ACTION

1. Digital video has become fundamental to how society interacts, communicates, educates, and entertains. In fact, video consumption now accounts for more than 82% of all Internet traffic.[1] The ability to reliably provide high-quality video drives the growth of digital platforms that are increasingly integral to the global economy.

2. The advent of high-quality video as a staple of digital consumption did not happen instantaneously. As with any complex technology, digital video presented implementation

[1] *See* Ex. 1, *The Sustainable Future of Video Entertainment*, INTERDIGITAL (Aug. 2020), https://www.interdigital.com/white_papers/the-sustainable-future-of-video-entertainment?submit_success=true (last visited Jan. 20, 2022).

challenges. Many companies spent many years and resources to develop new and innovative technologies that guide how video is created, streamed, secured, managed, and consumed.

3. Various inventions and technological advances have transformed digital video. Some of these technologies, such as techniques to efficiently compress video file size, address central challenges to storing and transmitting video. Others enable video content to be efficiently and securely streamed to the many user devices that exist today. Yet others involve managing and organizing videos to provide viewers easier access to content and address how they interact with content. Successful video streaming thus requires myriad technologies that necessarily coordinate with one another.

4. Because various companies played roles in developing the foundational technology for today's digital video, no single company can provide the high-quality video experiences that consumers have come to expect without using technology owned by other companies.

5. The founders of VideoLabs recognized this problem and understood that collective action was needed to address it. If the companies that developed critical video technologies worked together, everyone could benefit: innovators could receive fair compensation for their contributions, companies deploying video technology could respect the innovators' patents and license them on affordable and predictable terms, and consumers could experience better and more affordable video technology.

6. In 2019, with support from widely-recognized industry leaders, VideoLabs launched a platform to achieve these goals. VideoLabs spent millions of dollars and thousands of hours analyzing the video space and identifying the patents that reflect the innovations with the highest impact. VideoLabs then compiled a portfolio of these core patents, obtaining them from

leading companies, including Hewlett Packard Enterprise, Alcatel-Lucent S.A., Siemens AG, Swisscom AG, 3Com, Panasonic, LG, and Nokia.

7. VideoLabs then opened-up membership on its platform to all willing companies. In exchange for low-cost membership or licensing fees, VideoLabs provides access to its patent portfolio and a commitment to seek out the most important patents in the video industry and clear them. Many prominent companies recognized the benefits of the VideoLabs platform and worked with VideoLabs to efficiently and responsibly license its video technology patents.

8. Unfortunately, Amazon has not. Amazon is one of the world's largest users of video technologies and is enmeshed in practically every aspect of video, from creation to processing, delivery, and display. It operates one of the world's largest video streaming services, Amazon Prime Video, which makes up 8% of all Internet traffic;[2] its video cloud services, such as AWS Elemental MediaLive, process, package, and securely distribute video content for numerous global companies;[3] and it sells directly to consumers tablets, streaming devices, TVs, and other hardware for viewing the latest video content.[4]

9. VideoLabs has reached out to Amazon multiple times over many months to alert it to its use of VideoLabs' patented technology and offer Amazon the benefit of VideoLabs' platform. But VideoLabs has received no real response. Rather than meaningfully engage with

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[2] *See* Ex. 2, AWS Events, AWS re:Invent 2019: How Prime Video processes 8 percent of all US internet traffic on AWS (ANT348), YOUTUBE (Dec. 3, 2019), https://www.youtube.com/watch?v=V4QDq-OFojQ.

[3] *See* Ex. 3, AWS Elemental MediaLive, https://aws.amazon.com/medialive/?nc2=h_ql_prod_ms_eml (last visited Jan. 20, 2022).

[4] *See, e.g.*, Ex. 4, Todd Spangler, *Amazon Says It Has Sold More Than 150 Million Fire TV Devices, Announces Ford, BMW, and Stellantis Pacts for In-car Streaming*, VARIETY (Jan. 5, 2022), https://variety.com/2022/digital/news/amazon-fire-tv-150-million-sold-1235147080/ (last visited Jan. 20, 2022); Ex. 5, Malcolm Owen, *Apple's iPad Still Leading Global Tablet Market Despite Amazon Surge*, AI (Nov. 6, 2019), https://appleinsider.com/articles/19/11/06/apples-ipad-still-leading-global-tablet-market-despite-amazon-surge (last visited Jan. 20, 2022).

VideoLabs, Amazon has chosen to continue to free-ride on VideoLabs' patents and the significant innovations they represent.

10. Amazon's refusal to acknowledge VideoLabs' patents and offer fair compensation for their use violates the patent laws and undermines the viability of VideoLabs' platform. VideoLabs feels it has no recourse but to file this action to stop Amazon's unauthorized use of VideoLabs' patents.

11. This case is ultimately about ensuring the integrity of the patent system and compensating patent owners for their protected innovations. Respect for intellectual property, as the law requires, is essential to incentivize innovation and promote technological progress. Accordingly, VideoLabs brings this action under the patent laws, 35 U.S.C. § 1 *et seq.*, in order to stop Amazon's willful infringement of U.S. Patent Nos. 7,769,238; 8,139,878; 7,970,059; 8,605,794; 7,266,682; 6,880,156; and 7,440,559 (collectively, "patents-in-suit").

THE PARTIES

12. VL was founded in 2018 as part of an industry-sponsored and -funded effort to reduce the cost and risk of technological gridlock associated with diverse patent ownership. VL's leadership has decades of experience in intellectual property licensing, during which they have completed over 1,000 intellectual property transactions worldwide and drawn more than $6 billion in revenue.

13. VL is a corporation organized under the laws of the State of Delaware, with its principal place of business in Palo Alto, California.

14. VL IP was founded in 2019 as a subsidiary of VideoLabs, Inc.

15. VL IP is a corporation organized under the laws of the State of Delaware, with its principal place of business in Palo Alto, California.

16. Amazon.com is a publicly traded corporation organized and existing under the laws of the State of Delaware and is registered to do business in the State of Texas. Amazon.com's headquarters are located at 410 Terry Avenue North, Seattle, Washington 98109. Amazon.com maintains regular and established places of business throughout this District, including at 11501 Alterra Parkway, Austin, Texas 78758 and 11601 Alterra Parkway, Austin, Texas 78758.

17. AWS is a corporation organized and existing under the laws of the State of Delaware and is registered to do business in the State of Texas. Upon information and belief, AWS has its principal place of business at 410 Terry Avenue North, Seattle, Washington 98109. AWS maintains regular and established places of business throughout this District, including at 11501 Alterra Parkway, Austin, Texas 78758 and 11601 Alterra Parkway, Austin, Texas 78758.

18. On information and belief, AWS is a subsidiary of Amazon.com, and the two companies are heavily intertwined, including with respect to the products accused herein of infringing VideoLabs' patents. "Internally, the [AWS] division is Amazon's cash cow, making up 59% of the company's $22.9 billion profit . . . . AWS infrastructure also supports Amazon logistics . . . not to mention nearly all of Amazon's other operations."[5] AWS is "a development platform for technical innovations that run through Amazon's operations" and is how Amazon.com "exports innovations it develops in commerce operations to outside consumers of cloud computing."[6] As

[5] *See* Ex. 6, Katherine Anne Long, *In the 15 Years Since its Launch, Amazon Web Services Transformed How Companies Do Business*, SEATTLE TIMES (Mar. 13, 2021), https://www.seattletimes.com/business/amazon/in-the-15-years-since-its-launch-amazon-web-services-has-transformed-how-companies-do-business/ (last visited Jan. 20, 2022).

[6] *See* Ex. 7, Tiernan Ray, *Why Amazon Should Issue a Tracking Stock for Its Cloud Division*, THESTREET (Jan. 3, 2019), https://www.thestreet.com/investing/amazon-should-issue-tracking-stock-for-aws-14822389 (last visited Jan. 20, 2022).

just one example, according to Amazon, "Amazon Prime Video uses the Amazon Web Service (AWS) Cloud as the underlying technology for all its services."[7]

JURISDICTION AND VENUE

19. This is an action for patent infringement arising under the patent laws of the United States. This Court has jurisdiction over the subject matter of this action under 28 U.S.C. §§ 1331 and 1338(a).

20. This Court has personal jurisdiction over Amazon because it conducts business in and has committed acts of patent infringement in this District and throughout the State of Texas, and has established minimum contacts with this forum state such that the exercise of jurisdiction over Amazon would not offend traditional notions of fair play and substantial justice.

21. Amazon advertises that it has invested over $29 billion in Texas since 2010, including building infrastructure in Texas and compensating employees in Texas. Amazon has hired over 70,000 employees in Texas. Amazon credits its investments with adding over 112,000 indirect jobs in Texas and over $34 billion to Texas's GDP. Amazon's investments in Texas include 36 Fulfillment Centers, 25 Delivery Stations, 3 "Tech Hub" offices, 36 Whole Foods Market locations, 2 Amazon Books retail stores, 5 Prime Now Fulfillment Centers, and 1 wind farm.[8]

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[7] *See* Ex. 8, *Amazon Prime Video Uses AWS to Deliver Solid Streaming Experience to More Than 18 Million Football Fans*, AWS, https://aws.amazon.com/solutions/case-studies/amazon-prime-video/ (last visited Jan. 20, 2022).

[8] *See* Ex. 9, *Investing in the U.S.*, AMAZON, https://www.aboutamazon.com/investing-in-the-u-s (last visited Jan. 20, 2022); *see also, e.g.,* Ex. 10, *Amazon Announces Plans to Create 2,000 New Jobs at Austin Tech Hub*, AMAZON (Dec. 21, 2021), https://press.aboutamazon.com/news-releases/news-release-details/amazon-announces-plans-create-2000-new-jobs-austin-tech-hub (last visited Jan. 20, 2022) (Amazon press release); Ex. 11, *Amazon Expands Austin Tech Hub and Announces Plans to Create 800 New Tech Jobs*, BUSINESSWIRE (Mar. 28, 2019), https://www.businesswire.com/news/home/20190328005489/en/ (last visited Jan. 20, 2022) (Amazon company statement).

22. Upon information and belief, Amazon, directly and/or through subsidiaries or intermediaries, transacts substantial business with entities and individuals in the State of Texas and this District by, among other things, designing, using, offering to sell, distributing, and selling products that infringe the patents-in-suit, as well as by providing service and support to customers of infringing products in this District, and/or inducing others to commit acts of patent infringement in this District.

23. Venue is proper in this District pursuant to 28 U.S.C. §§ 1391 and 1400 because Amazon has committed acts of infringement in this District and has regular and established places of business in this District, including offices at 11501 Alterra Parkway, Austin, Texas 78758 and 11601 Alterra Parkway, Austin, Texas 78758. Amazon proudly advertises that it is "Committed to Austin."[9] Amazon has hired over 3,000 tech and corporate employees in this District[10] and continues to routinely hire software engineers in this District.[11] Amazon recently leased an additional 330,000 square feet of office space in Austin and announced plans to hire an additional 2,000 tech and corporate employees at its Austin offices.[12]

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[9] *See* Ex. 10, *Amazon Announces Plans to Create 2,000 New Jobs at Austin Tech Hub*, AMAZON (Dec. 21, 2021), https://press.aboutamazon.com/news-releases/news-release-details/amazon-announces-plans-create-2000-new-jobs-austin-tech-hub (last visited Jan. 20, 2022) (Amazon press release).

[10] *Id.*

[11] *See* Ex. 12, Jobs in Austin, TX, AMAZONJOBS, https://www.amazon.jobs/en/search?offset=0&result_limit=10&sort=relevant&category%5B%5D=software-development&distanceType=Mi&radius=24km&latitude=30.26759&longitude=-97.74299&loc_group_id=&loc_query=Austin%2C%20TX%2C%20United%20States&base_query=&city=Austin&country=USA&region=Texas&county=Travis&query_options=& (last visited Jan. 20, 2022).

[12] *See* Ex. 10, *Amazon Announces Plans to Create 2,000 New Jobs at Austin Tech Hub*, AMAZON (Dec. 21, 2021), https://press.aboutamazon.com/news-releases/news-release-details/amazon-announces-plans-create-2000-new-jobs-austin-tech-hub (last visited Jan. 20, 2021) (Amazon press release).

24. Amazon operates Fulfillment Centers in this District, including at, at least, 2093-2209 Rutland Drive, Austin, Texas 78758 and 2000 Exchange Parkway, Waco, Texas 76712. Amazon's Waco Fulfillment Center has received tax breaks from the City and McLennan County[13] and will employ over 1,000 people.[14] Amazon operates a retail store in this District at 11700 Rock Rose Avenue, Austin, Texas 78758.[15] Amazon owns additional property in this District, including at least 2000 E Pecan St., Pflugerville, Texas 78660[16] and 2010 Campus Dr., Waco, Texas 76705.[17]

25. Furthermore, upon information and belief, Amazon designs, uses, distributes, sells, and/or offers for sale the accused products to consumers and businesses in this District.

26. Upon information and belief, Amazon Web Services (AWS) has customers in this District, and in its AWS Standard Customer Agreement § 9 agrees to "defend . . . against any third-party claim alleging that Services infringe or misappropriate that third party's intellectual property rights,"[18] including those in this District.

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[13] *See* Ex. 13, Mike Copeland, *Amazon Gets $9.5 Million from Waco, County in Tax Breaks*, WACO TRIBUNE-HERALD (Feb. 16, 2021), https://wacotrib.com/news/local/amazon-gets-9-5m-from-waco-county-intax-breaks-over-20-years/article_730bc48e-7094-11eb-bcd1-eb93141c16b0.html (last visited Jan. 20, 2022).

[14] *See* Ex. 14, Bary Roy, *From Amazon to More Road Construction, Big Things on Horizon for Waco*, KCENTV (May 24, 2021), https://www.kcentv.com/article/news/local/mclennan-county/amazon-road-construction-big-things-waco/500-ed205591-83d2-4d4d-a4fe-9e821a1dea36 (last visited Jan. 20, 2022).

[15] *See* Ex. 15, Travis Central Appraisal District, https://stage.travis.prodigycad.com/property-detail/899854/2022 (last visited Jan. 20, 2022).

[16] *See* Ex. 16, Travis Central Appraisal District, https://stage.travis.prodigycad.com/property-detail/937090/2022 (last visited Jan. 20, 2022).

[17] *See* Ex. 17, McLennan CAD Property Search, https://propaccess.trueautomation.com/clientdb/Property.aspx?cid=20&prop_id=381979 (last visited Jan. 20, 2022).

[18] *See* Ex. 18, AWS Customer Agreement, https://aws.amazon.com/agreement/ (last visited Jan. 20, 2022).

27. Upon information and belief, people from this District have knowledge, information, documents, and things relevant to this action and are potential witnesses to this action, including as to Amazon's infringing activities and VideoLabs' damages. For instance, Amazon employs software engineers who work with Amazon's infringing devices, including at least the Fire TV, in this District.[19] Amazon employs AWS engineers in this District.[20] There are WebRTC engineers located in this District who may have expertise relevant to the '682 patent.[21] Hewlett-Packard, the original assignee of the '156 Patent, has a substantial presence in Texas and may have information, documents, and things relevant to Amazon's infringement of the '156 Patent.

28. Litigating in this District is convenient and will yield efficiencies because of related pending lawsuits in this District.[22]

29. The facts alleged in this First Amended Complaint further support the propriety of venue in this case.

THE VIDEOLABS PATENTS-IN-SUIT

A. U.S. Patent Nos. 8,139,878, 7,769,238, and 7,970,059

30. U.S. Patent No. 8,139,878 (the "'878 Patent"), titled "Picture Coding Method and

[19] *See* Ex. 19, *Find Jobs in Austin, TX*, AMAZONJOBS, https://www.amazon.jobs/en/locations/austin?offset=0&result_limit=10&sort=relevant&cities%5B%5D=Austin%2C%20Texas%2C%20USA&business_category%5B%5D=amazon-devices&distanceType=Mi&radius=24km&latitude=&longitude=&loc_group_id=&loc_query=&base_query=&city=&country=&region=&county=&query_options=& (last visited Jan. 20, 2022).

[20] *See* Ex. 20, *Amazon Web Services Jobs*, LINKEDIN, https://www.linkedin.com/jobs/amazon-web-services-aws-jobs-austin-texas-metropolitan-area?currentJobId=2657974180&position=8&pageNum=0 (last visited Jan. 20, 2022).

[21] *See* Ex. 21, *WebRTC Jobs in Austin, TX*, ZIPRECRUITER, https://www.ziprecruiter.com/Jobs/Webrtc/-in-Austin,TX (last visited Jan. 13, 2022).

[22] *See VideoLabs, Inc. v. Dell Tech., Inc.*, 6-21-cv-00456 (W.D. Tex. filed May 3, 2021) and *VideoLabs, Inc. v. Dell Tech., Inc.,* 6-21-cv-00932 (W.D. Tex. filed September 10, 2021).

Picture Decoding Method," issued on March 20, 2012. VL owns all rights and title to the '878 Patent, as necessary to bring this action. A true and correct copy of the '878 Patent is attached as Exhibit 22.

31. U.S. Patent No. 7,769,238 (the "'238 Patent"), titled "Picture Coding Method and Picture Decoding Method," issued on August 3, 2010. VL owns all rights and title to the '238 Patent, as necessary to bring this action. A true and correct copy of the '238 Patent is attached as Exhibit 23.

32. U.S. Patent No. 7,970,059 (the "'059 Patent"), titled "Variable Length Coding Method and Variable Length Decoding Method," issued on June 28, 2011. VL owns all rights and title to the '059 Patent, as necessary to bring this action. A true and correct copy of the '059 Patent is attached as Exhibit 24.

33. The '878, '238, and '059 Patents (collectively, the "Coding Patents") were developed by engineers at Panasonic, one of the largest consumer electronics companies at the time of the invention and a major innovator in Internet technologies. In 2002, when patent applications were first filed for the Coding Patents, Panasonic was a world leader in digital video technologies.[23] Panasonic developed video coding technologies and designed consumer electronics — including TVs, DVD players, and memory cards — for storing, processing, and displaying video content.[24]

34. Native video content is massive. Modern digital video cameras used by premier television and movie studios capture images at incredibly fast rates (ranging from 30 frames per

[23] *See* Ex. 25, *Annual Report 2002*, National/Panasonic Matsuhita Electric, available at https://www.annualreportowl.com/Panasonic/2002/Annual%20Report (last accessed Jan. 20, 2022).

[24] *See id.*

second up to 300 frames per second) and extremely high resolutions (up to "5k," or 5120 x 2880, for a total size of 14,745,600 pixels per frame). Storing just an hour of this raw content requires more than 300 GB of memory.[25] Most modern TVs, laptops, tablets, and smartphones cannot possibly store and play such large files.

35. Even if they could, there would be little point from the perspective of on-demand content delivery: Internet speeds are far too slow to stream such massive video files. The fact is that transmitting high quality audiovisual content is simply not possible without powerful compression technologies. Streaming even just standard high-definition content (720p) requires network bandwidth of approximately 1.5 Gbps,[26] which is about 35 times faster than the average Internet speed in the United States.[27] "Encoding" and "decoding," which respectively refer to the processes of compressing and decompressing content, are thus essential to applications such as video streaming, digital television, and videoconferencing.

36. Encoding video content allows the content to be made small for storage and transmission, while decoding permits the viewer to watch high-quality content on his or her device. In addition to making real-time streaming of content possible, every incremental increase in compression efficiency yields substantial benefits to companies that store, process, transmit, or access video. For example, if a video streaming company can cut the size of each of its movie files in half, then it reasons that it only needs half the numbers of servers to store its movies, half

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[25] *See* Ex. 26, *How Many GB Is a 2 Hour 4k Movie?*, https://gamingsection.net/news/how-many-gb-is-a-2-hour-4k-movie/ (last visited Jan. 20, 2022).

[26] *See* Ex. 27, Bryan Samis, *Back to Basics: GOPs Explained*, AWS MEDIA BLOG (May 28, 2020), https://aws.amazon.com/blogs/media/part-1-back-to-basics-gops-explained/ (last visited Jan. 20, 2022).

[27] *See* Ex. 28, *Average U.S. Internet Speed is 42.86 Mbps*, ETI (Feb. 2, 2021), https://etisoftware.com/resources/blog/report-average-u-s-internet-speed-is-42-86-mbps/ (last visited Jan. 20, 2022).

the network bandwidth to transmit its movies, and half of all other related expenses, such as energy costs and staffing resources.

37. The Coding Patents describe breakthrough techniques for encoding and decoding audiovisual content so that it can be transmitted and stored with fewer resources. The patents vastly improve upon existing methods, and the core technology they describe has been used throughout the industry for years as the gold standard for coding content.

1. Background On Coding Technology

38. Video "coding" refers to both the encoding and decoding of video content. Video compression techniques minimize the size of the data that is sent between the encoder and the decoder by removing redundancies and imperceivable changes and then efficiently representing the remaining data for transmission.

39. Video is comprised of a series of frames. These frames are successively output to create the moving pictures that we recognize as video.

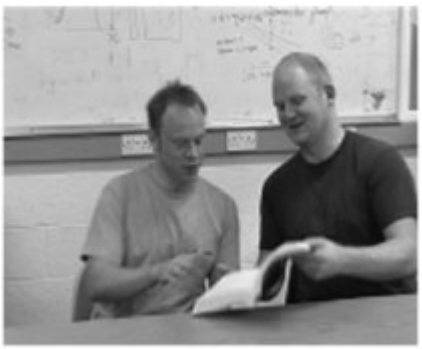

Figure 3.10 Frame 1

Figure 3.11 Frame 2

Ex. 29, Iain E. Richardson, *The H.264 Advanced Video Compression Standard* (2d. ed. 2010) (hereinafter "Richardson"), at 33.

40. In the early 2000s, certain techniques existed to reduce the amount of data needed to describe each frame without any loss in picture quality. For example, if there are a series of 50 white pixels in a row followed by 75 green pixels, then it is more efficient to store the fact that

there are 50 white pixels followed by 75 green pixels than to store the value of all 125 pixels. This algorithm, which reduces the redundancy stemming from repeating pixels within a frame, yielded substantial benefits.

41. Video engineers also realized that, very often, not much changes between successive frames. In the images shown above, for example, the changes between frames 1 and 2 are largely concentrated in the area near the book. As a result, it is not necessary to send the complete data for every frame of a video. Instead, frames can be sent periodically at strategic points, such as when there is a scene change that creates major differences between successive frames. Those strategic frames — called "key frames" — could be used to "predict" other frames nearby in time by analyzing each frame and storing the differences from one frame to the next.

42. Further research yielded additional advances in what became known as predictive coding. Video engineers realized that it was advantageous to divide each frame into blocks, as shown below.

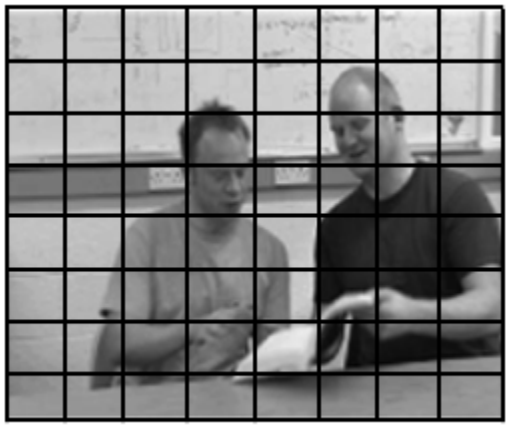

Figure 3.10 Frame 1

43. These blocks could be analyzed and used to predict the pixels in the same block in *surrounding* frames ("*inter*-picture prediction," also called "temporal compression"). Additionally, these blocks could be analyzed to predict the pixels in surrounding blocks in the

same frame ("*intra*-picture prediction," also called "spatial compression"). While predictive coding does not always recreate frames that are identical to the original frames, the differences are so minor as to be imperceptible. For example, in the middle of an intense action sequence, a frame might display a pixel as blue even though it should be green because doing so enables the image to be represented more efficiently. This minor alteration from the original content will go unnoticed by the viewer, who is distracted by all the other activity.

44. Once redundancy in the video content has been minimized and imperceptible details have been streamlined, a process called "entropy encoding" further compresses the data by using as few bits to represent the data as possible, while still ensuring fidelity to the original visual content. This is achieved by allocating the fewest bits to commonly appearing bit sequences, and the most bits to infrequently occurring bit sequences. By way of analogy, when training your dog, the commands you use most frequently are likely the shortest, single-word commands, like "sit" and "no." But commands that you need less frequently may be longer, such as "wait for it" and "roll over." In this way, over the course of a week, you expend fewer (verbal) resources. Entropy encoding applies this same principle to the bits of data that comprise video content.

45. There are standardized ways to represent sequences of bits, and depending on the type of entropy coding, these sequences are stored in either "coding tables" or "probability tables." Entropy coding involves selecting the optimal table for the data being transmitted and ensuring that the decoder knows the proper table to use when decoding the data.

46. It was in this context that the inventors of the Coding Patents made their contributions.

2. The '878 and '238 Patents

47. The '878 and '238 Patents are directed to a type of coding called "Context-based Adaptive Variable Length Coding," or "CAVLC." *See, e.g.*, Ex. 22, '878 Patent at col. 1, ll. 49-

52.[28] The patents share the same specification and describe the same advances in coding technology but claim different aspects of the inventions. In particular, the claims of the '878 patent are directed to *encoding* audio and video content for transmission, while the claims of the '238 patent are directed to *decoding* the encoded content for playback.

48. When encoded, the image data in a particular image block is represented by, among other things, its "coefficients." *Id*. at col. 1, ll. 63-67; col. 7, ll. 38-43; col. 21, ll. 60-66; col. 25, ll. 29-36. Roughly speaking, larger coefficients for a block indicate a larger amount of changes in that block as compared with a reference block. *See id.* For many blocks, there are no such changes, and so all the coefficients have a value of zero. *See id. a*t col. 21, ll. 60-66. The inventors of the '878 and '238 Patents recognized that these "zero-coefficient" blocks presented an opportunity for further compression. *See*, *e.g.*, *id.* at col. 1, ll. 49-52.

49. They realized that the decoder did not need to know every single time a zero-coefficient block existed; rather, the decoder needs to know only when blocks have *non-zero* coefficients. They devised a technique wherein data about zero-coefficient blocks are effectively not encoded at all, and only non-zero coefficient block data is stored and transmitted. *See*, *e.g.*, *id.* at col. 1, ll.49-52, 56-62; col. 1, l. 65 – col. 2, l. 10. The inventors thereby achieved nearly perfect compression for these zero-coefficient blocks by communicating them practically without sending any information whatsoever. *See id.* at col. 2, ll.11-14.

50. The inventors also made a substantial contribution to the efficiency of entropy coding. They recognized that the coefficients in neighboring blocks were a good predictor of the coefficients in the block being analyzed, and so could be used to select the optimal coding table

[28] The '878 Patent and the '238 Patent share a specification. Accordingly, citations to the '878 Patent specification apply equally to the '238 Patent and vice versa; for simplicity, citations in the present section will be to the '878 Patent, but apply equally to the '238 Patent.

for the block, yielding enhanced compression. *See, e.g.*, *id.* at col. 9, ll. 34-37; col. 13, ll. 4-11. Prior techniques lacked this level of sophistication. They did not take advantage of the predictive power provided by analyzing the coefficients of the surrounding blocks. They would also use the same coding table for both inter- and intra-predictive coding, which was inefficient because there could be significant differences between neighboring blocks in the current frame and blocks in subsequent frames. *See, e.g.*, *id.* at col. 1, ll. 33-38. Due to these limitations in the use of coding tables, compression efficiency in previously known entropy coding techniques would vary significantly between different types of content, and generally decreased as the quality of content increased. *Id.* at col. 1, ll.39-44. These problems (and others) were overcome by the inventors of the '878 and '238 Patents.

3. The '059 Patent

51. Similar to the '878 and '238 Patents, the '059 Patent describes an advance in video compression that involves the novel use of tables. The '059 Patent, however, uses a kind of entropy coding referred to as "Context Adaptive Binary Arithmetic Coding," or "CABAC," that relies on probability tables. *See* Ex. 24, '059 Patent at col. 1, ll. 37-42.

52. CABAC achieves strong compression performance using arithmetic coding — a sophisticated approach to flexibly pack a string of numbers based on the probability that each next number will be a particular value. *See, e.g.*, *id.* at col. 1, ll.11-14, 37-42. CABAC can optimize and adapt its selection of probability estimates for image data based on the context of the data. *See id.* at col. 2, ll. 33-51. CABAC uses "binary coding," which means that information can be represented only by a "0" or a "1." *See, e.g., id.* at col. 1, ll. 37-42. Once the data is binarized, it is arithmetically coded. *Id.* Arithmetic coding uses predefined probability tables to compress the data into its final bit stream before transmission. *See, e.g., id.* at col. 1, l. 60 – col. 2, l. 2. Probability tables are known to both the encoder and the decoder and referenced by a number (e.g.,

probability table #2). *See, e.g.*, *id.* at col. 6, ll.13-14.

53. Multiple probability tables are available when encoding content, and probability table selection is based on analyzing the data being arithmetically coded and the previously coded data. *See, e.g.*, *id. a*t col. 1, ll. 57-59; Fig. 2. The inventors of the '059 Patent recognized that it was advantageous to choose the probability table based on the current probability table and the absolute value of the data being coded. *See, e.g., id.* at col. 2, l. 52 – col. 3, l. 11. Further, a particular sequence of probability tables was determined in advance (e.g., probability table #2, #4, #3, #1), and the encoder (and thus the decoder) always proceed through the tables in that order, never reversing and stopping once the final table is reached. *See, e.g., id.* at col. 2, ll. 48-51. The inventors realized that following this approach takes advantage of the natural ordering of data and the context surrounding it. *See id.* at col. 2, ll. 52-56. The tables are adjusted to respond to the previous and current data being encoded, but importantly, there are limits on how and when the probability table can change. *See id.* at col. 3, ll. 3-7. This adaptation, which gives higher priority to more recent observations, increases the efficiency of the coding. *See id.* at col. 3, ll. 7-11.

54. The innovations of all three Coding Patents provided a significant advance in compression that was recognized throughout the industry. In fact, the compression techniques of the Coding Patents are used in the ubiquitous video codec, H.264. H.264 was revolutionary in the video industry, as it provided a quantum leap of improvement over the video codecs that had previously been commonly used, such as Motion JPEG video and MPEG-2. In particular, H.264 "has an 80% lower bitrate than Motion JPEG video" and "the bitrate savings can be as much as 50% or more compared to MPEG-2."[29]

[29] *See* Ex. 30, *What is H264 Encoding?*, BlackBox, https://www.blackbox.co.uk/gb-gb/page/38313/Resources/Technical-Resources/Black-Box-Explains/Multimedia/What-is-H264-video-encoding/ (last visited Jan. 20, 2022).

B. U.S. Patent No. 8,605,794

55. U.S. Patent No. 8,605,794 (the "'794 Patent"), titled "Method for Synchronizing Content-Dependent Data Segments of Files," issued on December 10, 2013. VL IP owns all rights and title to the '794 Patent, as necessary to bring this action. A true and correct copy of the '794 Patent is attached as Exhibit 31.

56. The original assignee of the '794 Patent is Siemens Aktiengesellschaft ("Siemens"), one of the largest consumer electronics companies at the time of the invention and a major innovator in Internet technologies. In 2005 alone, the year in which Siemens first filed for patent protection for the inventions of the '794 Patent, Siemens invested €5.2 billion in research and development.[30]

57. In the early 2000s, the inventors realized that the way that audiovisual content (e.g., television shows and movies) was transmitted to consumers was fundamentally changing. While content could be stored and accessed from media such as VHS tapes and DVDs, content was *transmitted* to consumers primarily through televisions — and had been for decades. Moreover, within each global region (e.g., the United States or Europe), all television content was encoded in a single formatting standard (e.g., the PAL standard in Europe and the NTSC standard in the United States) that could be played by all televisions. *See, e.g.*, Ex. 31, '794 Patent, col. 1, ll. 23-33.

58. But with the increasing importance of the Internet, the types of devices to which content could be transmitted was proliferating. *See, e.g.*, *id.* at col. 1, ll. 34-43. Content was now being streamed to computers, laptops, PDAs, and other electronic devices. Unlike televisions, which were all designed to play content formatted in the same way, these new devices could play

[30] Ex. 32, https://www.siemens.com/investor/pool/en/investor_relations/downloadcenter/e05_00_gb2005_1336469.pdf (last accessed Jan. 20, 2022).

content encoded in any number of formats based on their capabilities. For example, a PDA, with its limited screen resolution and processing capabilities, could not process the higher quality content intended for high-resolution monitors connected to desktop computers. Additionally, a computer running a Windows operating system could play different content formats than an Apple computer.

59. The varying strength of Internet connections, particularly on wireless devices, also necessitated multiple content formats. For example, while a desktop computer might be capable of playing high resolution content, doing so is not desirable if the Internet connection for that computer is slow. Instead, it can be a better viewer experience for a lower quality version of the content to be transmitted more quickly rather than having the user constantly waiting for higher quality content to download. Content delivery companies further realized that it would be beneficial to be able to change the quality of content *during a stream*. That is, when an Internet connection is weak, send lower quality content; when the connection is strong, send higher quality content. Thus, not only were different content formats necessitated by different device capabilities — even for the same device and during a single stream, it was advantageous to be able to vary the quality of the transmitted content.

60. Consumer expectations for the delivery of content also began to change. Whereas consumers could previously only watch whatever was "on TV," consumers increasingly began to expect to watch whatever they wanted whenever they wanted, i.e., "on demand." Consumers expected content to start playing at the click of a mouse, and to be able to jump to any point in the content and have playback resume immediately.

61. These changes in technology and consumer expectations led to new techniques for managing and processing audiovisual content. Content was no longer stored as a single file in a

single location. Instead, for example, a movie's audio and video data was broken up into numerous "segments" that might be stored on various Internet servers. These segments could be more easily transmitted over the Internet to consumer devices, and content could be played as soon as the first few segments were received instead of waiting until the entire file had been downloaded.

62. Prior to the innovations of the '794 Patent, however, there was not a suitable method for aligning the various audio and video segments that comprised a piece of content. The need was all the greater when switching between content formats midstream (e.g., to account for changing Internet bandwidth) or skipping to different points within a piece of content.

63. Known techniques at the time would align the segments for playback using timestamp information stored in each segment. Essentially, each segment includes metadata indicating when in the timeline of the content the segment should be played (e.g., audio content from 5 minutes and 30 seconds of the movie to 6 minutes and 30 seconds of the movie). Once a segment was downloaded, this information would have to be read out (which could require decoding the segment), and then additional processing would be needed to order this segment with the other segments. This technique was rooted in the nature of the old technologies, in which viewers received content in the order it was to be played, did not alternate in real time between different versions of the same content, and could not selectively play different parts of the content. Disadvantageously, this technique had a large overhead, and so could be slow and resource intensive. *See, e.g.*, *id.* at col. 2, ll. 4-12, 36-54.

64. The '794 Patent improves upon these timestamp-based implementations. It describes a novel technique in which segments are ordered chronologically and aligned with corresponding segments (e.g., aligning a video segment with the correct audio segment) using predefined assignment rules. *See id.*, col. 2, ll. 36-42; col. 5, ll. 10-13. These assignment rules are

not based on timestamps. *See id.*, col. 2, ll. 42-43. Instead, they flexibly permit the alignment of segments using rules appropriate for different contexts. This could include implementations in which, for example, each sequential video segment is aligned with every fourth audio segment. *See id.*, col. 2, ll. 55-60; col. 5, ln. 35 – col. 6, ln. 42. Alternatively, the assignment rules could be used to build pseudo-timelines that order and match audio and video segments based on the context of the content. *See id.*, col. 6, ll. 50-60. For example, key audio and video segments will align at the start of new scenes, changes in camera viewpoint, or the start of a song. The assignment rules of the '794 Patent require little overhead and are thus significantly faster than timestamp-based techniques while also providing more options in the management of segments. *See, e.g.*, *id.* at col. 2, ll. 4-12, 36-54. This flexibility enables, for example, a user to jump to a key scene in a movie, and the corresponding segments to quickly be located, downloaded, and played. *See id.* at col. 3, ll. 20-28. This is because the context of content can be mapped to a particular segment, and then assignment rules can be used to quickly identify the corresponding and subsequent segments.

65. Today, online video streaming is ubiquitous, and the ability to alter the format of content mid-stream has been standardized and is known as "adaptive bitrate streaming." There are two main protocols for this type of delivery: HTTP Live Streaming ("HLS") and Dynamic Adaptive Streaming over HTTP ("DASH"). These protocols are used to stream the vast majority of online video. They are used by major streaming services (e.g., Disney+, Hulu), including Amazon Prime Video.

66. The '794 Patent is a core building block to these technologies, which has been recognized by the video technology industry. MPEG LA, which pioneered the concept of technology-specific patent pools and has created and maintained patent pools that efficiently

license key technologies worldwide, launched a patent pool for DASH in November 2016.[31] The '794 Patent was submitted for inclusion into MPEG LA's DASH patent pool, evaluated by MPEG LA's patent experts, and declared as essential to using DASH to stream content. Indeed, the '794 patent is one of just 10 U.S. patents that have been deemed essential to DASH, and its importance to the streaming technology and foundational nature is evidenced by the fact that it has the earliest invention date of all patents in the pool. Numerous companies have taken a license to the '794 patent to obtain the right to use its technology to implement DASH.[32]

C. U.S. Patent No. 7,266,682

67. U.S. Patent No. 7,266,682 (the "'682 Patent"), titled "Method and System for Transmitting Data from a Transmitter to a Receiver and Transmitter and Receiver Therefore," issued on September 4, 2007. VL IP owns all rights and title to the '682 Patent, as necessary to bring this action. A true and correct copy of the '682 Patent is attached as Exhibit 35.

68. The original assignee of the '682 Patent was Siemens, one of the largest consumer electronics companies at the time of the invention and a major innovator in Internet technologies, including those related transmitting audio and video. In 2001 alone, Siemens spent €6.6 billion in research and development.[33] At that time, Siemens recognized the importance of growing Internet technologies, and that security would be essential to communicating and transmitting content over the Internet.[34]

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[31] Ex. 33, *MPEG LA Releases MPEG-DASH Patent Portfolio License*, MPEG LA (Nov. 17, 2016), https://www.mpegla.com/media/ (last visited Jan. 20, 2022).

[32] Ex. 34, *DASH Licensees*, MPEG-LA, https://www.mpegla.com/programs/dash/licensees/ (last visited Jan. 20, 2022).

[33] *See* Ex. 36, *Siemens Annual Report 2001*, available at https://web.lib.aalto.fi/fi/old/yrityspalvelin/pdf/2001/Esiemens.pdf (last accessed Jan. 20, 2022).

[34] *See id.*

69. It used to be very difficult to transmit real-time data (such as audio and video) over the Internet. In the mid-1990s the Real Time Transport Protocol (or RTP) was developed to handle such real-time Internet traffic in a standard way. RTP was developed by the Audio-Video Transport Working Group of the Internet Engineering Task Force (IETF) and first published in 1996 as RFC 1889.

70. RTP is designed for end-to-end, real-time transfer of streaming media. Indeed, RTP is regarded as the primary standard for audio/video transport in IP networks and is used with an associated profile and payload format. Today, RTP is used in communication and entertainment systems that involve streaming media, such as telephony, video teleconference applications including WebRTC, television services, and web-based push-to-talk features. The design of RTP is based on the architectural principle known as application-layer framing, where protocol functions are implemented in the application as opposed to the operating system's protocol stack.

71. However, typical RTP messaging was not very secure. The transmission networks carrying RTP payload packets were susceptible to security flaws at the transmitter, during transmission, and at the receiver. *See* '682 Patent, col. 2, ln. 44 – col. 3, ln. 10. For example, an attacker could hide his/her attack within data during its transmission, and the receiver would — as a matter of course — decode it. *See id.* at col. 3, ll. 1-10. As another example, an attacker could interfere with the data transmission and read the data for itself. *See id.* at col. 2, ll. 47-54.

72. Ultimately, a security and authentication layer was introduced into RTP, known as Secure Real-Time Transport Protocol (SRTP), intended to provide encryption, message authentication and integrity, and replay attack protection to the RTP data. SRTP was published

by the IETF in March 2004 as RFC 3711.[35]

73. Yet, years before the formalization and publication of SRTP, Siemens had already recognized, and solved, the RTP security problems. The '682 Patent prevents the security flaws by ensuring, at the receiver, that data being transmitted is not insecure or unwanted. *See* Ex. 35, '682 Patent, col. 3, ll. 45-48. Specifically, the transmitter is used to insert authentication data into the data packets before the data is transmitted. *See id.* at col. 3, ll. 49-52, col. 7, ll. 6-10. The authentication data is then transmitted together with the data packet and analyzed by the receiver to ensure that the transmitter and the receiver know each other. *See id.* at Fig. 3, col. 3, ll. 52-54, col. 5, ll. 32-36, col. 7, ll. 10-17. If the receiver knows the transmitter, the data is processed; if not, the data is rejected. *See id.* at col. 7, ll. 14-21.

74. Data transmission networks operate on a variety of levels of discreteness. Many people of skill in the art refer to the seven-layer OSI reference model to abstract the layers of functionality in these networks. *See, e.g., id.* at col. 1, ll. 19-45. The well-known OSI model breaks transmission networks into seven layers, each of which has a different functionality. *Id.* at col. 1, ll. 21-25. The lowest layer, layer 1, corresponds to the physical layer, where data and messages are transmitted from the transmitter to the receiver using a physical protocol. *Id.* at col. 1, ll.25-28. Each subsequent layer builds on the layer(s) before it, all the way up to layer 7, which corresponds to an application layer using an application protocol. *Id.* at col. 1, ll. 36-37. The '682 Patent optimizes the security of data transmission by performing authentication in the application layer. *See id.* at col. 3, ll. 60 – col. 4, ll. 10.

75. Authenticating in the application layer provides myriad benefits to the user and the

[35] *See* Ex. 37, *The Secure Real-time Transport Protocol,* IETF (Mar. 2004), https://datatracker.ietf.org/doc/html/rfc3711 (last visited Jan. 20, 2022).

network. For one, it permits reduced size of authentication data, including because it allows the transmitter and receiver to share secret information, such as a key, which can be economically used to generate message authentications. *See id.* at col. 3, ln. 60 – col. 4, ln. 10, col. 7, ll. 30-34.

76. Another benefit of the '682 Patent inventor's insight that authenticating should take place in the application layer is that it increases the transmission system's performance and reduces the implementation complexity of the system. *See* '682 Patent at col. 4, ll. 15-21. Authenticating in the application layer provides real time availability of the data. *See id.* at col. 3, ln. 60 – col. 4, ln. 10. Once the receiver determines that the transmitter is known, the message is immediately accepted. *See id.* at col. 4, ll. 3-7. If the receiver determines that the transmitter is not known, the message is immediately rejected; no buffering or loading are performed, and no further action is needed. *See id.* at col. 4, ll. 7-9.

D. U.S. Patent No. 6,880,156

77. U.S. Patent No. 6,880,156 (the "'156 Patent"), titled "Demand Responsive Method and Apparatus to Automatically Activate Spare Servers," issued on April 12, 2005. VL IP owns all rights and title to the '156 Patent, as necessary to bring this action. A true and correct copy of the '156 Patent is attached as Exhibit 38.

78. The original assignee of the '156 Patent is Hewlett-Packard Development Company, L.P. ("HP"), one of the largest consumer electronics companies at the time of the invention and a major innovator in Internet technologies. In 2000, the year when the patent application for the '156 Patent was filed, HP was the world's largest consumer technology supplier and a leader in server solutions.[36]

[36] *See* Ex. 39, *HP Annual Report 2000*, available at https://www.annualreports.com/HostedData/AnnualReportArchive/h/NYSE_HPQ_2000.pdf (last accessed Jan. 20, 2022).

79. Leading up to 2000, Internet adoption was accelerating and there was an explosion in the number of daily visitors to popular websites. This included search and email websites from AOL, Yahoo, and Google, as well as rapidly growing e-commerce websites like Amazon.com. These webpages were increasingly attracting users from not just all over the country, but all over the world. An Amazon press release dated February 2, 2000 touts that the Amazon.com website had 15.9 million unique visitors in December 1999.[37]

80. Companies of all sizes needed the requisite computer and network infrastructure to handle this growing Internet usage. Complicating matters was that website traffic was not steady. It would increase during the daytime, vary seasonally, and could also go up completely unexpectedly — a celebrity could promote a website, causing a sudden surge in popularity. *See, e.g.*, Ex. 38, '156 Patent, at col. 1, ll. 40-56. Companies would also intentionally create spikes in demand, such as by running a nationwide advertising campaign for their website. *See id.*

81. Even if the timing of these increases in demand could be foreseen, the amount of the surge was nearly impossible to predict. This was a serious problem. In 1999, Amazon had so few servers that its employees gave them recognizable names like "fishy" or "online-01."[38] If a company does not have enough infrastructure devoted to handling traffic surges, then its website can slow down, deny access to certain users, or crash entirely. The threat of a website crash was especially acute in the nascent e-commerce industry in the late 1990s, when traffic surges meant "that hardly a week [went] by without an outage at a major E-commerce site . . . like the bookseller

[37] *See* Ex. 40, Amazon.com Announces Profitability in U.S.-based Book Sales, AMAZON (Feb. 2, 2000), https://press.aboutamazon.com/news-releases/news-release-details/amazoncom-announces-profitability-us-based-book-sales-financial.

[38] *See* Ex. 41, *Challenges with Distributed Systems*, Amazon, https://aws.amazon.com/builders-library/challenges-with-distributed-systems/ (last visited Jan. 20, 2022).

Amazon.com."[39] Poor customer experiences caused by slow or broken webpages not only cause harm in the short term — eBay, for example, lost $3-5 million in revenue because of a day-long website crash in June 1999[40] — but also threaten to cripple businesses and their reputations, leading to long-term customer abandonment of websites. An industry representative in 1999 likened the daily effort of dealing with traffic surges to "preparing an aircraft carrier to go to war."[41]

82. At the time of the invention of the '156 patent, it was known to use a specialized server called a "load balancer" to mitigate the harm of sudden surges in demand. *See* Ex. 38, '156 Patent, col. 1, ll. 26-33. A load balancer serves as the traffic cop for incoming webpage requests. It receives all requests for a company's webpage and routes it to one of potentially many "server applications" to handle the request. Each server application can handle a finite number of requests for a given time period (e.g., 100 requests per second). By tracking the number of requests that each server application is handling, the load balancer can route incoming requests to the least busy server application, and thereby evenly distribute the requests and reduce the likelihood that any given server application becomes overwhelmed. *See id.*

83. While it was known to use load balancers to manage a defined fleet of server applications, effective techniques for adjusting the number of server applications within a fleet were lacking. As a result, unexpected spikes in demand would still routinely cause poor website performance. *See id.* at col. 1, ll. 40-56. New ways to prevent these issues were sorely needed.

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[39] *See* Ex. 42, Mark Richtel, *Keeping E-Commerce On Line; As Internet Traffic Surges, So Do Technical Problems*, N.Y. TIMES (June 21, 1999), https://www.nytimes.com/1999/06/21/business/keeping-e-commerce-on-line-as-internet-traffic-surges-so-do-technical-problems.html?searchResultPosition=1.

[40] *Id.*

[41] *Id.*

84. Before the '156 patent, there were two known but inadequate approaches for dealing with surges: (1) over-provisioning; and (2) manual reaction. *See id.* at col. 1, l. 57 – col. 2, l. 10. The first approach, over-provisioning, required companies to buy in advance enough server applications to handle peak website demand. *See id.* at col. 1, ll. 57-67. There were major shortcomings with this approach. It was difficult if not impossible to predict peak demand, and so server overload could not be entirely avoided. *See id.* Even if peak demand could be accurately predicted, constantly maintaining enough servers to handle peaks was prohibitively expensive. *See id.* Especially for small or medium-sized companies, paying for the computer and human infrastructure needed to handle surges that were many times the typical demand was not a viable option. If the extra demand was ultimately not needed, the company still was on the hook financially for buying the extra capacity and would not get refunded.

85. The second approach, manual reaction, required a human operator to first notice that demand was exceeding server capacity and then purchase or otherwise acquire additional server applications, install the necessary software, and add them to the fleet of servers being managed by the load balancer. *See id.* at col. 2, ll. 1-10. But this approach also had severe limitations. The significant time lag time between the surge and bringing additional capacity online meant that users would still experience slow and crashing websites. *See id.* And once additional servers had been brought into the fleet, the same problem existed — numerous server applications would sit idle. *See id.* The manual reaction approach was thus slow and expensive.

86. To address these problems, the inventors of the '156 Patent realized that computer logic would be needed to automatically and effectively determine when to bring online additional server applications. *See id.* at col. 2, ll. 13-23. This logic, referred to as an "allocator," would monitor various network metrics, including the load on server applications. *See id.* The inventors

identified several key metrics and specific scenarios in which a surge was likely occurring for an application and so additional server applications should be made available. *See id.* at col. 2, ll. 23-55; col. 3, ln. 49 – col. 4, ln. 62. For example, the allocator would monitor the number of connections per unit time against a set of heuristics, and when the ratio of the current number of connections per unit time to a particular past number of connections per unit time exceeds a threshold value, a surge condition is detected, and additional server applications are activated. *See id.* Because no human actions are needed, the additional server applications can be added in time to meet the increased demand.

87. The inventors further recognized the importance of deactivating server applications once the peak had passed, and discovered that similar metrics and computations are well-suited to the task. *See id.* Taking server applications offline post-surge enables the newly offline resources to be repurposed for use in other applications that are experiencing surges. This benefit is particularly pronounced for large companies running many webpages and online applications, as certain applications will experience peaks while others experience normal or reduced usage. *See id.* at col. 3, ll. 28-40. Since server capacity is relatively expensive, substantial cost savings are gained by efficiently managing resources using predictive analytics.

88. The '156 Patent therefore provides adaptive server capacity response, with the benefit of accommodating demand surges automatically and quickly without human intervention, while also providing more efficient allocation and use of server resources.

89. The need for handling sudden and sharp increases in demand for webpages and other online services has not declined — to the contrary, it has grown exponentially. Amazon.com

had over 2.4 *billion* unique visitors in June 2021.[42] The need to effectively scale network resources to handle massive, unexpected inflows of Internet requests is particularly acute in the video space. As just one example, during its live streaming of a National Football League game on December 26, 2020, Amazon Prime was simultaneously transmitting to an average of 4.8 million viewers.[43] This meant that Amazon's server infrastructure needed to be running video streaming applications that spiked from zero connections (shortly before the game started), to an average of 4.8 million connections (during the game), and then back down to zero (once the broadcast had concluded). The claimed inventions of the '156 Patent enable this automatic and efficient adjusting of server application resources.

E. U.S. Patent No. 7,440,559

90. U.S. Patent No. 7,440,559 (the "'559 Patent"), titled "System and Associated Terminal, Method and Computer Program Product for Controlling the Flow of Content," issued on October 21, 2008. VL IP owns all rights and title to the '559 Patent, as necessary to bring this action. A true and correct copy of the '559 Patent is attached as Exhibit 45.

91. The original assignee of the '559 Patent is Nokia Corporation, one of the largest consumer electronics and information technology companies in the world at the time of the invention and a major innovator of digital communications technologies. In 2003, the year in which Nokia first filed for patent protection for the innovations of the '559 Patent, Nokia was a world leader in mobile device sales and technology. That year, Nokia launched its first media

[42] *See* Ex. 43, *Leading E-commerce Sites in the U.S., by Monthly Visits,* Statistica, https://www.statista.com/statistics/271450/monthly-unique-visitors-to-us-retail-websites/.

[43] *See* Ex. 44, *Advertising Insights: Thursday Night Football on Prime Video*, Amazon, https://advertising.amazon.com/blog/thursday-night-football-on-prime-video.

device, the Nokia 7700, and invested nearly one billion euros in research and development.[44]

92. Customers are consuming more content via streaming services, commonly referred to in the industry as OTT (Over-The-Top) services, than ever before. At the same time, competition among video services is increasing. The number of OTT providers is constantly growing and consumer confusion is mounting. Consumers expect the same level of innovation and development for OTT video as they do for other online services, and broadcasters and content providers are under constant pressure to distinguish their offerings through personalization and availability of innovative apps that entice and retain customers. The management, curation and optimization of audience viewing experiences across screens is becoming a core customer need, and at the same time an opportunity for service differentiation.

93. In the early 2000s, the deployment of high bit-rate mobile networks such as 3G enabled the delivery of new digital services, including video calling and streaming. *See, e.g.*, Ex. 45, '559 Patent, col. 1, ll. 17-40. While audio could be delivered adequately using the bit rates available at the time, the limited transfer rates made it difficult to handle data-intensive tasks like delivering high quality full-motion video. *See, e.g.*, *id.* For this and other reasons, alternative broadband delivery techniques were being investigated to support the delivery of data-intensive content. As digital broadband data broadcast networks evolved, there was increasing interest in combining use of mobile telecommunications with a broadband delivery technique to achieve efficient delivery of digital services to users on the move. But this led to new technical challenges for content providers as they had to learn new techniques to efficiently deliver content to the myriad mobile devices that could consume broadband content over mobile networks.

[44] *See* Ex. 46, Press Release, Nokia, Nokia Closes 2003 With Excellent Fourth Quarter, (Jan. 24, 2004), at 6, 9, available at https://www.nokia.com/system/files/files/q4-2003-earnings-release-pdf.pdf.

94. At the time, mobile terminals would typically download content by "pulling" it from a server. *See, e.g.*, *id.* at col. 2, ll. 25-39. This is because content providers tended to use content flow policies that had been used in non-mobile networks. *See id.* In those cases, the content provider typically maintained control over the content flow policy to the mobile terminal to enforce content access rights requirements. *See id.* The "pull" technique was thus rooted in the industry's established habits, which ignored input from the devices consuming the content that might otherwise affect an operator's content flow policy. Such outdated content flow policies were inefficient and undesirable as broadband content became accessible to mobile users everywhere and with myriad devices. When controlling content sent to a mobile device, they did not take into account, for example, the user preferences, terminal capabilities, previous content downloads, and/or use of previous content for that device. *See id.* at col. 2, ll. 40-53.

95. The '559 Patent addresses these problems, among others, by giving a network entity control of the flow of content to the terminal based, in part, on status information from the terminal. *See* '559 Patent, col. 2, ln. 57 – col. 3, ln. 9. Content flow is controlled, for example, by instructing the terminal to perform actions, such as downloading pieces of content from an origin server, or other content related actions based, in part, on the status information provided to the network entity from the terminal. *See id.* at col. 3, ll. 20-51. For example, the content provider can control the downloading and storage of content, as well as the deletion of content, at the terminal based upon status information regarding the terminal, and if so desired, further based upon status information regarding a source of content, such as the digital broadcast receiver, an origin server, or the like. *See id.* at col. 11, ll. 6-30. In that way, the flow of content to the terminal is more efficient since the flow of new content to the terminal is affected by aspects of the terminal itself. *See id.* at col. 10, ll. 45-59.

ACCUSED PRODUCTS

A. Amazon Coding Patents Accused Products

96. The "Amazon.com Coding Patents Accused Products" refers to all Amazon.com products, services, and functionalities that use H.264 entropy coding. This includes, for example, all versions and implementations of Amazon Prime Video, Amazon Smart TV, Amazon Echo Show, Amazon Glow, Fire TV, Fire TV Cube, Fire Tablet (including Kindle Fire), and Fire TV Stick. It also includes the encoding/decoding of video (using H.264) by AWS that is at the direction, request, or control of Amazon.com.

97. The "AWS Coding Patents Accused Products" refers to all AWS products, services, and functionalities that use H.264 entropy coding. This includes, for example, all versions and implementations of AWS Elemental MediaConvert, AWS Elemental Live, AWS Elemental Server, Amazon Elastic Transcoder, AWS Elemental MediaPackage, and AWS Elemental MediaLive. It also includes the encoding/decoding of video (using H.264) by Amazon.com that is at the direction, request, or control of AWS.

98. "Amazon Coding Patents Accused Products" refers to the Amazon.com Coding Patents Accused Products and the AWS Coding Patents Accused Products, collectively.

99. On information and belief, in relevant respects for the Amazon Coding Patents Accused Products, Amazon.com and AWS act in concert with one another.

100. H.264 is the name for technology described in an industry standard that is widely used to encode and decode streaming video. H.264 reduces the file size of video files without any loss in quality of video, enabling companies to stream video in higher quality given the same network bandwidth.

101. H.264 focuses on the coding of the picture portions of the video content. To this

end, H.264 defines a format, or syntax, for compressed video and a method for decoding this syntax to produce a displayable video sequence. An H.264 video encoder carries out prediction, transform, and encoding processes to produce a compressed H.264 bitstream. An H.264 video decoder carries out the complementary processes of decoding, inverse transform, and reconstruction to produce a decoded video sequence.

102. H.264 has been the dominant industry standard for compressing video for applications such as digital television, DVD video, video conferencing, and Internet video streaming. Standardizing video compression made it possible for products from different manufacturers to inter-operate. Recommendation H.264: Advanced Video Coding is a video decoding standard published by the international standards bodies ITU-T (International Telecommunication Union) and ISO/IEC (International Organisation for Standardisation / International Electrotechnical Commission) (attached as Ex. 47). It defines a format (syntax) for compressed video and a method for decoding this syntax to produce a displayable video sequence. Products that support H.264 encoding and decoding are compliant with the H.264 standard.

103. In H.264, picture data can be coded using context-adaptive binary arithmetic coding ("CABAC") or context-adaptive variable-length coding ("CAVLC"). Each coding algorithm provides different benefits. CABAC highly compresses the picture data, but is computationally expensive to decode, while CAVLC is lower-complexity and more efficient.

104. Amazon uses H.264 coding to efficiently and seamlessly deliver video to its customers.

105. On information and belief, exemplary products that use H.264 include Amazon Prime Video, Amazon Smart TV, Amazon Echo Show, Amazon Glow, Fire TV, Fire TV Cube, Fire Tablet (including Kindle Fire), Fire TV Stick, AWS Elemental MediaConvert, AWS

Elemental Live, AWS Elemental Server, Amazon Elastic Transcoder, AWS Elemental MediaPackage, and AWS Elemental MediaLive.

106. On information and belief, and according to Amazon, Amazon Prime Video supports coding in H.264.[45]

107. On information and belief, and according to Amazon, Amazon Smart TV, Amazon Echo Show, Amazon Glow, Fire TV, Fire TV Cube, Fire Tablet (including Kindle Fire), and Fire TV Stick support coding in H.264.[46]

108. On information and belief, and according to Amazon, AWS Elemental MediaConvert, AWS Elemental Live, AWS Elemental Server, Amazon Elastic Transcoder, AWS

[45] *See* Ex. 48, *Video Central*, Amazon, https://videocentral.amazon.com/home/help?topicId=GDDDXTDKXPSEY7JF&ref_=avd_sup_GDDDXTDKXPSEY7JF; *see also* Ex. 49, *Amazon Prime Video: Delivering the Amazing Video Experience (CTD203-R1) - AWS re:Invent 2018*, AWS, available at https://www.slideshare.net/AmazonWebServices/amazon-prime-video-delivering-the-amazing-video-experience-ctd203r1-aws-reinvent-2018 (slide 17).

[46] *See* Exs. 50–53, *Comparison Table for Fire TV Devices*, Amazon Appstore, https://developer.amazon.com/docs/fire-tv/device-specifications-comparison-table.html (last visited Jan. 20, 2022) (listing device specifications including H.264 and audio codec support for Fire TV devices); Ex. 54, *Fire Tablet Device Specifications: Fire HD Models*, Amazon Appstore, https://developer.amazon.com/docs/fire-tablets/ft-device-specifications-firehd-models.html (last visited Jan. 20, 2022) (listing device specifications including H.264 and audio codec support for Amazon Fire HD Tablet, 11th Generation (2021)); Ex. 55, *Fire Tablet Device Specifications: Fire HD Models*, Amazon Appstore, https://developer.amazon.com/docs/fire-tablets/ft-device-specifications-firehd-models.html?v=firehd8_2020 (last visited Jan. 20, 2022) (listing device specifications including H.264 and audio codec support for Amazon Fire HD Tablet, 10th Generation (2020)); Ex. 56, *Fire Tablet Device Specifications: Fire HD Models*, Amazon Appstore, https://developer.amazon.com/docs/fire-tablets/ft-device-specifications-firehd-models.html?v=firehd10_2019 (last visited Jan. 20, 2022) (listing device specifications including H.264 and audio codec support for Amazon Fire HD Tablet, 9th Generation (2019)); Ex. 57, *Web Player Requirements (VSK Echo Show)*, Amazon Appstore, https://developer.amazon.com/docs/video-skills-multimodal-devices/vsk-echo-show-web-player-requirements.html (last visited Jan. 20, 2022) (listing video and audio requirements, including H.264 and audio codec support, for Amazon Echo Show); Ex. 58, Kistent Wuang, *Amazon Kindle Fire Supported Video Formats and Conversion Tips*, Digiarty (Dec. 14, 20210), https://www.winxdvd.com/video-converter-software/amazon-kindle-fire-supported-movie-video-formats.htm (last visited Jan. 20, 2022).

Elemental MediaPackage, and AWS Elemental MediaLive support coding in H.264.[47]

B. Amazon '794 Accused Products

109. "Amazon.com '794 Accused Products" refers to all Amazon.com products, services, features, and functionalities that implement, in whole or in part, HTTP Live Streaming ("HLS") or Dynamic Adaptive Streaming over HTTP ("DASH"). This includes, for example, all versions and implementations of Amazon Prime Video (including the service and the application). It also includes the use of HLS and DASH by AWS that is at the direction, request, or control of Amazon.com.

110. "AWS '794 Accused Products" refers to all AWS products, services, features, and functionalities that implement, in whole or in-part, HLS or DASH. This includes, for example, Amazon Elastic Transcoder, AWS Elemental MediaConvert, AWS Elemental Server, AWS Elemental MediaPackage, AWS MediaLive, and Amazon Kinesis Video Streams. It also includes the use of HLS or DASH by Amazon.com that is at the direction, request, or control of AWS.

111. "Amazon '794 Accused Products" refers to the Amazon.com '794 Accused Products and the AWS '794 Accused Products, collectively.

112. On information and belief, in relevant respects for the Amazon '794 Accused Products, Amazon.com and AWS act in concert with one another.

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[47] Ex. 59, https://docs.aws.amazon.com/mediaconvert/latest/ug/reference-codecs-containers.html (listing H.264 and audio codec support for AWS Elemental MediaConvert); Ex. 60, https://docs.aws.amazon.com/elemental-live/latest/ug/supported-inputs-live-codecs.html (listing H.264 and audio codec support for AWS Elemental Live); Ex. 61, https://docs.aws.amazon.com/elemental-server/latest/ug/vq-avc.html (listing H.264 and audio codec support for AWS Elemental Server); Ex. 62, https://aws.amazon.com/elastictranscoder/faqs/ (listing H.264 and audio codec support for AWS Elastic Transcoder); Ex. 63, https://docs.aws.amazon.com/mediapackage/latest/ug/supported-inputs-live.html (listing H.264 and audio codec support for AWS Elemental MediaPackage); Ex. 64, https://docs.aws.amazon.com/medialive/latest/ug/inputs-supported-containers-and-codecs.html (listing H.264 and audio codec support for AWS MediaLive).

113. HLS is a proprietary protocol created by Apple to facilitate sending live and on-demand audio and video to Apple devices, including the iPhone, iPad, Mac, Apple Watch, and Apple TV. HLS has also been adopted and is used on many non-Apple environments as well, including, for example, on many non-Apple computers, tablets, mobile phones, smart TVs, streaming players, and web browsers.

114. RFC 8216: HTTP Live Streaming 2nd Edition is a draft streaming protocol standard submitted to the Internet Engineering Task Force (or "IETF") that describes the HLS streaming standard. It defines a data format (syntax) for the files and the actions taken by the server and clients of unbounded streams of multimedia data according to the HLS protocol.[48] HLS dynamically adapts to network conditions by optimizing playback for the available speed of wired and wireless connections. HLS is an HTTP-based technology.

115. DASH is an adaptive bitrate streaming technique that enables high quality streaming of media content over the Internet delivered from conventional HTTP web servers. *See, e.g.*, ISO/IEC, ISO/IEC23009-1, Information technology – Dynamic adaptive streaming over HTTP (DASH) – Part 1: Media presentation description and segment formats (4th ed. 2019-12) (hereinafter "DASH Standard") (available at https://www.iso.org/standard/79329.html).

116. Amazon uses HLS and DASH to efficiently and seamlessly deliver video to its customers.

117. On information and belief, exemplary products that use HLS include Amazon Prime Video, Amazon Elastic Transcoder, AWS Elemental MediaConvert, AWS Elemental Server, AWS Elemental MediaPackage, AWS MediaLive, and Amazon Kinesis Video Streams.

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[48] *See* Ex. 65, *Informational Internet Draft: HTTP Live Streaming 2nd Edition*, IETF (Nov. 8, 2021) [hereinafter "HLS Internet-Draft"], https://datatracker.ietf.org/doc/html/draft-pantos-hls-rfc8216bis (last visited Jan. 20, 2022).

118. Amazon Prime Video uses HLS and DASH to seamlessly deliver video to its subscribers. The package formats used by Amazon Prime Video to deliver its content to Prime Video subscribers include "MSS, DASH, HLS, MP4."[49]

119. According to AWS, Amazon Elastic Transcoder is a "way for developers and businesses to convert (or 'transcode') media files from their source format into versions that will playback on devices like smartphones, tablets and PCs."[50] Amazon Elastic Transcoder allows users to transcode videos using HLS and DASH.[51]

120. According to AWS, AWS Elemental MediaConvert is a "file-based video transcoding service" that "allows video providers with any size content library to easily and reliably transcode on-demand content for broadcast and multiscreen delivery."[52] AWS Elemental MediaConvert supports a broad range of adaptive bitrate packing formats "including CMAF, Apple HLS, DASH ISO, and Microsoft Smooth Streaming."[53]

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[49] *See* Ex. 49, *Amazon Prime Video: Delivering the Amazing Video Experience (CTD203-R1) - AWS re:Invent 2018*, AWS, available at https://www.slideshare.net/AmazonWebServices/amazon-prime-video-delivering-the-amazing-video-experience-ctd203r1-aws-reinvent-2018 (slide 17).

[50] *See* Ex. 66, Amazon Elastic Transcoder, AWS, https://aws.amazon.com/elastictranscoder/ (last accessed Jan. 20, 2022).

[51] *See* Ex. 67, Amazon Elastic Transcoder Now Supports HLS Content Protection, AWS, https://aws.amazon.com/about-aws/whats-new/2015/01/13/amazon-elastic-transcoder-now-supports-hls-content-protection/ (last accessed Jan. 20, 2022); Ex. 132, Amazon Elastic Transcoder Now Supports MPEG-DASH, https://aws.amazon.com/about-aws/whats-new/2016/05/amazon-elastic-transcoder-now-supports-mpeg-dash/ (last accessed Apr. 20, 2022); *see also* Ex. 68, Foliovision, AWS Elastic Transcoder End User Guide, https://foliovision.com/player/securing-your-video/aws-hls-end-user-guide (last accessed Jan. 20, 2022).

[52] *See* Ex. 69, AWS Elemental MediaConvert, AWS, https://aws.amazon.com/mediaconvert/ (last accessed Jan. 20, 2022).

[53] *See* Ex. 70, AWS Elemental MediaConvert Features, AWS, https://aws.amazon.com/mediaconvert/features/ (last accessed Jan. 20, 2022); Ex. 133, Announcing New AWS Elemental MediaConvert Features for Accelerated Transcoding, DASH,

121. According to AWS, AWS Elemental Server is a service that provides "video processing for file-based workflows" and "performs simultaneous, faster-than-real-time conversion of multiple video files to create mezzanine deliverables, traditional on-demand assets, and adaptive bitrate outputs for delivery to TVs, PCs, and mobile devices."[54] AWS Elemental Servers allows customers to, for example, set up an "HLS output group" with "one [output] set consisting of high bitrate video and audio in four languages and another set consisting of low bitrate video and audio in the same four languages."[55] According to Amazon, "AWS Elemental Server incorporates advanced features and functionality to support the latest screens and experiences. Create content for delivery via Adobe Flash, Microsoft Smooth Streaming, Apple HLS, MPEG-DASH, QuickTime, or traditional broadcast formats."[56]

122. According to AWS, AWS Elemental MediaPackage "reliably prepares and protects your video for delivery over the Internet" and "[f]rom a single video input, . . . creates video streams formatted to play on connected TVs, mobile phones, computers, tablets, and game consoles."[57] According to AWS, AWS Elemental MediaPackage can "[p]ush an HLS stream from an external source or encoder . . . using the HTTPS protocol," and supports both HLS and DASH

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and AVC Video Quality, https://aws.amazon.com/about-aws/whats-new/2019/10/announcing-new-aws-elemental-mediaconvert-features-for-accelerated-transcoding-dash-and-avc-video-quality/.

[54] *See* Ex. 71, What is AWS Elemental Server?, AWS, https://docs.aws.amazon.com/elemental-server/latest/ug/what-is-aws-elemental-server.html (last accessed Jan. 20, 2022).

[55] *See* Ex. 72, Setting up HLS Rendition Groups, AWS, https://docs.aws.amazon.com/elemental-server/latest/ug/hls-rendition-groups.html (last accessed Jan. 20, 2022).

[56] *See* Ex. 134, AWS Elemental Server Features, https://aws.amazon.com/elemental-server/features/ (last accessed Apr. 20, 2022).

[57] *See* Ex. 73, AWS Elemental MediaPackage, AWS, https://aws.amazon.com/mediapackage/ (last accessed Jan. 20, 2022).

as output codecs when delivering content.[58]

123. According to AWS, AWS Elemental MediaLive is a "live video processing service" that "lets you create high-quality video streams for delivery to broadcast televisions and internet-connected multiscreen devices, like connected TVs, tablets, smart phones, and set-top boxes."[59] According to AWS, HLS "audio and video assets can be multiplexed into a single stream or in a separate audio rendition group" using AWS Elemental MediaLive.[60]

124. According to AWS, Amazon Kinesis Video Streams "is a service for securely capturing, processing, and storing video for analytics and machine learning — from one device or millions. Customers are using Kinesis Video with machine learning algorithms to power everything from home automation and smart cities to industrial automation and security."[61] Amazon Kinesis Video Streams provides customers the means to use HLS and DASH streams to facilitate data collection.[62] For example, the Amazon Kinesis Video Streams "HLS output" feature is advertised as a "a convenient . . . feature that allows customers to create HLS endpoints for their Kinesis Video Streams, convenient for building custom UIs and tools that can playback live and

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[58] *See* Ex. 74, Live supported codecs and input types, AWS, https://docs.aws.amazon.com/mediapackage/latest/ug/supported-inputs-live.html (last accessed Jan. 20, 2022).

[59] *See* Ex. 75, AWS Elemental MediaLive, AWS, https://aws.amazon.com/medialive/ (last accessed Jan. 20, 2022).

[60] *See* Ex. 76, Supported codecs for inputs, AWS, https://docs.aws.amazon.com/medialive/latest/ug/inputs-supported-containers-and-codecs.html (last accessed Jan. 20, 2022).

[61] *See* Ex. 77, Amazon Kinesis Video Streams Adds Support for HLS Output Streams, AWS, https://aws.amazon.com/blogs/aws/amazon-kinesis-video-streams-adds-support-for-hls-output-streams/ (last accessed Jan. 20, 2022).

[62] *See* Ex. 78, Video Playback with HLS, AWS, https://docs.aws.amazon.com/kinesisvideostreams/latest/dg/hls-playback.html (last accessed Jan. 20, 2022); Ex. 136, Video Playback with MPEG-DASH, https://docs.aws.amazon.com/kinesisvideostreams/latest/dg/dash-playback.html (last accessed Apr. 20, 2022).

on-demand video."[63]

125. AWS encourages its customers to employ many features and functionalities of HLS. For example, AWS tells its customers that the "great thing about HLS is that it is an industry standard and really easy to leverage in existing web players . . ., or even render[] natively in mobile apps . . . ."[64] Further, Amazon states that "Amazon Kinesis Video Streams Dynamic Adaptive Streaming over HTTP (DASH) capability enables developers to playback their ingested video streams using the industry-standard, HTTP-based media streaming protocol."[65]

C. Amazon '682 Accused Products

126. "Amazon.com '682 Accused Products" refers to all Amazon.com products, services, functionalities, and features that implement, in whole or in part, Web RealTime Communication ("WebRTC") or Secure Real-Time Transport Protocol (SRTP). This includes, for example, all versions and implementations of Amazon Echo Show, Amazon Echo Spot, Amazon Connect, and Amazon Chime. It also includes the use of WebRTC or SRTP by AWS that is at the direction, request, or control of Amazon.com.

127. "AWS '682 Accused Products" refers to all AWS products, services, functionalities, and features that implement, in whole or in part, WebRTC or SRTP. This includes, for example, all versions and implementations of Amazon Kinesis Video Streams. It also includes the use of WebRTC or SRTP by Amazon.com that is at the direction, request, or control of AWS.

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[63] *See* Ex. 77, Amazon Kinesis Video Streams Adds Support for HLS Output Streams, AWS, https://aws.amazon.com/blogs/aws/amazon-kinesis-video-streams-adds-support-for-hls-output-streams/.

[64] *See id*.

[65] Ex. 135, Kinesis Video Streams adds support for Dynamic Adaptive Streaming over HTTP (DASH) and H.265 video, https://aws.amazon.com/about-aws/whats-new/2019/07/kinesis-video-streams-adds-support-for-dynamic-adaptive-streaming-over-http-dash-and-h-2-6-5-video/ (last accessed Apr. 20, 2022).

128. "Amazon '682 Accused Products" refers to the Amazon.com '682 Accused Products and the AWS '682 Accused Products, collectively.

129. On information and belief, in relevant respects for the Amazon '682 Accused Products, Amazon.com and AWS act in concert with one another.

130. WebRTC facilitates secure, real-time communication by permitting a web browser to request backend resources using available application programming interfaces, or APIs.

131. Amazon uses WebRTC to provide secure, real-time communication across browsers and mobile applications using WebRTC's APIs in the provision of digital video.

132. On information and belief, exemplary products that use WebRTC include Amazon Echo Show, Amazon Echo Spot, Amazon Connect, Amazon Chime, and Amazon Kinesis Video Streams.

133. According to Amazon.com, it "supports WebRTC to enable real-time streaming of audio, video, and (optionally) arbitrary data between Alexa and your Smart Home device," such as Echo Show or Echo Spot.[66] "Amazon recommends that you use WebRTC whenever possible" for streaming video and audio with cloud-enabled cameras.[67]

134. Amazon advertises that "[w]ith Amazon Connect, you can set up a contact center in minutes that can scale to support millions of customers."[68] Amazon further advertises that Amazon Connect offers easy set-up, cost savings of "[u]p to 80 percent compared to traditional

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[66] *See* Ex. 79, *About the Real-Time Communication Interface*, AMAZON.COM, https://developer.amazon.com/en-US/docs/alexa/device-apis/about-alexa-rtc.html (last visited Jan 20, 2022).

[67] *See* Ex. 80, *Smart Home Security Skill Overview*, AMAZON.COM, https://developer.amazon.com/en-US/docs/alexa/device-apis/overview-smart-home-security.html (last visited Jan. 20, 2022).

[68] *See* Ex. 81, *Amazon Connect*, AWS, https://aws.amazon.com/connect/ (last visited Jan. 20, 2022).

contact center solutions," and easy scaling "up or down to meet demand."[69] According to AWS, "[t]he Amazon Connect softphone uses the WebRTC protocol."[70]

135. According to Amazon, "Amazon Chime Voice Connector delivers a pay-as-you-go SIP trunking service that enables companies to make and/or receive secure and inexpensive phone calls with their phone systems."[71] On information and belief, Amazon Chime uses WebRTC.[72]

136. According to AWS, "Amazon Kinesis Video Streams provides a standards-compliant WebRTC implementation as a fully manage capability."[73] Using WebRTC with Kinesis Video Streams allows users to "easily build applications from live peer-to-peer media streaming,

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[69] *Id.*

[70] *See* Ex. 82, Kun Qian & Robertson Taylor, *Easily Monitor Call Quality with Amazon Connect*, AWS (Oct. 1, 2020), https://aws.amazon.com/blogs/contact-center/easily-monitor-call-quality-with-amazon-connect/ (last visited Jan. 20, 2022) ("The Amazon Connect softphone uses the WebRTC protocol . . . .").

[71] *See* Ex. 83, *WebRTC and WebRTC Gateway*, AWS, https://d1.awsstatic.com/whitepapers/Industries/Telco/real-time_communication_aws.pdf, at 15; *see also* Ex. 84, Brian Crum, *Announcing Doorbell Chime Announcements and 2-Way Communication APIs, Unlocking New Customer Scenarios in Home Automation and Monitoring*, AmazonAlexa (Oct. 9, 2018), https://developer.amazon.com/en-US/blogs/alexa/device-makers/2018/10/announcing-doorbell-chime-announcements-and-2-way-communication-apis-unlocking-new-customer-scenarios-in-home-automation-and-monitoring (last visited Jan. 20, 2022) ("[W]e have also released the 2-Way Communication API that enables smart cameras and doorbells to establish a 2-way communication with Echo Show and Echo Spot. Ring has implemented the 2-way communication API and this feature is coming soon with August. *We currently support only WebRTC compliant cameras or 3Ps who use a WebRTC bridge to connect to Alexa*. Alexa voice commands are currently only available for full duplex cameras. Half duplex cameras will have push to talk capabilities on the Echo Show or Echo Spot.") (emphasis added).

[72] *See* Ex. 85, *Amazon Chime SDK Features*, AWS, https://aws.amazon.com/chime/chime-sdk/features/ (last visited Jan. 20, 2022) ("Integrate the Amazon Chime SDK for JavaScript, iOS, or Android into your applications to enable high-quality audio and video on *WebRTC-enabled browsers and mobile operating systems*.") (emphasis added).

[73] *See* Ex. 86, AWS, *What Is Amazon Kinesis Video Streams With WebRTC*, https://docs.aws.amazon.com/kinesisvideostreams-webrtc-dg/latest/devguide/what-is-kvswebrtc.html (last visited Jan. 20, 2022).

or real-time audio or video interactivity between camera IoT devices, web browsers, and mobile devices for a variety of use cases."[74] Using the WebRTC implementation of Amazon Kinesis is advertised as permitting "real-time data exchange," "low latency," and "reliable and secure real-time media and data streaming."[75]

D. Amazon '156 Accused Products

137. "Amazon.com '156 Accused Products" refers to all Amazon.com products, services, functionalities, and features that implement, in whole or in part, Auto Scaling. This includes, for example, all versions and implementations of AWS Auto Scaling and EC2 Auto Scaling. It also includes the use of Auto Scaling by AWS that is at the direction, request, or control of Amazon.com.

138. "AWS '156 Accused Products" refers to all AWS products, services, functionalities, and features that implement, in whole or in part, Auto Scaling. This includes, for example, all versions and implementations of AWS Auto Scaling and EC2 Auto Scaling. It also includes the use of Auto Scaling by Amazon.com that is at the direction, request, or control of AWS.

139. "Amazon '156 Accused Products" refers to the Amazon.com '156 Accused Products and the AWS '156 Accused Products, collectively.

140. On information and belief, in relevant respects for the Amazon '156 Accused Products, Amazon.com and AWS act in concert with one another.

141. On information and belief, exemplary products that use Auto Scaling include AWS Auto Scaling and EC2 Auto Scaling.

[74] *Id.*

[75] *Id.*

142. AWS Auto Scaling provides a user interface that allows customers to build scaling plans for resources. According to AWS, AWS Auto Scaling "monitors . . . applications and automatically adjusts capacity to maintain steady, predictable performance at the lowest possible cost," and makes it "easy to setup application scaling for multiple resources across multiple services in minutes."[76]

143. Amazon proudly touts numerous benefits to using AWS Auto Scaling. For example, AWS Auto Scaling offers recommendations that allow customers to "optimize performance, costs, or balance between" those two considerations, which "can help you optimize your utilization and cost efficiencies when consuming AWS services so you only pay for the resources you actually need. When demand drops, AWS Auto Scaling will automatically remove any excess resource capacity so you avoid overspending."[77] Additionally, AWS advertises that "AWS Auto Scaling continually monitors resources underlying your application to make sure that they are operating at your desired performance levels. When demand spikes, AWS Auto Scaling automatically increases the capacity of constrained resources so you maintain a high quality of service."[78]

144. According to AWS, Amazon uses AWS Auto Scaling to optimize other AWS products and services, such as allowing customers to "build scaling plans for resources including Amazon EC2 instances and Spot Fleets, Amazon ECS tasks, Amazon DynamoDB tables and indexes, and Amazon Aurora Replicas."[79]

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[76] *See* Ex. 87, *AWS Auto Scaling*, AWS, https://aws.amazon.com/autoscaling/ (last visited Jan. 19, 2022).

[77] *Id.*

[78] *Id.*

[79] *Id.*

145. On information and belief, Amazon offers AWS Auto Scaling in the following public AWS regions: US East (Northern Virginia), US East (Ohio), US West (Oregon), and US West (Northern California).[80]

146. Amazon EC2 (short for "Amazon Elastic Compute Cloud") is an Amazon service that offers customers "access to a virtual computing environment," where an "EC2 instance" refers to a virtual server.[81] According to AWS, "Amazon EC2 Auto Scaling helps you maintain application availability and allows you to automatically add or remove EC2 instances according to conditions you define."[82] AWS advertises that "[y]ou can use the fleet management features of EC2 Auto Scaling to maintain the health and availability of your fleet. You can also use the dynamic and predictive scaling features of EC2 Auto Scaling to add or remove EC2 instances. Dynamic scaling responds to changing demand and predictive scaling automatically schedules the right number of EC2 instances based on predicted demand. Dynamic scaling and predictive scaling can be used together to scale faster."[83]

147. AWS Auto Scaling and Amazon EC2 Auto Scaling operate synergistically. For example, according to AWS, "[u]sing AWS Auto Scaling, customers can configure Predictive Scaling to automatically scale their Amazon EC2 Auto Scaling Groups in advance of impending traffic changes. Customers can also use AWS Auto Scaling to manage scaling configuration for

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[80] *See* Ex. 88, *AWS Auto Scaling is Now Available in 8 more Regions Worldwide and Offers Predictive Scaling for Amazon EC2*, AWS, https://aws.amazon.com/about-aws/whats-new/2018/12/aws-auto-scaling-is-now-available-in-8-more-regions-worldwide/ (last visited Jan. 20, 2022).

[81] *See* Ex. 89, Jeff Barr, *Amazon EC2 Beta*, AWS, https://aws.amazon.com/blogs/aws/amazon_ec2_beta/ (last visited Jan. 20, 2022).

[82] *See* Ex. 90, *Amazon EC2 Auto Scaling*, AWS, https://aws.amazon.com/ec2/autoscaling/ (last visited Jan. 20, 2022).

[83] *Id.*

multiple resources with a single scaling plan for services such as Amazon EC2 . . . ."[84]

E. Amazon '559 Accused Products

148. "Amazon.com '559 Accused Products" refers to all Amazon.com products, services, features, and functionalities that control the flow of content to a client based on status information from a client and/or a content server. This includes, for example, all versions and implementations of Amazon Prime Video (including the service and the application). It also includes the content flow control by AWS that is at the direction, request, or control of Amazon.com.

149. "AWS '559 Accused Products" refers to all AWS products, services, features, and functionalities that control the flow of content to a client based on status information from a client and/or a content server. It includes the content flow control by Amazon.com that is at the direction, request, or control of AWS.

150. "Amazon '559 Accused Products" refers to the Amazon.com '559 Accused Products and the AWS '559 Accused Products, collectively.

151. On information and belief, in relevant respects for the Amazon '559 Accused Products, Amazon.com and AWS act in concert with one another.

152. Amazon Prime Video controls the flow of streaming content to Amazon Prime Video clients based, in part, on status information from the client and/or a content server.

153. On information and belief, Amazon Prime Video uses status information from the

[84] *See* Ex. 88, *AWS Auto Scaling is Now Available in 8 more Regions Worldwide and Offers Predictive Scaling for Amazon EC2*, AWS, https://aws.amazon.com/about-aws/whats-new/2018/12/aws-auto-scaling-is-now-available-in-8-more-regions-worldwide/ (last visited Jan. 20, 2022); *see also* Ex. 91, *AWS Auto Scaling FAQs*, AWS, https://aws.amazon.com/autoscaling/faqs/ (last visited Jan. 20, 2022) (comparing "AWS Auto Scaling vs. Amazon EC2 Auto Scaling").

client and/or a content server to "bookmark" content so that, when a viewer stops viewing content and then returns to view the same content later, the content begins at the time segment where the viewer left off. Without this feature, returning to view content would be significantly more inconvenient and probably cause viewers to view less content.[85]

154. On information and belief, Amazon Prime Video uses status information from the client and/or a content server to automatically download content based on the customer's viewing history. Amazon Prime Video's automatic download feature operates so that, "[by] default, once a customer has downloaded and watched an episode of a TV show, [the Prime Video application] will begin downloading the next three episodes for offline viewing."[86] The automatic download feature allows Amazon Prime Video to "smartly download new episodes of TV shows so that users don't have to worry about doing the same manually."[87]

155. On information and belief, Amazon Prime Video further uses status information from the client and/or a content server to prompt video features that significantly improve the consumer viewing experience. For example, when starting an episode on Amazon Prime Video that includes advertisements, Amazon Prime Video offers the viewer an opportunity to "Skip Ads" shortly after the advertisements begin. Similarly, Amazon Prime Video provides viewers a "Skip Intro" option shortly after the opening credits sequence begins. When the beginning of an episode

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[85] *See, e.g.*, Ex. 92, *Prime Video Not Updating Last Watched Episode*, ROKUCOMMUNITY (July 10, 2020), https://community.roku.com/t5/Channel-Issues-Questions/Prime-Video-not-updating-the-last-watched-episode/td-p/582536 (last visited Jan. 20, 2022) (various Prime Video user complaints about "Prime Video not updating the last watched episode," including descriptions of the problem as "irritating" and "frustrating").

[86] *See* Ex. 93, *Amazon Prime Video Enables Auto-Download Feature*, DIGITALTV (Sep. 10, 2020), https://www.digitaltveurope.com/2020/09/10/amazon-prime-video-enables-auto-download-feature/ (last visited Jan. 20, 2022).

[87] *See* Ex. 94, *Amazon Prime Video to Get Netflix-like Smart Downloads Feature*, MOBILESCOUT (Nov. 19, 2019), https://www.mobilescout.com/android/news/n114549/amazon-prime-video-auto-downloads-feature-spotted.html (last visited Jan. 20, 2022).

includes a summary of previous episodes, Amazon Prime Video provides viewers a "Skip Recap" option. Additionally, immediately after the final scene of an episode, Amazon Prime Video prompts the viewer to begin the "Next Episode." Without these features, viewing content would be more burdensome and the viewing experience would suffer.[88]

ALLEGATIONS OF PATENT INFRINGEMENT

COUNT I
INFRINGEMENT OF U.S. PATENT NO. 8,139,878

156. VideoLabs incorporates by reference the foregoing paragraphs of this First Amended Complaint as if fully set forth herein.

157. VL is the assignee and lawful owner of all right, title, and interest in and to the '878 Patent. The '878 Patent is valid and enforceable.

158. On information and belief, Amazon has infringed and continues to infringe the '878 Patent in violation of 35 U.S.C. § 271(a), either literally or through the doctrine of equivalents, by making, using, selling, offering for sale, and/or importing into the United States products and/or

[88] *See, e.g.*, Ex. 95, Ian Morris, *Amazon Prime Video Ads Between Shows Are Really Annoying*, T3 (Mar. 10, 2021), https://www.t3.com/us/news/amazon-prime-video-ads-between-shows-are-really-annoying; Ex. 96, *Amazon Prime Video Advert Skip*, DIGITALSPY (July 12, 2021), https://forums.digitalspy.com/discussion/2420457/amazon-prime-video-advert-skip (last visited Jan. 20, 2022) ("The skip credits and Recap option is very useful as one click is a lot easier than having to forward to the place you want. It is obviously a popular feature as Netflix, Amazon and Disney Plus all have the feature and now BBC Iplayer has introduced it on some titles."); Ex. 97, Amazon Prime FAQ (June 26, 2020), https://www.amazon.com/ask/questions/Tx9MKU2IRUWOME/ref=ask_ql_ql_al_hza ("Skipping their stinking stupid ads no longer works. They're trying to drive their paying customers away."); Ex. 98, *New Feature to Automatically Intro Skip on TV Series*, AMAZON, https://www.amazonforum.com/s/question/0D54P00006zSwAM/new-feature-to-an-automatically-intro-skip-on-tv-series (last visited Jan. 20, 2022) ("I love the feature Skip Intro on many of the TV series."); Ex. 99, *Thank You, Amazon Prime, For Finally Implementing the 'Skip Intro' and 'Skip Recap' Buttons on Television Shows Streaming on Your Service*, REDDIT, https://www.reddit.com/r/television/comments/93l9yg/thank_you_amazon_prime_for_finally_implementing/ (last visited Jan. 20, 2022).

methods that practice at least claim 1 of the '878 Patent, including with respect to the Amazon Coding Patents Accused Products.

159. On information and belief, Amazon uses the Amazon Coding Patents Accused Products for its own business purposes. In addition, Amazon regularly conducts testing and troubleshooting of the Amazon Coding Patents Accused Products. Further, VideoLabs is informed and believes companies related to Amazon (e.g., AWS, Amazon, and Amazon's subsidiaries) use the '878 Amazon Accused Products.

160. On information and belief, Amazon's infringement through its use of H.264 entropy encoding, described below, is exemplary of all of Amazon's infringement with respect to all the Amazon Coding Patents Accused Products.

161. The Amazon Coding Patents Accused Products directly infringe at least claim 1 of the '878 Patent, for example, by performing variable length encoding of blocks of picture data using the block data, inter-, intra-, and context-aware prediction to generate a predictive block, calculating a residual block using orthogonal transformation and quantization, and using the number of non-zero coefficients in the predicted block to encode the picture data at the encoder.

162. Each of the Amazon Coding Patents Accused Products meet every limitation of claim 1 of the '878 Patent, which recites:

> 1. A transmitting apparatus which transmits multiplexed data which is obtained by multiplexing coded audio data and coded picture data, said transmitting apparatus comprising:
>
> an audio processing unit configured to code audio data to obtain coded audio data
>
> a picture coding unit configured to code picture data to obtain coded picture data; and
>
> a multiplexing unit configured to multiplex the coded audio data and the coded picture data to obtain multiplexed data,

> wherein said picture coding unit includes a block decoding unit configured to code a block image to obtain coded block data, the block image being obtained by dividing a picture signal into plural blocks, generating a residual block image from a block image of the respective blocks and a predictive block image obtained by intra-picture prediction or inter-picture prediction, and coding, on a block basis, coefficients obtained by performing orthogonal transformation and quantization on the residual block image,
>
> wherein said block coding unit includes:
>
> a coefficient number coding unit configured to code a total number of non-zero coefficients included in a current block to be coded, each of the non-zero coefficients being a coefficient having a value other than "0";
>
> wherein said coefficient number coding unit includes:
>
> a determining unit configured to determine a predictive value for the number of non-zero coefficients included in the current block based on the number of non-zero coefficients included in a coded block located on a periphery of the current block;
>
> a selecting unit configured to select a variable length code table based on the determined predictive value; and
>
> a variable length coding unit configured to perform variable length coding on the total number of the non-zero coefficients included in the current block, by using the selected variable length code table.

163. Each of the Amazon Coding Patents Accused Products includes a transmitting apparatus that transmits multiplexed data, which is obtained by multiplexing coded audio data and coded picture data. H.264 carries audio and video multiplexed in a single stream. H.264 is directed to the picture portion of video, so devices containing H.264 encoders and decoders must multiplex/demultiplex audio and picture data in order to provide the H.264 picture data. Encoders multiplex the audio and pictures into a single stream, so that decoders receive the complete video presentation, including sound. Decoders receive the complete video presentation, including sound, and decode the stream to recreate the video. In the ISO Media File Format, which each accused H.264 product, and Amazon Prime Video, is capable of processing, a coded stream such as an H.264 video sequence or an audio stream is stored as a track, representing a sequence of coded

data items or samples. Figure 8.32, below, illustrates an example of such multiplexed data, in which coded audio data ("audio track samples") and coded picture data ("video track samples") are multiplexed together.

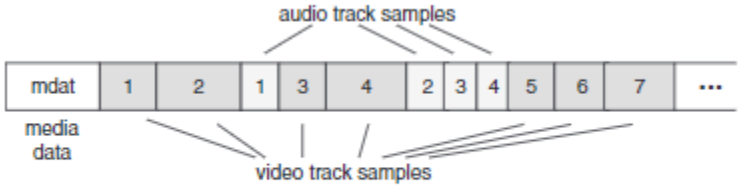

Figure 8.32 ISO Media File

Ex. 29, Richardson, at 247.

164. The Amazon Coding Patents Accused Products have an audio processing unit configured to code audio data to obtain coded audio data. For example, the Amazon Coding Patents Accused Products incorporate an audio codec that is configured to code audio data according to one of several input formats, including without limitation, Dolby Atmos, AC3, AAC, FLAC, MIDI, and MP3. The audio data is encoded as coded audio data ("audio track samples").

165. The Amazon Coding Patents Accused Products further include a picture coding unit configured to code picture data to obtain coded picture data. For example, the Amazon Coding Patents Accused Products incorporate a H.264 video codec that is configured to code picture data to generate a H.264-compliant bitstream. The picture data is encoded as coded picture data ("video track samples").

166. The Amazon Coding Patents Accused Products include a multiplexing unit configured to multiplex the coded audio data and the coded picture data into multiplexed data. Encoders multiplex the audio track samples and video track samples so that decoders receive the complete video presentation, including sound. One representative example of multiplexed data generated by the Amazon Coding Patents Accused Products is shown in Figure 8.32 below, which

shows the multiplexed stream of an ISO Media File including both coded audio track data and coded video track data.

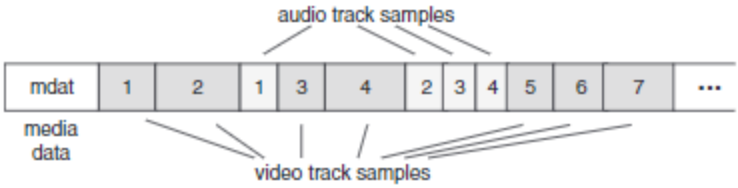

Figure 8.32 ISO Media File

Id. at 247.

167. The picture coding unit in the Amazon Coding Patents Accused Products includes a block coding unit configured to code a block image to obtain coded block data, the block image being obtained by dividing a picture signal into plural blocks.

168. In the Amazon Coding Patents Accused Products picture data is coded by an H.264-compliant encoder by dividing a picture signal into macroblocks, as shown in Figure 6-7:

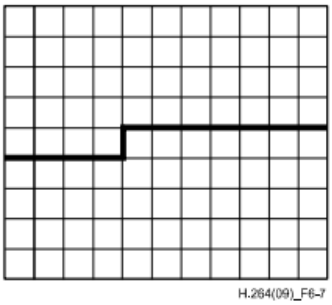

Figure 6-7 – A picture with 11 by 9 macroblocks that is partitioned into two slices

See ITU-T H.264, *Series H: Audiovisual and Multimedia Systems, Infrastructure of audiovisual services – Coding of moving video, Advanced video coding for generic audiovisual services*, Section 6.3, p. 25 (03/2009), at Figure 6-7.

169. The macroblock consists of a 16 x 16 block of luma samples and two corresponding blocks of chroma samples. A macroblock can be further partitioned for inter-prediction forming segmentations for motion representation as small as a block of 4 x 4 luma samples.[89]

170. In the Amazon Coding Patents Accused Products a residual block image is generated from the block image of the respective blocks and a predictive block image is obtained by intra-picture prediction or inter-picture prediction by an H.264-compliant encoder. For example, Figure 6.6 below shows a picture signal to be coded, with the macroblock being coded highlighted. The macroblock is predicted using neighboring, previously-encoded samples, as shown in Figure 6.7; because this prediction looks only to the other macroblocks of the same picture, this is called intra-picture prediction. The predicted macroblock is shown in Figure 6.7. Figure 6.8 shows the prediction (Figure 6.7) subtracted from the original (Figure 6.6), which is called the residual.

Figure 6.6 QCIF frame with highlighted macroblock

Figure 6.7 Predicted luma frame formed using H.264 intra prediction

Figure 6.8 Residual after subtracting intra prediction

Richardson at 141-143.

171. The Amazon Coding Patents Accused Products can use intra- and inter- picture coding on the macroblocks of a picture signal. Inter-picture coding predicts the value of the macroblock using temporal statistical dependencies between different pictures. Both types of

[89] *See generally* Ex. 47, ITU-T H.264, *Series H: Audio Visual and Multimedia Systems, Infrastructure of Audiovisual Services – Coding of Moving Video, Advanced Video Coding for Generic Audio Visual Services* [hereinafter "H.264 Standard"], Section 0.6.3, p. 5 (09/2019).

prediction can be used by the H.264-compliant encoder to calculate the residual.

172. In the Amazon Coding Patents Accused Products the H.264-compliant encoder codes, on a block basis, coefficients obtained by performing orthogonal transformation and quantization on the residual block image. H.264 specifies an *entropy_coding_mode* flag that dictates the entropy encoding algorithm used to encode the picture data. When this flag is set to "0" the residual block data is coded using a CAVLC scheme.[90] In such case, the resulting prediction residual is split into 4x4 blocks, and transformation and quantization are applied. An integer transform is applied to the residual, outputting a set of coefficient weighting values. This process is shown in the figures below:

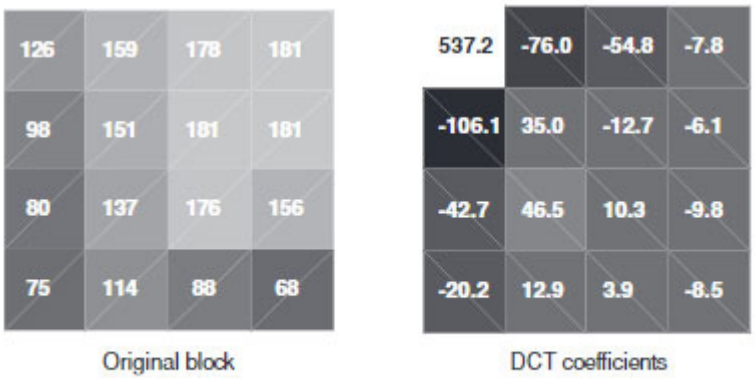

Figure 3.31 Close-up of 4 × 4 block; DCT coefficients

Ex. 29, Richardson, at 47.

[90] *See* Ex. 47, H.264 Standard, Section 7.4.2.2, pp. 81-82 (09/2019).

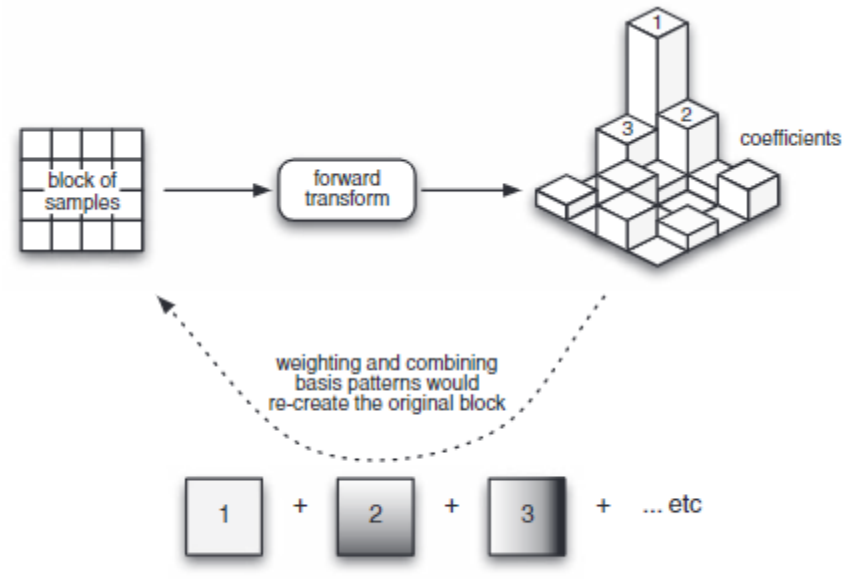

Figure 4.11 Forward transform

Ex. 29, Richardson, at 88.

173. The coefficients are then quantized, meaning that insignificant coefficient values are rounded down (for example, to zero), while a small number of significant, non-zero coefficients are retained. The quantization step is shown in Figure 4.12:

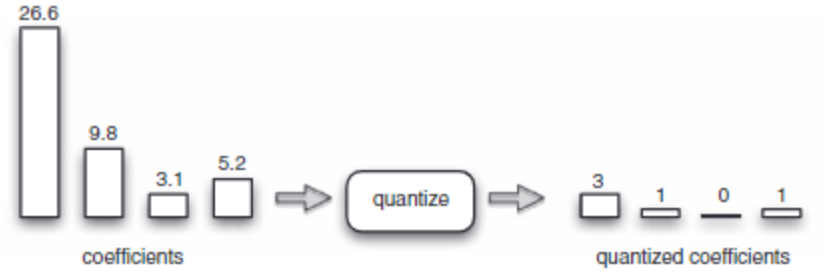

Figure 4.12 Quantization example

Ex. 29, Richardson, at 88.

174. The encoding process is shown in Figure 4.4:

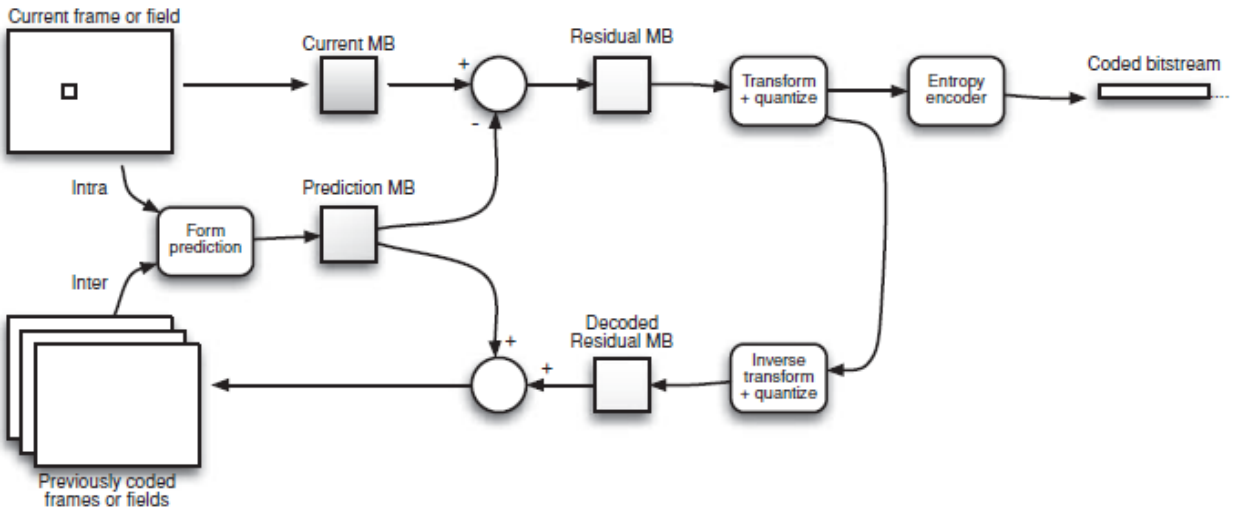

Figure 4.4 Typical H.264 encoder

Ex. 29, Richardson, at 84.

175. In the Amazon Coding Patents Accused Products the block coding unit includes a coefficient number coding unit configured to code a total number of non-zero coefficients included in a current block to be coded, where each of the non-zero coefficients having a value other than "0". In H.264 CAVLC encoding generally, which the Amazon Coding Patents Accused Products support, the total number of non-zero coefficients included in a current block to be coded is derived in order to generate a H.264-compliant bitstream.

176. To this end, the coefficient number coding unit in the Amazon Coding Patents Accused Products includes a determining unit configured to determine a predictive value for the number of non-zero coefficients included in the current block based on the number of non-zero coefficients included in a block located on a periphery of the current block. Since CAVLC is a context-adaptive variable length coding technique, the number of non-zero coefficients in neighboring blocks is correlated as part of the entropy coding process. An H.264-compliant encoder uses previously-processed macroblocks to help encode the currently-processed macroblock. The number of non-zero coefficients in previously-processed blocks on the

periphery—including the blocks to the left and above the current macroblock—are used to predict the number of non-zero coefficients in the current block. This use of the blocks of the periphery is shown in Figure 6-14:

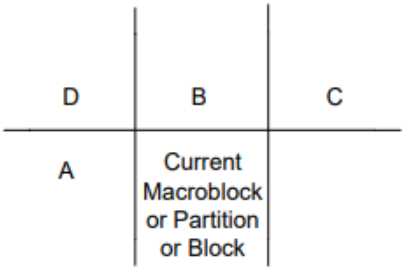

Figure 6-14 – Determination of the neighbouring macroblock, blocks, and partitions (informative)

Ex. 47, H.264 Standard, at 33.

177. The H.264-compliant encoder in the Amazon Coding Patents Accused Products obtains the number of non-zero coefficients in the left and above blocks to set the variable *nC*, the prediction of the current macroblock's number of non-zero coefficients based on the neighboring macroblocks' number of non-zero coefficients.[91]

178. The coefficient number coding unit in the Amazon Coding Patents Accused Products also includes a selecting unit configured to select a variable length code table based on the determined predictive value. The H.264-compliant encoder in the Amazon Coding Patents Accused Products uses the predictive value *nC* to select one of six variable length coding tables specified in Table 9-5 of the H.264 standard in order to generate a H.264-compliant bitstream.[92]

179. This selection of a variable length code table based on a determined predictive value is exemplified in Figure 7.19:

[91] *See* Ex. 47, H.264 Standard, Section 9.2.1, pp. 214-216 (09/2019).

[92] *See* Ex. 47, H.264 Standard, Section 9.2.1 and Table 9-5, pp. 214-218 (09/2019).

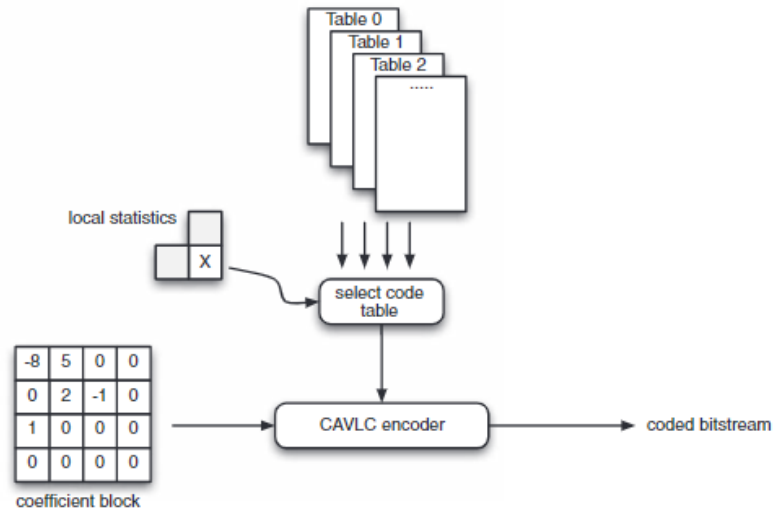

Figure 7.19 CAVLC encoder overview

Richardson at 211.

180. The coefficient number coding unit in the Amazon Coding Patents Accused Products further includes a variable length coding unit configured to perform variable length coding on the number of the non-zero coefficients included in the current block, by using the selected variable length code table. Figure 7.19, *supra*, shows a **C**ontext-**A**daptive **V**ariable-**L**ength **C**oding ("CAVLC") coding unit. The unit uses the selected variable length code table to perform variable length coding on the syntax element *coeff_token* representing the number of non-zero coefficients of the current macroblock to generate a H.264-compliant bitstream.[93]

181. VideoLabs representatives met with Amazon representatives at least on March 12, 2020 to present VideoLabs' platform and gauge Amazon's interest in joining as a partner or member.[94] Following the meeting, VideoLabs offered to provide more detail about its patent portfolio but Amazon did not respond. At least by August 5, 2021, so that patent licensing discussions could proceed, VideoLabs provided Amazon a list of VideoLabs' patents, including

[93] *See generally* H.264 Standard, Section 9.2.1 and Table 9-5, pp. 214-218 (09/2019).

[94] *See* Ex. 100 (VideoLabs presentation to Amazon).

all patents asserted in this First Amended Complaint.[95] On August 31, 2021, Amazon indicated that it had conducted an initial review of VideoLabs' patents, was in the process of conducting a deeper review of certain patents, and would get back to VideoLabs in a matter of weeks. But to date, months later, Amazon has not reengaged with VideoLabs.

182. Amazon of course knows how its products operate, and on information and belief, Amazon investigated the '878 Patent and its infringement of the Amazon Coding Patents Accused Products. Amazon has been given further notice of the '878 Patent and its infringement of the '878 Patent through the filing of the Complaint (Dkt. 1) on January 21, 2022, the service of infringement contentions on April 14, 2022, and the filing of this First Amended Complaint. On information and belief, Amazon is either knowingly infringing the '878 Patent or is willfully blind to its infringement, and continues to act in wanton disregard of VideoLabs' patent rights.

183. Despite becoming aware of or willfully blinding itself to its infringement of the '878 Patent, Amazon has nonetheless continued to engage in and has escalated its infringing activities by continuing to develop, advertise, make available, and use the infringing functionalities of the Amazon Coding Patents Accused Products. On information and belief, Amazon has made no attempts to design around the '878 Patent or otherwise stop its infringing behavior.

184. Amazon's infringement of the '878 Patent therefore has been and remains willful.

185. Amazon also indirectly infringes the '878 Patent by inducing others to infringe and contributing to the infringement of others, including third party users of the Amazon Coding Patents Accused Products in this District and throughout the United States. As described above, on information and belief, Amazon has known about the '878 Patent since at least August 5, 2021.

186. On information and belief, Amazon has actively induced the infringement of the

[95] *See* Ex. 101 (VideoLabs email to Amazon attaching portfolio listing).

'878 Patent under 35 U.S.C. § 271(b) by actively inducing the infringement of the Amazon Coding Patents Accused Products by third parties in the United States. Amazon knew or was willfully blind to the fact that its conduct would induce these third parties to act in a manner that infringes the '878 Patent in violation of 35 U.S.C. § 271(a).

187. Amazon actively encouraged and continues to actively encourage third parties to directly infringe the '878 Patent by, for example, marketing the Coding Patents Accused Products and infringing functionalities to consumers; working with consumers to implement, install and/or operate the Coding Patents Accused Products and infringing functionalities; fully supporting and managing consumers' continuing use of the Coding Patents Accused Products and infringing functionalities; and providing technical assistance to consumers during their continued use of the Coding Patents Accused Products and infringing functionalities.[96]

[96] *See e.g.,* Ex. 102, *Digital Service and Device Support*, AMAZON, https://www.amazon.com/gp/help/customer/display.html?nodeId=200127470 (last accessed Jan. 18, 2022) (customer service support for Amazon Prime Video, Fire TV devices, Fire Tablet devices, Amazon Kindle, and Amazon Glow); Ex. 103, *Alexa Devices Help*, AMAZON, https://www.amazon.com/gp/help/customer/display.html?nodeId=202009680 (last accessed Jan. 18, 2022) (customer service support for Amazon Echo Show and Amazon Echo Glow); Ex. 104, *Install Prime Video on Your Devices*, AMAZON, https://www.amazon.com/gp/help/customer/display.html?nodeId=GWX36LKK4FFEHMWA (last accessed Jan. 18, 2022); Ex. 105, Amazon Prime Video, *Welcome to Prime Video 2021*, YOUTUBE (Jan. 3, 2021), https://www.youtube.com/watch?v=C4vrcDgVnjE (Prime Video advertisement); Ex. 106, Amazon Fire TV, *Start Streaming with Fire TV*, YOUTUBE (May 12, 2021), https://www.youtube.com/watch?v=1NgJYYQqYqY (last accessed Jan. 18, 2022) (Fire TV advertisement); Ex. 107, Amazon News, *Introducing Amazon Glow—A Whole New Way to Bring Families Together for Fun and Learning*, YOUTUBE (Sep. 29, 2021), https://www.youtube.com/watch?v=Dlf01ksX5dI (last accessed Jan. 18, 2022) (Amazon Glow promotion); Ex. 108, *What is Elemental MediaConvert?*, AWS, https://docs.aws.amazon.com/mediaconvert/latest/ug/what-is.html (last accessed Jan. 18, 2022) (user guide for Elemental MediaConvert); Ex. 109, *AWS Elemental Server Resources*, AWS, https://aws.amazon.com/elemental-server/resources/ (last accessed Jan. 18, 2022); Ex. 110, *Amazon Elastic Transcoder Developer* Resources, AWS, https://aws.amazon.com/elastictranscoder/developer-resources/ (last accessed Jan. 18, 2022); Exs. 48-64.

188. On information and belief, Amazon contributorily infringes the '878 Patent under 35 U.S.C. § 271(c) by importing, selling, and/or offering to sell within the United States the Amazon Coding Patents Accused Products (or components thereof) that constitute a material part of the claimed invention and are not staple articles of commerce suitable for substantial non-infringing use. For example, the hardware and/or software for encoding content with H.264 using CAVLC is material, has no insubstantial non-infringing uses, and is known by Amazon to be especially made or adapted for use in a manner that infringes the '878 Patent.

COUNT II
INFRINGEMENT OF U.S. PATENT NO. 7,769,238

189. VideoLabs incorporates by reference the foregoing paragraphs of this First Amended Complaint as if fully set forth herein.

190. VL is the assignee and lawful owner of all right, title, and interest in and to the '238 Patent. The '238 Patent is valid and enforceable.

191. On information and belief, Amazon has infringed and continues to infringe the '238 Patent in violation of 35 U.S.C. § 271(a), either literally or through the doctrine of equivalents, by making, using, selling, offering for sale, and/or importing into the United States products and/or methods that practice claim 1 of the '238 Patent, including with respect to the Amazon Coding Patents Accused Products.

192. On information and belief, Amazon uses the Amazon Coding Patents Accused Products for its own business purposes. In addition, Amazon regularly conducts testing and troubleshooting of the Amazon Coding Patents Accused Products. Further, VideoLabs is informed and believes companies related to Amazon (e.g., AWS, Amazon, and Amazon's subsidiaries) use the '238 Amazon Accused Products.

193. On information and belief, Amazon's infringement through its use of H.264 entropy

decoding, described below, is exemplary of all of Amazon's infringement with respect to all the Amazon Coding Patents Accused Products.

194. The Amazon Coding Patents Accused Products directly infringe claim 1 of the '238 Patent by performing variable length decoding of coded blocks of picture data using the coded block data, inter-, intra-, and context-aware prediction to generate a predictive block, calculating a residual block using orthogonal transformation and quantization, and using the number of non-zero coefficients in the predicted block to reconstruct the picture data at the decoder.

195. Each of the Amazon Coding Patents Accused Products meet every limitation of claim 1 of the '238 Patent, which recites:

> 1. A receiving apparatus which receives multiplexed data which is obtained by multiplexing coded audio data and coded picture data, said receiving apparatus comprising:
>
> a demultiplexing unit configured to separate the multiplexed data into the coded audio data and the coded picture data;
>
> an audio processing unit configured to decode the separated coded audio data; and
>
> a picture decoding unit configured to decode the separated coded picture data,
>
> wherein said picture decoding unit includes a block decoding unit configured to decode coded block data included in the coded picture data, the coded block data being obtained by dividing a picture signal into plural blocks, generating a residual block image from a block image of the respective blocks and a predictive block image obtained by intra-picture prediction or inter-picture prediction, and coding, on a block basis, coefficients obtained by performing orthogonal transformation and quantization on the residual block image,
>
> said block decoding unit includes:
>
> a coefficient number decoding unit configured to decode the coded block data to obtain the number of non-zero coefficients which are coefficients included in a current block to be decoded and having a value other than "0";
>
> a unit configured to obtain coefficients corresponding to a residual block image of the current block by decoding the coded block data;

> a unit configured to obtain the residual block image of the current block by performing inverse quantization and inverse orthogonal transformation on the coefficients corresponding to the residual block image of the current block; and
>
> a reproducing unit configured to reproduce a block image of the current block, from the obtained residual block image and a predictive block image obtained by intra-picture prediction or inter-picture prediction,
>
> said coefficient number decoding unit includes:
>
> a determining unit configured to determine a predictive value for the number of non-zero coefficients included in the current block based on the number of non-zero coefficients included in a decoded block located on a periphery of the current block;
>
> a selecting unit configured to select a variable length code table based on the determined predictive value; and
>
> a variable length decoding unit configured to perform variable length decoding on a coded stream which is generated by coding the number of the non-zero coefficients included in the current block, by using the selected variable length code table.

196. Each of the Amazon Coding Patents Accused Products includes a receiving apparatus that receives multiplexed data, which is obtained by multiplexing coded audio data and coded picture data. H.264 carries audio and video multiplexed in a single stream. H.264 is directed to the picture portion of video, so devices containing H.264 encoders and decoders must multiplex/demultiplex audio and picture data in order to obtain the H.264 picture data. Encoders multiplex the audio and pictures into a single stream, so that decoders receive the complete video presentation, including sound. Decoders receive the complete video presentation, including sound, and decode the stream to recreate the video. In the ISO Media File Format, which each accused H.264 product is capable of processing, a coded stream such as an H.264 video sequence or an audio stream is stored as a track, representing a sequence of coded data items or samples. Figure 8.32, below, illustrates an example of such multiplexed data, in which coded audio data ("audio track samples") and coded picture data ("video track samples") are multiplexed together.

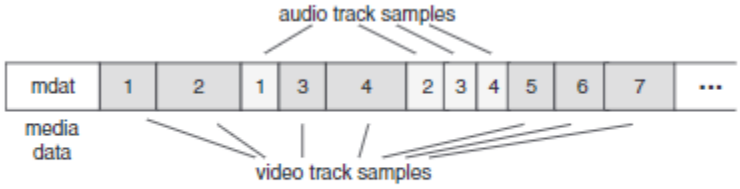

Figure 8.32 ISO Media File

Ex. 29, Richardson, at 247.

197. The Amazon Coding Patents Accused Products include a demultiplexing unit configured to separate the multiplexed data into the coded audio data and the coded picture data. Since the coded audio data and the coded picture data are decoded by separate respective decoders, it is necessary to first demultiplex the audio track samples and video track samples in order to reproduce the encoded data in its entirety. Figure 8.32 below shows the multiplexed stream of an ISO Media File as received at the demultiplexing unit, which includes coded audio data ("audio track samples") and coded picture data ("video track samples"). The coded audio data and the coded picture data are demultiplexed and sent to respective decoders for further processing.

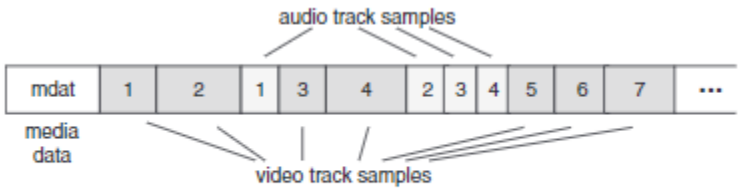

Figure 8.32 ISO Media File

Ex. 29, Richardson, at 247.

198. The Amazon Coding Patents Accused Products have an audio processing unit configured to decode the separated coded audio data. For example, the Amazon Coding Patents Accused Products incorporate an audio codec that is configured to decode audio data according to

one of several formats, including without limitation, Dolby Atmos, AC3, AAC, FLAC, MIDI, and MP3.

199. The Amazon Coding Patents Accused Products further include a picture decoding unit configured to decode the separated coded picture data. For example, the Amazon Coding Patents Accused Products incorporate a H.264 video codec that is configured to decode a H.264 encoded bitstream.

200. The picture decoding unit in the Amazon Coding Patents Accused Products includes a block decoding unit configured to decode coded block data included in the coded picture data, the coded block data being obtained by dividing a picture signal into plural blocks.

201. The Amazon Coding Patents Accused Products decode picture data that has been coded by an H.264-compliant encoder which divides a picture signal into macroblocks, generates a residual block image from a block image of the respective blocks and a predictive block image obtained by intra-picture prediction or inter-picture prediction, and codes, on a block basis, coefficients obtained by performing orthogonal transformation and quantization on the residual block image to generate a H.264-compliant bitstream.

202. The process of dividing the picture signal into macroblocks is shown in Figure 6-7:

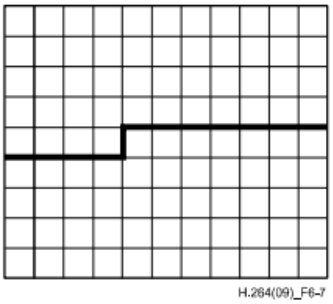

Figure 6-7 – A picture with 11 by 9 macroblocks that is partitioned into two slices

Id. at Figure 6-7.

203. The macroblock consists of a 16 x 16 block of luma samples and two corresponding blocks of chroma samples. A macroblock can be further partitioned for inter-prediction forming segmentations for motion representation as small as a block of 4 x 4 luma samples.[97]

204. A residual block image is generated from the block image of the respective blocks and a predictive block image is obtained by intra-picture prediction or inter-picture prediction by an H.264-compliant encoder. For example, Figure 6.6 below shows a picture signal to be coded, with the macroblock being coded highlighted. The macroblock is predicted using neighboring, previously-encoded samples, as shown in Figure 6.7; because this prediction looks only to the other macroblocks of the same picture, this is called intra-picture prediction. The predicted macroblock is shown in Figure 6.7. Figure 6.8 shows the prediction (Figure 6.7) subtracted from the original (Figure 6.6), which is called the residual.

Figure 6.6 QCIF frame with highlighted macroblock

Figure 6.7 Predicted luma frame formed using H.264 intra prediction

Figure 6.8 Residual after subtracting intra prediction

Ex. 29, Richardson, at 141-143.

205. Intra- and inter- picture prediction can be used by the H.264-compliant encoder to calculate the residual. Inter-picture coding predicts the value of the macroblock using temporal statistical dependencies between different pictures.

206. An H.264-compliant encoder codes, on a block basis, coefficients obtained by

[97] *See* Ex. 47, H.264 Standard, Section 0.6.3, p. 5 (09/2019).

performing orthogonal transformation and quantization on the residual block image. H.264 specifies an *entropy_coding_mode* flag that dictates the entropy encoding algorithm used to encode the picture data. When this flag is set to "0" the residual block data is coded using a CAVLC scheme.[98] In such case, the resulting prediction residual is split into 4x4 blocks, and transformation and quantization are applied. An integer transform is applied to the residual, outputting a set of coefficient weighting values. This process is shown in the figures below:

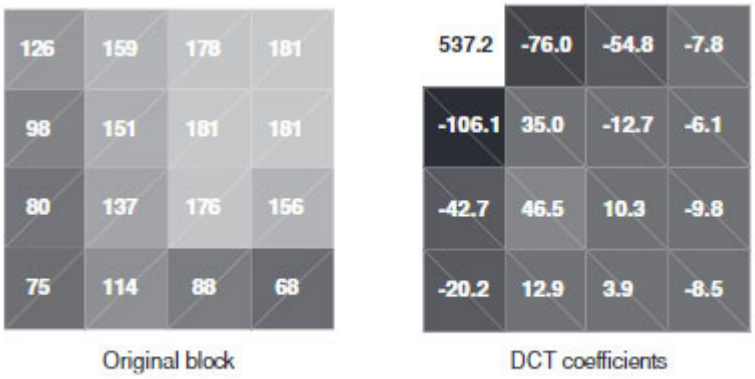

Figure 3.31 Close-up of 4 × 4 block; DCT coefficients

Ex. 29, Richardson, at 47.

[98] *See* Ex. 47, H.264 Standard, Section 7.4.2.2, pp. 81-82 (09/2019).

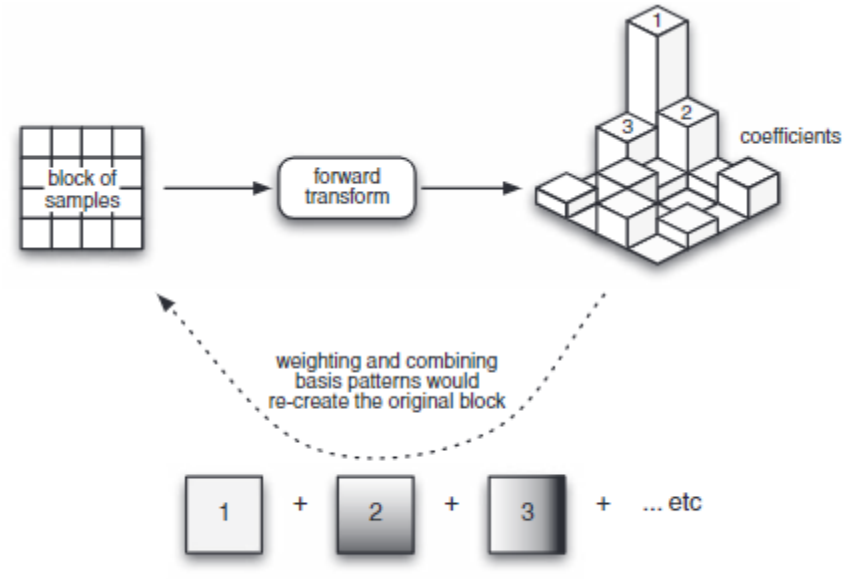

Figure 4.11 Forward transform

Richardson at 88.

207. The coefficients are then quantized, meaning that insignificant coefficient values are rounded down (for example, to zero), while a small number of significant, non-zero coefficients are retained. The quantization step is shown in Figure 4.12:

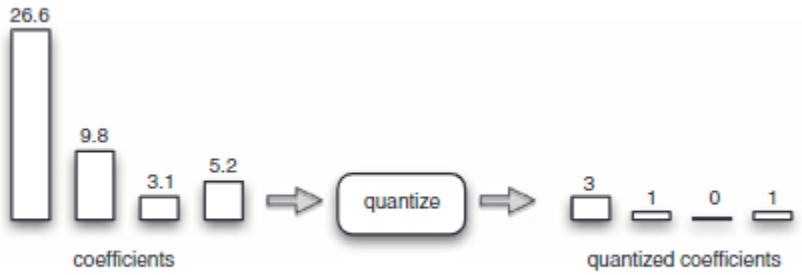

Figure 4.12 Quantization example

Ex. 29, Richardson, at 88.

208. These quantized coefficients are rescaled to obtain similar coefficients at the decoder, as shown in Figure 4.14:

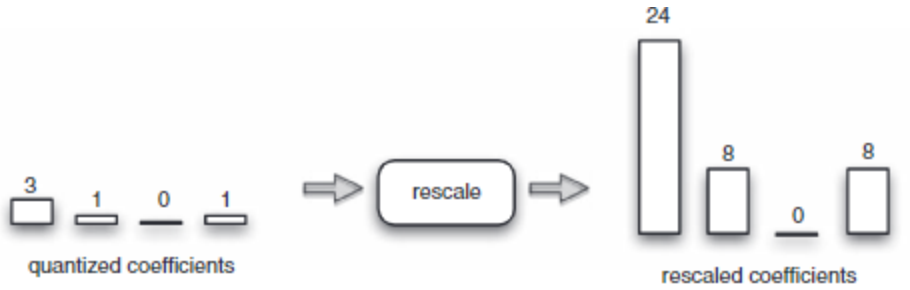

Figure 4.14 Rescaling example

Richardson at 89.

209. The encoding process is shown in Figure 4.4:

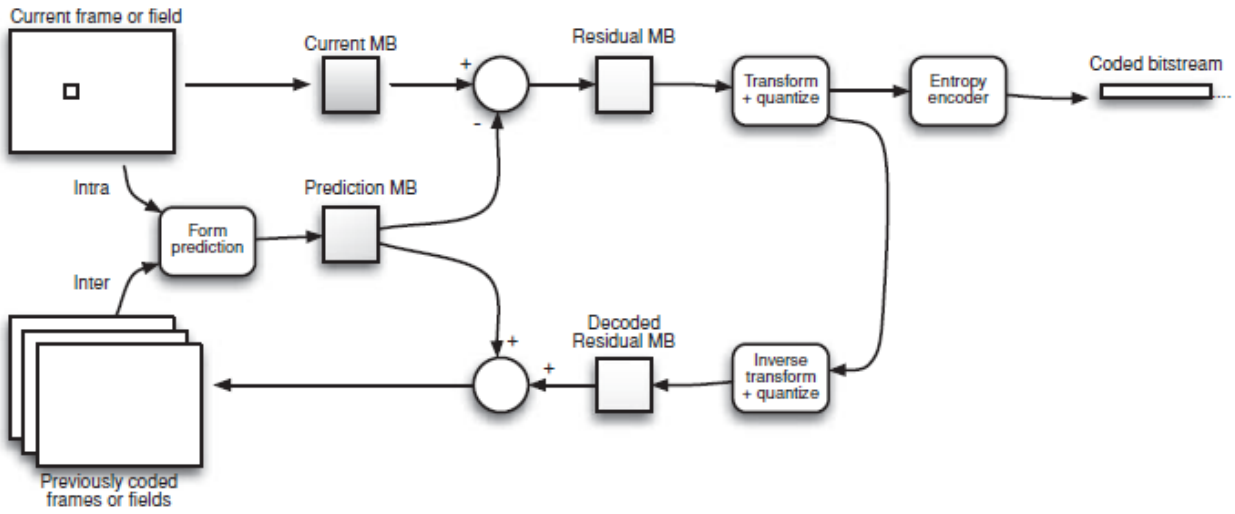

Figure 4.4 Typical H.264 encoder

Ex. 29, Richardson, at 84.

210. In the Amazon Coding Patents Accused Products the block decoding unit includes a coefficient number decoding unit configured to decode the coded block data to obtain the number of non-zero coefficients which are coefficients included in a current block to be decoded and have a value other than "0." In H.264, the total number of non-zero coefficients in the current block is encoded by the variable *coeff_token*. The coefficient number decoding unit in the Amazon Coding Patents Accused Products is configured to decode the coded block data by executing the function

TotalCoeff(*coeff_token*) to return the number of non-zero transform coefficient levels derived from *coeff_token*.[99] A "level" in this context is the value of a transform coefficient prior to scaling.[100]

211. The block decoding unit in the Amazon Coding Patents Accused Products also includes a unit configured to obtain coefficients corresponding to a residual block image of the current block by decoding the coded block data. H.264-compliant decoders read the encoded residual macroblock data and extract the coefficients located in that data. This extraction is called parsing. The parsed data is then inverse quantized and inverse orthogonal transforms are applied to reconstruct the residual macroblock. The H.264 decoding process in this instance employs a CAVLC parsing process to obtain a list of transform coefficient levels (coeffLevel) of the luma block or the chroma block.[101]

212. The block decoding unit in the Amazon Coding Patents Accused Products further includes a unit configured to obtain the residual block image of the current block by performing inverse quantization and inverse orthogonal transformation on the coefficients corresponding to the residual block image of the current block. Once the residual luma and chroma coefficient blocks are extracted, the H.264-compliant decoder calculates a quantization parameter, and carries out inverse quantization and inverse transformation to (re)produce the residual sample blocks.[102]

213. The block decoding unit in the Amazon Coding Patents Accused Products also includes a reproducing unit configured to reproduce a block image of the current block, from the obtained residual block image and a predictive block image obtained by intra-picture prediction or

[99] *See* Ex. 47, H.264 Standard, Section 7.4.5.3.2, p. 110 (09/2019).

[100] *See* Ex. 47, H.264 Standard, Section 3.175 (transform coefficient level definition), p. 15 (09/2019).

[101] *See* Ex. 47, H.264 Standard, Section 9.2-9.2.4, pp. 214-223 (09/2019).

[102] *See* Ex. 29, Richardson, at 96.

inter-picture prediction. For each macroblock, the H.264 decoder forms an identical prediction to the one created by the encoder using inter-picture prediction from previously-decoded frames or intra-picture prediction from previously-decoded samples in the current frame. The decoder adds the prediction to the decoded residual to reconstruct a decoded macroblock which can then be displayed as part of a video frame. This reconstruction of a macroblock at the decoder can be seen in Figure 4.17:

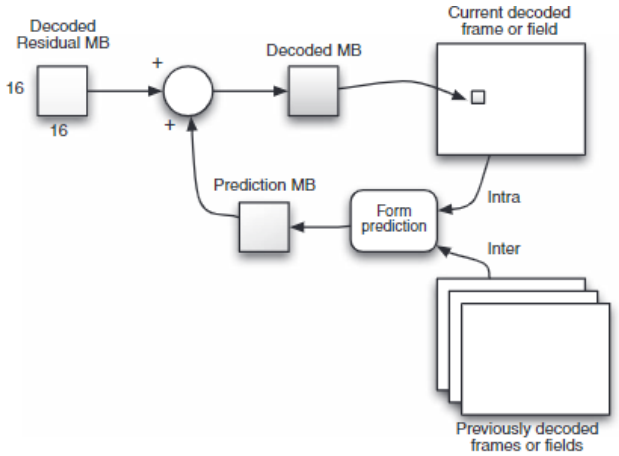

Figure 4.17 Reconstruction flow diagram

Richardson at 91.

214. The decoding process is shown in Figure 4.21:

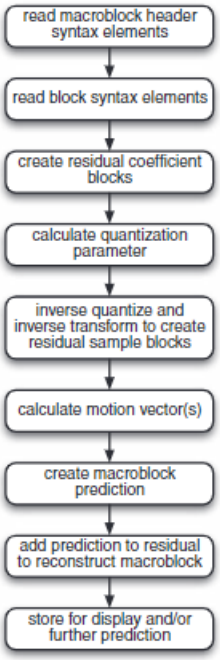

Figure 4.21 P-macroblock decoding process

Ex. 29, Richardson, at 96.

215. The coefficient number decoding unit in the Amazon Coding Patents Accused Products includes a determining unit configured to determine a predictive value for the number of non-zero coefficients included in the current block based on the number of non-zero coefficients included in a decoded block located on a periphery of the current block. Since CAVLC is a context-adaptive variable length coding technique, the number of non-zero coefficients in neighboring blocks is correlated as part of the entropy decoding process. An H.264-compliant decoder uses previously-processed macroblocks to help decode the currently-processed macroblock. The number of non-zero coefficients in previously-processed blocks on the periphery — including the blocks to the left and above the current macroblock — are used to predict the number of non-zero coefficients in the current block. This use of the blocks of the periphery is shown in Figure 6-14:

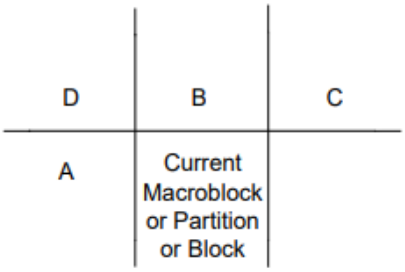

Figure 6-14 – Determination of the neighbouring macroblock, blocks, and partitions (informative)

Ex. 47, H.264 Standard, at 33.

216. The H.264-compliant decoder in the Amazon Coding Patents Accused Products obtains the number of non-zero coefficients in the left and above blocks to set the variable *nC*, the prediction of the current macroblock's number of non-zero coefficients based on the neighboring macroblocks' number of non-zero coefficients.[103]

217. The coefficient number decoding unit in the Amazon Coding Patents Accused Products also includes a selecting unit configured to select a variable length code table based on the determined predictive value. The H.264-compliant decoder in the Amazon Coding Patents Accused Products uses the predictive value *nC* to select one of six variable length coding tables specified in Table 9-5 of the H.264 standard in order to decode the H.264-compliant bitstream.[104]

218. The coefficient number decoding unit in the Amazon Coding Patents Accused Products further includes a variable length decoding unit configured to perform variable length decoding on a coded stream which is generated by coding the number of the non-zero coefficients included in the current block, by using the selected variable length code table. At the H.264-compliant CAVLC decoder, the selected variable length code table will be used to decode the syntax element *coeff_token*, in the H.264-compliant bitstream, which represents the number of

[103] *See* Ex. 47, H.264 Standard, Section 9.2.1, pp. 214-216 (09/2019).

[104] *See* Ex. 47, H.264 Standard, Section 9.2.1 and Table 9-5, pp. 214-218 (09/2019).

non-zero coefficients in the macroblock.[105]

219. VideoLabs representatives met with Amazon representatives at least on March 12, 2020 to present VideoLabs' platform and gauge Amazon's interest in joining as a partner or member.[106] Following the meeting, VideoLabs offered to provide more detail about its patent portfolio but Amazon did not respond. At least by August 5, 2021, so that patent licensing discussions could proceed, VideoLabs provided Amazon a list of VideoLabs' patents, including all patents asserted in this First Amended Complaint.[107] On August 31, 2021, Amazon indicated that it had conducted an initial review of VideoLabs' patents, was in the process of conducting a deeper review of certain patents, and would get back to VideoLabs in a matter of weeks. But to date, months later, Amazon has not reengaged with VideoLabs.

220. Amazon of course knows how its products operate, and on information and belief, Amazon investigated the '238 Patent and its infringement of the Amazon Coding Patents Accused Products. Amazon has been given further notice of the '238 Patent and its infringement of the '238 Patent through the filing of the Complaint (Dkt. 1) on January 21, 2022, the service of infringement contentions on April 14, 2022, and the filing of this First Amended Complaint. On information and belief, Amazon is either knowingly infringing the '238 Patent or is willfully blind to its infringement, and continues to act in wanton disregard of VideoLabs' patent rights.

221. Despite becoming aware of or willfully blinding itself to its infringement of the '238 Patent, Amazon has nonetheless continued to engage in and has escalated its infringing activities by continuing to develop, advertise, make available, and use the infringing functionalities

[105] *See generally* H.264 Standard, Section 9.2.1 and Table 9-5, pp. 214-218 (09/2019).

[106] *See* Ex. 100 (VideoLabs presentation to Amazon).

[107] *See* Ex. 101 (VideoLabs email to Amazon attaching portfolio listing).

of the Amazon Coding Patents Accused Products. On information and belief, Amazon has made no attempts to design around the '238 Patent or otherwise stop its infringing behavior.

222. Amazon's infringement of the '238 Patent therefore has been and remains willful.

223. Amazon also indirectly infringes the '238 Patent by inducing others to infringe and contributing to the infringement of others, including third-party users of the Amazon Coding Patents Accused Products in this District and throughout the United States. As described above, on information and belief, Amazon has known about the '238 Patent since at least August 5, 2021.

224. On information and belief, Amazon has actively induced the infringement of the '238 Patent under 35 U.S.C. § 271(b) by actively inducing the infringement of the Amazon Coding Patents Accused Products by third parties in the United States. Amazon knew or was willfully blind to the fact that its conduct would induce these third parties to act in a manner that infringes the '238 Patent in violation of 35 U.S.C. § 271(a).

225. Amazon actively encouraged and continues to actively encourage third parties to directly infringe the '238 Patent by, for example, marketing the Coding Patents Accused Products and infringing functionalities to consumers; working with consumers to implement, install and/or operate the Coding Patents Accused Products and infringing functionalities; fully supporting and managing consumers' continuing use of the Coding Patents Accused Products and infringing functionalities; and providing technical assistance to consumers during their continued use of the Coding Patents Accused Products and infringing functionalities.[108]

[108] *See e.g.,* Ex. 102, *Digital Service and Device Support*, AMAZON, https://www.amazon.com/gp/help/customer/display.html?nodeId=200127470 (last accessed Jan. 18, 2022) (customer service support for Amazon Prime Video, Fire TV devices, Fire Tablet devices, Amazon Kindle, and Amazon Glow); Ex. 103, *Alexa Devices Help*, AMAZON, https://www.amazon.com/gp/help/customer/display.html?nodeId=202009680 (last accessed Jan. 18, 2022) (customer service support for Amazon Echo Show and Amazon Echo Glow); Ex. 104,

226. For example, Amazon induces third parties to infringe the '238 Patent by at least encouraging them to install and operate the Amazon Prime Video streaming service, which, when used, will result in infringement of the '238 Patent. Amazon advertises and promotes its Amazon Prime Video streaming service on its website and in various app stores such as Apple's app store and Android's app store in connection with the Amazon Prime Video mobile application that can be installed on consumers' respective connected iOS and Android devices (as well as others), and encourages consumers to configure and operate their mobile and computer devices in an infringing manner.[109] In response, consumers acquire, configure, and operate the Amazon Prime Video streaming service in an infringing manner.

227. On information and belief, Amazon contributorily infringes the '238 Patent under 35 U.S.C. § 271(c) by importing, selling, and/or offering to sell within the United States the Amazon Coding Patents Accused Products (or components thereof) that constitute a material part

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Install Prime Video on Your Devices, AMAZON, https://www.amazon.com/gp/help/customer/display.html?nodeId=GWX36LKK4FFEHMWA (last accessed Jan. 18, 2022); Ex. 105, Amazon Prime Video, *Welcome to Prime Video 2021*, YOUTUBE (Jan. 3, 2021), https://www.youtube.com/watch?v=C4vrcDgVnjE (Prime Video advertisement); Ex. 106, Amazon Fire TV, *Start Streaming with Fire TV*, YOUTUBE (May 12, 2021), https://www.youtube.com/watch?v=1NgJYYQqYqY (last accessed Jan. 18, 2022) (Fire TV advertisement); Ex. 107, Amazon News, *Introducing Amazon Glow—A Whole New Way to Bring Families Together for Fun and Learning*, YOUTUBE (Sep. 29, 2021), https://www.youtube.com/watch?v=Dlf01ksX5dI (last accessed Jan. 18, 2022) (Amazon Glow promotion); Ex. 108, *What is Elemental MediaConvert?*, AWS, https://docs.aws.amazon.com/mediaconvert/latest/ug/what-is.html (last accessed Jan. 18, 2022) (user guide for Elemental MediaConvert); Ex. 109, *AWS Elemental Server Resources*, AWS, https://aws.amazon.com/elemental-server/resources/ (last accessed Jan. 18, 2022); Ex. 110, *Amazon Elastic Transcoder Developer Resources*, AWS, https://aws.amazon.com/elastictranscoder/developer-resources/ (last accessed Jan. 18, 2022); Exs. 48-64.

[109] *See e.g.,* Ex. 111, *Prime Video – Amazon Customer Service*, AMAZON, https://www.amazon.com/gp/help/customer/display.html?nodeId=G9SY6AQJV45JFMET (last accessed Jan. 18, 2022); Ex. 104, *Install Prime Video on Your Devices*, AMAZON, https://www.amazon.com/gp/help/customer/display.html?nodeId=GWX36LKK4FFEHMWA (last accessed Jan. 18, 2022).

of the claimed invention and are not staple articles of commerce suitable for substantial non-infringing use. For example, the hardware and/or software for decoding content with H.264 using CAVLC is material, has no insubstantial non-infringing uses, and is known by Amazon to be especially made or adapted for use in a manner that infringes the '238 Patent.

COUNT III
INFRINGEMENT OF U.S. PATENT NO. 7,970,059

228. VideoLabs incorporates by reference the foregoing paragraphs of this First Amended Complaint as if fully set forth herein.

229. VL is the assignee and lawful owner of all right, title, and interest in and to the '059 Patent. The '059 Patent is valid and enforceable.

230. On information and belief, Amazon has infringed and continues to infringe the '059 Patent in violation of 35 U.S.C. § 271(a), either literally or through the doctrine of equivalents, by making, using, selling, offering for sale, and/or importing into the United States products and/or methods that practice at least claim 3 of the '059 Patent, including with respect to the Amazon Coding Patents Accused Products.

231. On information and belief, Amazon uses the Amazon Coding Patents Accused Products for its own business purposes. In addition, Amazon regularly conducts testing and troubleshooting of the Amazon Coding Patents Accused Products. Further, VideoLabs is informed and believes companies related to Amazon (e.g., AWS, Amazon, and Amazon's subsidiaries) use the '059 Amazon Accused Products.

232. On information and belief, Amazon's infringement through its use of H.264 entropy coding, described below, is exemplary of all of Amazon's infringement with respect to all the Amazon Coding Patents Accused Products.

233. The Amazon Coding Patents Accused Products directly infringe at least claim 3 of

the ’059 Patent by, for example, performing arithmetic decoding of coded blocks of picture data, where the probability table to be used is switched to another probability table in one direction, when the arithmetic-coded absolute values of the coefficient values include an absolute value exceeding a predetermined threshold value.

234. Each of the Amazon Coding Patents Accused Products meet every limitation of claim 3 of the ’059 Patent, which recites:

> 3. A decoding method comprising:
>
> receiving multiplexed data obtained by multiplexing (i) coded picture data that is obtained by coding a moving picture and (ii) audio data that is obtained by coding an audio signal;
>
> demultiplexing the multiplexed data received in said receiving into the coded picture data and the audio data;
>
> decoding the coded picture data into a first bit of binary data corresponding to each absolute value of coefficients of a two-dimensional array of frequency components, on a block basis, according to a predetermined scanning order starting at a high frequency component toward a low frequency component by using a plurality of probability tables, the coefficients being generated by frequency transformation performed on picture data of a block which has a predetermined size of pixels;
>
> switching between the plurality of probability tables, from a current probability table for the first bit of the binary data corresponding to a first coefficient to be decoded, to a new probability table for the first bit of the binary data corresponding to a second coefficient to be decoded, based on a result of a comparison between an absolute value of the first coefficient to be decoded and a predetermined threshold value; and
>
> decoding audio data;
>
> wherein, in said switching, the switching between the plurality of probability tables (i) is performed in a predetermined one direction within each block such that each of the probability tables, which has been used for performing arithmetic decoding on the first bit of the binary data corresponding to an already decoded coefficient before switching to the new probability table, is not used within each block after switching to the new probability table, and (ii) is not performed in the direction opposite to the predetermined one direction regardless of the result of the comparison,

wherein, within each block, if a predetermined one of the plurality of probability tables has been used to perform arithmetic decoding, in said switching, the switching between the plurality of probability tables is not performed regardless of the result of the comparison,

wherein the coded picture data and the audio data are coded by an arithmetic coding apparatus,

wherein the arithmetic coding apparatus includes: a coefficients scanning unit configured to scan coefficients of frequency components, which are generated by frequency transformation performed on the picture data of a block which has a predetermined size of pixels, in a predetermined scanning order starting at a high frequency component toward a low frequency component;

a converting unit configured to convert each absolute value of the coefficients into binary data;

an arithmetic coding unit configured to perform arithmetic coding on a first bit of the binary data corresponding to each absolute value of the coefficients according to the predetermined scanning order by using a plurality of probability tables:

a switching unit configured to switch between the plurality of probability tables, from a current probability table for the first bit of the binary data corresponding to a first coefficient to be coded, to a new probability table for the first bit of the binary data corresponding to a second coefficient to be coded, based on a result of a comparison between an absolute value of the first coefficient to be coded and a predetermined threshold value; and

an audio coding unit configured to code an audio signal, wherein said switching unit is configured (i) to switch between the plurality of probability tables in a predetermined one direction within each block such that each of the probability tables, which has been used for performing arithmetic coding on the first bit of the binary data corresponding to an already coded coefficient before switching to the new probability table, is not used within each block after switching to the new probability table, and (ii) not to switch between the plurality of probability tables in the direction opposite to the predetermined one direction regardless of the result of the comparison, and

wherein, within each block, if a predetermined one of the plurality of probability tables has been used to perform arithmetic coding, said switching unit is configured not to switch between the plurality of probability tables regardless of the result of the comparison.

235. Each of the Amazon Coding Patents Accused Products perform decoding by receiving multiplexed data, which is obtained by multiplexing coded picture data and coded audio

data, and then demultiplexing the multiplexed data into coded picture data and coded audio data. H.264 carries audio and video multiplexed in a single stream. H.264 is directed to the picture portion of video, so devices containing H.264 encoders and decoders must multiplex/demultiplex picture and audio data in order to obtain the H.264 picture data. Encoders multiplex the audio and pictures into a single stream, so that decoders receive the complete video presentation, including sound. Decoders receive the complete video presentation, including sound, and decode the stream to recreate the video. In the ISO Media File Format, which each accused H.264 product is capable of processing, a coded stream such as an H.264 video sequence or an audio stream is stored as a track, representing a sequence of coded data items or samples. Figure 8.32, below, illustrates an example of such multiplexed data, in which coded audio data ("audio track samples") and coded picture data ("video track samples") are multiplexed together:

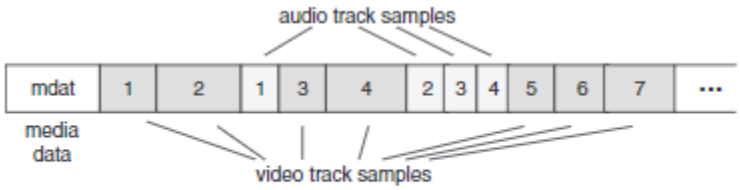

Figure 8.32 ISO Media File

Ex. 29, Richardson, at 247.

236. In the Amazon Coding Patents Accused Products, since the coded audio data and the coded picture data are decoded by separate respective decoders, it is necessary to first demultiplex the audio track samples and video track samples in order to reproduce the encoded data in its entirety. Figure 8.32 below shows the multiplexed stream of an ISO Media File as received, which includes coded audio data ("audio track samples") and coded picture data ("video track samples"). The coded audio data and the coded picture data are demultiplexed and sent to

respective decoders for further processing.

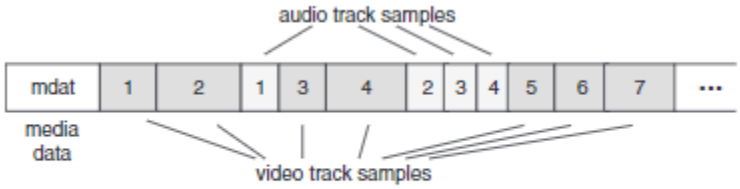

Figure 8.32 ISO Media File

Ex. 29, Richardson, at 247.

237. H.264-compliant decoders use one of two entropy decoders (CAVLC and CABAC) to extract binary data from a coded bitstream. Entropy encoders compress the parameters of the H.264 prediction model to remove statistical redundancy in the data, and then produce a H.264-compliant compressed bit stream or file for storage and/or transmission.

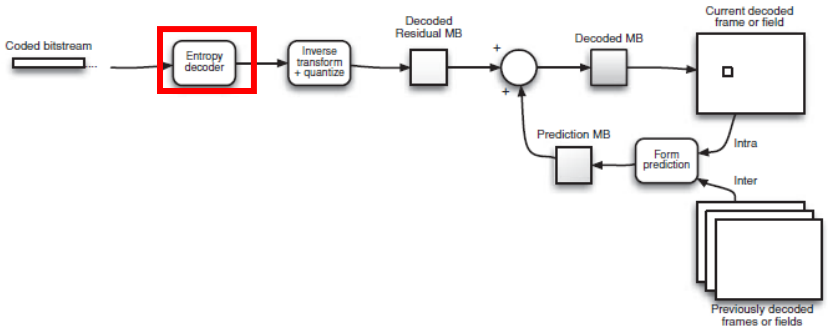

Figure 4.5 Typical H.264 decoder

Ex. 29, Richardson, at 85.

238. In the Amazon Coding Patents Accused Products, the H.264 decoder decodes the coded picture data into a first bit of binary data corresponding to each absolute value of coefficients of a two-dimensional array of frequency components, on a block basis, according to a predetermined scanning order starting at a high frequency component toward a low frequency component by using a plurality of probability tables, where the coefficients are generated by

frequency transformation performed on picture data of a block which has a predetermined size of pixels.

239. The H.264-compliant compressed bit stream or file sequence representing the coded picture data consists of coded prediction parameters, coded residual coefficients, and header information.

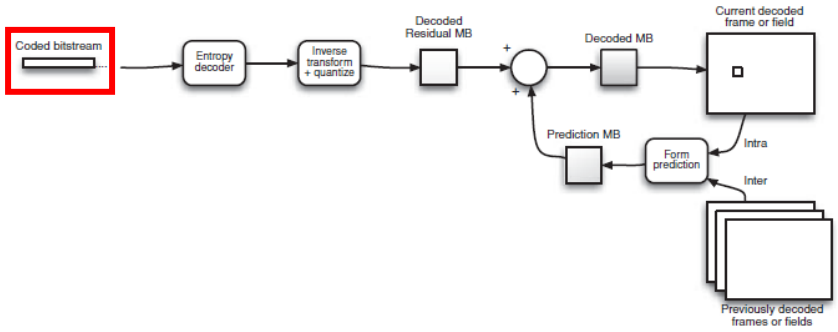

Figure 4.5 Typical H.264 decoder

Ex. 29, Richardson, at 85.

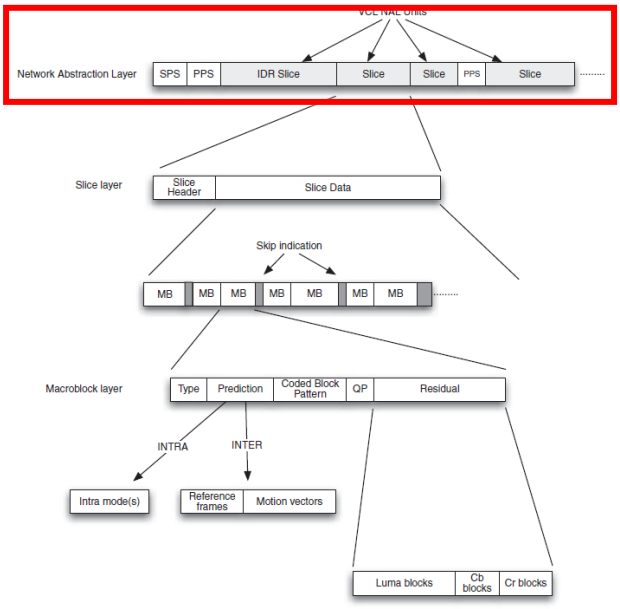

Figure 5.1 Syntax overview

Ex. 29, Richardson, at 100.

240. In accordance with the H.264 standard, H.264-compliant decoders, such as those in

the Amazon Coding Patents Accused Products, operate on a macroblock, consisting of a 16 x 16 block of luma samples and two corresponding blocks of chroma samples. For example, picture data is coded in accordance with H.264 by dividing a picture signal into macroblocks, as shown in Figure 6-7:

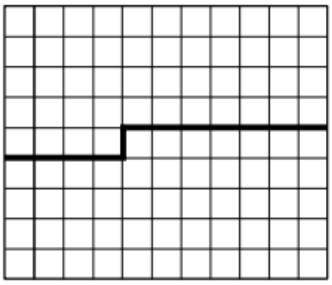

Figure 6-7 – A picture with 11 by 9 macroblocks that is partitioned into two slices

Id. at Figure 6-7.

241. The picture macroblocks are used to generate a residual block image. This residual may be obtained using intra- or inter- picture prediction. For example, Figure 6.6 below shows a picture signal to be coded, with the macroblock being coded highlighted. The macroblock is predicted using neighboring, previously-encoded samples, as shown in Figure 6.7; because this prediction looks only to the other macroblocks of the same picture, this is called intra-picture prediction. The predicted macroblock is shown in Figure 6.7. Figure 6.8 shows the prediction (Figure 6.7) subtracted from the original (Figure 6.6), which is called the residual.

Figure 6.6 QCIF frame with highlighted macroblock

Figure 6.7 Predicted luma frame formed using H.264 intra prediction

Figure 6.8 Residual after subtracting intra prediction

Ex. 29, Richardson, at 141-143.

242. H.264-compliant encoders can use intra- and inter- picture coding on the macroblocks of a picture signal. Inter-picture coding predicts the value of the macroblock using temporal statistical dependencies between different pictures. Both types of prediction can be used to calculate the residual.

243. The resulting prediction residual is split into 4x4 blocks, and transformation and quantization are applied. An integer transform is applied to the residual, outputting a set of coefficient weighting values. This process is shown in the figures below:

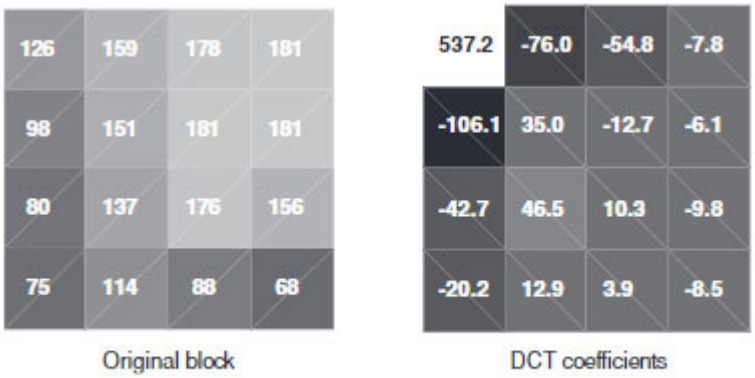

Figure 3.31 Close-up of 4 × 4 block; DCT coefficients

Ex. 29, Richardson, at 47.

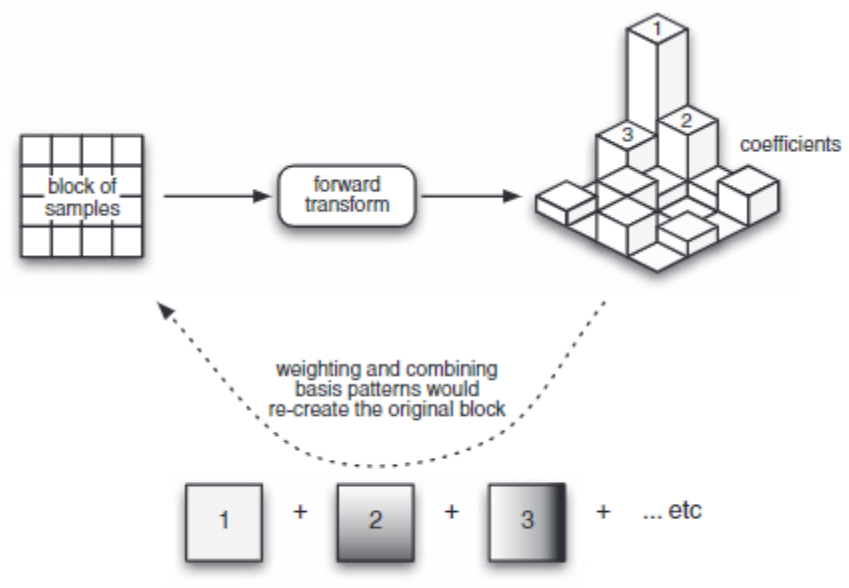

Figure 4.11 Forward transform

Ex. 29, Richardson, at 88.

244. H.264 specifies an *entropy_coding_mode* flag that dictates the entropy encoding algorithm used to encode the picture data. When this flag is set to "1" the residual block data is coded using a CABAC scheme.[110] In H.264, CABAC coding a data symbol involves binarizing the frequency transform coefficients, in scan order, and then further encoding the binary codes. Since CABAC is a context-adaptive binary arithmetic coding technique, it relies on probability model ("context model") selection for one or more bins of the binarized code. Context models and binarization schemes are specified in the H.264 standard.[111] The context model stores the probability of each bin being "1" or "0". An H.264-compliant arithmetic coder then encodes each bin according to the selected probability model and the selected context model is updated based

[110] *See* Ex. 47, H.264 Standard, Section 7.4.2.2, pp. 81-82 (09/2019).

[111] *See* Ex. 47, H.264 Standard, Section 9.3, pp. 223-278 (09/2019).

on the actual coded value for further encoding.[112] The H.264 decoder in the Amazon Coding Patents Accused Products reverses this process to decode the picture data.

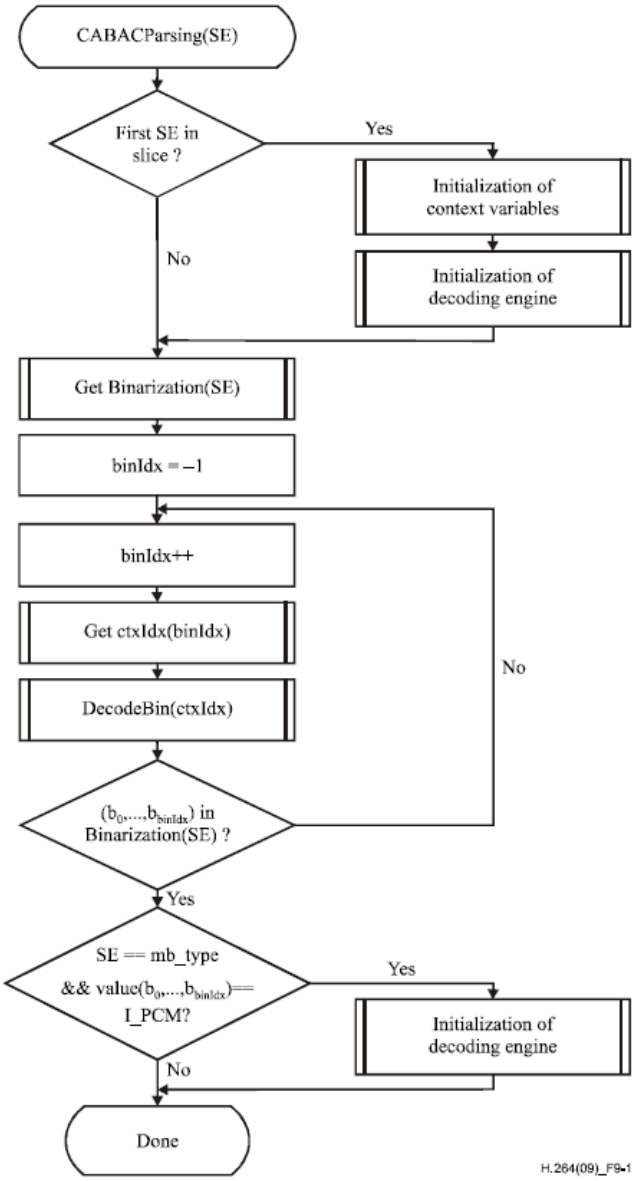

Figure 9-1 – Illustration of CABAC parsing process for a syntax element SE (informative)

245. The Amazon Coding Patents Accused Products perform CABAC decoding by switching between the plurality of probability tables, from a current probability table for the first

[112] *See* Ex. 47, H.264 Standard, Sections 7.4.5.3.3, 9.3, and Figure 9-1, pp. 110-111, 223-278 (09/2019).

bit of the binary data corresponding to a first coefficient to be decoded, to a new probability table for the first bit of the binary data corresponding to a second coefficient to be decoded.

246. In accordance with H.264 standard requirements, at the beginning of each coded slice, the context models are initialized. Initializing the context models produces context model tables that are accessed by index "ctxIdx".[113] The CABAC decoding engine in the Amazon Coding Patents Accused Products applies a specific table to decode each bin of a H.264 syntax element, such as the residual block. In particular, the H.264 standard defines six sets of probability tables assigned to residual block types. Residual blocks in categories 0-4 are assigned a group of tables starting at table ctxIdx_227. LumaLevel8x8 blocks (category 5) are assigned a group of tables starting at table ctxIdx_426. The first table within a group is denoted as ctxIdxOffset.[114]

[113] *See* Ex. 47, H.264 Standard, Section 9.3.1, Table 9-11, pp. 225-228 (09/2019).

[114] *See* Ex. 47, H.264 Standard, Section 9.3.3.1.3, Tables 9-34 and 9-42, pp. 249-251, 267-270.

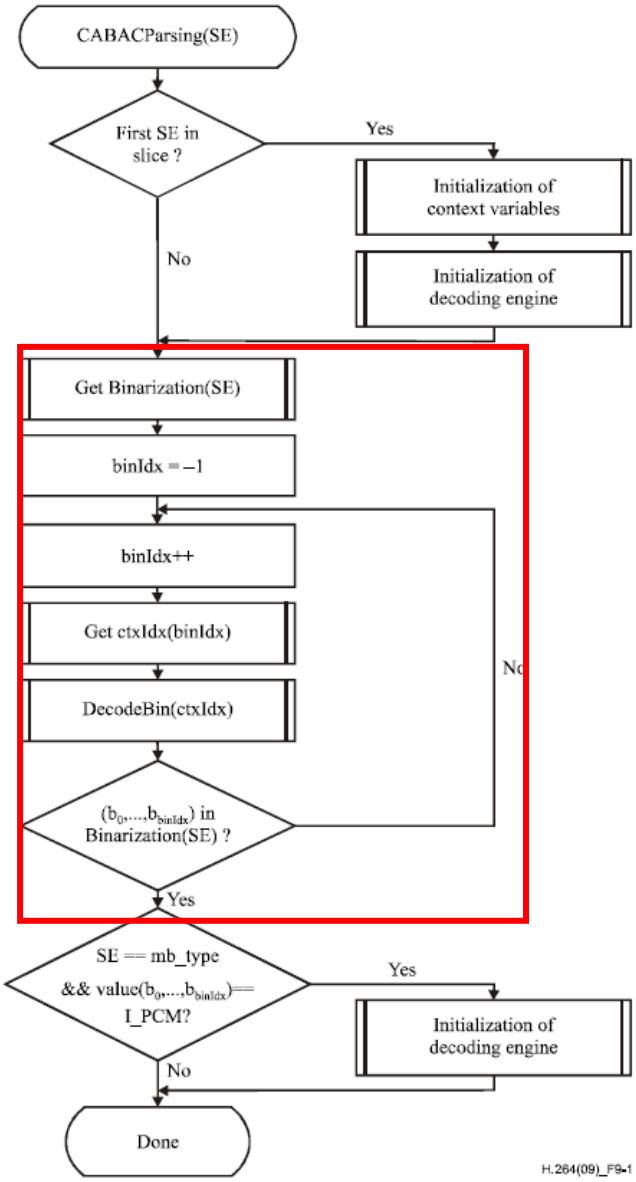

Figure 9-1 – Illustration of CABAC parsing process for a syntax element SE (informative)

Ex. 47, H.264 Standard, at 225.

247. To effect the table switching mandated by the H.264 standard, the CABAC decoder in the Amazon Coding Patents Accused Products computes index ctxIdx to access the table for decoding the first bit (b0) corresponding to a first transform coefficient to be decoded. To decode the first bit (b0) corresponding to a second transform coefficient to be decoded the CABAC

decoder computes another index ctxIdx to access the corresponding table.[115] Index ctxIdx is specified by the H.264 standard to be the sum of ctxIdxOffset and ctxIdxBlockCatOffset(ctxBlockCat) and variable ctxIdxInc.[116]

248. The Amazon Coding Patents Accused Products switch between the plurality of probability tables based on a result of a comparison between an absolute value of the first coefficient to be decoded and a predetermined threshold value. Equation 9-23 of the H.264 Specification mandates that the context increment index "ctxIdxInc" is incremented by one (i.e., switching to a new probability table correlated to ctxIdx), so long as the absolute value of the corresponding decoded coefficient is 1 and the number of the previous decoded single bit coefficients is less than 4.

Let numDecodAbsLevelEq1 denote the accumulated number of decoded transform coefficient levels with absolute value equal to 1, and let numDecodAbsLevelGt1 denote the accumulated number of decoded transform coefficient levels with absolute value greater than 1. Both numbers are related to the same transform coefficient block, where the current decoding process takes place. Then, for decoding of coeff_abs_level_minus1, ctxIdxInc for coeff_abs_level_minus1 is specified depending on binIdx as follows:

– If binIdx is equal to 0, ctxIdxInc is derived by

$$ctxIdxInc = ((numDecodAbsLevelGt1 \; != \; 0) \; ? \; 0 : Min(4, 1 + numDecodAbsLevelEq1)) \qquad (9\text{-}23)$$

Ex. 47, H.264 Standard, at 270, Section 9.3.3.1.

249. The Amazon Coding Patents Accused Products also decode audio data. For example, the Amazon Coding Patents Accused Products incorporate an audio codec that is configured to decode audio data according to one of several formats, including without limitation, Dolby Atmos, AC3, AAC, FLAC, MIDI, and MP3.

[115] *See* Ex. 47, H.264 Standard, Section 9.3.3.1.3, Equations 9-23 and 9-24, pp. 267-270 (09/2019).

[116] *See* Ex. 47, H.264 Standard, Section 9.3.3.1, Table 9-40, pp. 257-259 (09/2019).

250. In the Amazon Coding Patents Accused Products the switching between the plurality of probability tables is performed in a predetermined one direction within each block such that each of the probability tables which has been used for performing arithmetic decoding on the first bit of binary data corresponding to an already decoded coefficient before switching to the new probability table is not used within each block after switching to the new probability table, and is not performed in the opposite direction to the predetermined one direction regardless of the result of the comparison. In accordance with Equation 9-23, the H.264-compliant CABAC decoder in the Amazon Coding Patents Accused Products switches between the plurality of probability tables in a predetermined increasing direction (i.e., from ctxIdxInc 1 to 4) and will not reverse direction, as long as the absolute value of the corresponding decoded transform coefficient is 1 and the absolute value of the previously decoded coefficient is not greater than 1 (i.e., the switching increment ctxIdxInc for bin0 of a transform coefficient increases monotonically from 1 to 4 with each successive coefficient to be decoded and will not reverse direction).[117]

251. Similarly, in the Amazon Coding Patents Accused Products within each block if a predetermined one of the plurality of probability tables has been used to perform arithmetic decoding, in said switching, the switching between the plurality of probability tables is not performed regardless of the result of the comparison. For H.264-compliant CABAC decoders, such as those in the Amazon Coding Patents Accused Products, Equation 9-23 mandates that no switching between the plurality of tables is performed when the table ctxIdx corresponding to ctxIdxInc = 4 has been used to decode a transform coefficient with absolute value 1 and bin0 of the next single-bit coefficient is received. In such case, the same ctxIdx table will be used for decoding additional trailing 1s without further table switching. Additionally, after decoding a

[117] *See generally* H.264 Standard, Equation 9-23, p. 270 (09/2019).

transform coefficient with absolute value greater than 1, the table ctxIdx corresponding to ctxIdxInc = 0 will be used and no further switching will occur.[118]

252. H.264-compliant decoders, such as those in the Amazon Coding Patents Accused Products, are configured to decode coded picture data, including picture data that has already been encoded by an arithmetic coding apparatus using CABAC entropy encoding. Products capable of decoding H.264-compliant coded picture data, including the Amazon Coding Patents Accused Products, typically also incorporate an audio codec to decode related audio data previously encoded in accordance with various audio coding standards. An arithmetic coding apparatus, whether embodied in the Amazon Coding Patents Accused Products or otherwise, typically constitutes a H.264-compliant codec for coding picture data and one or more audio codecs for coding the audio data.

253. A H.264-compliant arithmetic coding apparatus, whether embodied in the Amazon Coding Patents Accused Products or otherwise embodied separately, includes a coefficient scanning unit configured to scan coefficients of frequency components, which are generated by frequency transformation performed on the picture data of a block which has a predetermined scanning order starting at a high frequency component toward a low frequency component. As noted previously, H.264-compliant encoders operate on a macroblock, consisting of a 16 x 16 block of luma samples and two corresponding blocks of chroma samples. A macroblock can be further portioned for inter-prediction forming segmentations for motion representation as small as 4 x 4 luma samples in size.[119] Two main coding types are specified in H.264, intra-coding and inter-coding. Intra-coding is done without reference to other pictures while inter-coding uses inter-

[118] *See* Ex. 47, H.264 Standard, Equation 9-23, p. 270 (09/2019).

[119] *See* Ex. 47, H.264 Standard, Section 0.6.3, p. 5 (09/2019).

prediction of each block of sample values from some previously decoded picture.[120] H.264 decoding is based on the use of a block-based transform method for spatial redundancy removal. The resulting residual block is split into 4 x 4 blocks. These residual blocks are converted into the transform domain where they are quantized.[121] H.264 specifies an *entropy_coding_mode* flag that dictates the entropy encoding algorithm used to encode the picture data. When this flag is set to "1" the residual block data is coded using a CABAC scheme.[122]

254. A H.264-compliant arithmetic coding apparatus, whether embodied in the Amazon Coding Patents Accused Products or otherwise embodied separately, includes a converting unit configured to convert each absolute value of the coefficients into binary data. In H.264 CABAC encoding generally, coding a data symbol involves binarizing the frequency transform coefficients, in scan order, and then further encoding the binary codes.

255. A H.264-compliant arithmetic coding apparatus, whether embodied in the Amazon Coding Patents Accused Products or otherwise embodied separately, includes an arithmetic coding unit configured to perform arithmetic coding on a first bit of the binary data corresponding to each absolute value of the coefficients according to the predetermined scanning order by using a plurality of probability tables. Since CABAC is a context-adaptive binary arithmetic coding technique, it relies on probability model ("context model") selection for one or more bins of the binarized code. Context models and binarization schemes are defined in the H.264 standard.[123] The context model stores the probability of each bin being "1" or "0". An arithmetic coder then

[120] *See* Ex. 47, H.264 Standard, Section 0.6.1, p. 4 (09/2019).
[121] *See* Ex. 47, H.264 Standard, Section 0.6.4, p. 5 (09/2019).
[122] *See* Ex. 47, H.264 Standard, Section 7.4.2.2, pp. 81-82 (09/2019).
[123] *See* Ex. 47, H.264 Standard, Section 9.3, pp. 223-278 (09/2019).

encodes each bin according to the selected probability model and the selected context model is updated based on the actual coded value for further encoding.[124]

256. A H.264-compliant arithmetic coding apparatus, whether embodied in the Amazon Coding Patents Accused Products or otherwise embodied separately, includes a switching unit configured to switch between the plurality of probability tables, from a current probability table for the first bit of the binary data corresponding to a first coefficient to be coded, to a new probability table for the first bit of the binary data corresponding to a second coefficient to be coded, based on a result of a comparison between an absolute value of the first coefficient to be coded and a predetermined threshold value. In accordance with H.264 CABAC encoding, at the beginning of each coded slice, the context models are initialized. Initializing the context models produces context model tables that are accessed by index "ctxIdx".[125] The CABAC encoder applies a specific table to encode each bin of a H.264 syntax element, such as a residual block. In particular, the H.264 standard defines six sets of probability tables assigned to residual block types. Residual blocks in categories 0-4 are assigned a group of tables starting at table ctxIdx_227. LumaLevel8x8 blocks (category 5) are assigned a group of tables starting at table ctxIdx_426. The first table within a group is denoted as ctxIdxOffset.[126]

257. H.264-compliant encoders, whether embodied in the Amazon Coding Patents Accused Products or embodied separately, necessarily incorporate switching logic to effect switching between probability tables in accordance with H.264 requirements when performing CABAC entropy encoding. Specifically, to encode the transform coefficient block, H.264-

[124] *See* Ex. 47, H.264 Standard, Sections 7.4.5.3.3, 9.3, and Figure 9-1, pp. 110-111, 223-278 (09/2019).

[125] *See* Ex. 47, H.264 Standard, Section 9.3.1, Table 9-11, pp. 225-228 (09/2019).

[126] *See* Ex. 47, H.264 Standard, Section 9.3.3.1.3, Tables 9-34 and 9-42, pp. 249-251, 267-270 (09/2019).

compliant encoders must implement switching logic that follows the mandates of Equations 9-23 and 9-24 of the H.264 Standard, depending on whether the absolute value of transform coefficients is greater than or equal to 1:[127]

– If binIdx is equal to 0, ctxIdxInc is derived by

ctxIdxInc = ((numDecodAbsLevelGt1 != 0) ? 0: Min(4, 1 + numDecodAbsLevelEq1)) (9-23)

– Otherwise (binIdx is greater than 0), ctxIdxInc is derived by

ctxIdxInc = 5 + Min(4 − ((ctxBlockCat == 3) ? 1 : 0), numDecodAbsLevelGt1) (9-24)

258. To effect the mandated table switching, the CABAC entropy encoder computes index ctxIdx to access the table for encoding the first bit (b0) corresponding to a first transform coefficient to be encoded. To encode the first bit (b0) corresponding to a second transform coefficient to be encoded, the CABAC entropy encoder computes another index ctxIdx to access the corresponding table.[128] Index ctxIdx is specified in the H.264 Standard to be the sum of ctxIdxOffset and ctxIdxBlockCatOffset(ctxBlockCat) and variable ctxIdxInc.[129] In accordance with Equation 9-23, as long as the absolute value of the corresponding encoded transform coefficient is 1 and the number of previous encoded single bit coefficients is less than 4, the context increment index ctxIdxInc is incremented by 1 (i.e., the switching unit switches to a new probability table correlated to ctxIdx).

259. Typical audio encoders, whether embodied in the Amazon Coding Patents Accused Products or embodied separately, as an element of the arithmetic coding apparatus, include an audio coding unit configured to code an audio signal in a standard audio format.

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[127] *See* Ex. 47, H.264 Standard, Section 9.3.3.1.3, Equations 9-23 and 9-24, pp. 267-270 (09/2019).

[128] *See* Ex. 47, H.264 Standard, Section 9.3.3.1.3, Equations 9-23 and 9-24, pp. 267-270 (09/2019).

[129] *See* Ex. 47, H.264 Standard, Section 9.3.3.1, Table 9-40, pp. 257-259 (09/2019).

260. In H.264-compliant encoders, whether embodied in the Amazon Coding Patents Accused Products or embodied separately, the switching unit is configured to switch between the plurality of probability tables in a predetermined one direction within each block such that each of the probability tables, which has been used for performing arithmetic coding on the first bit of the binary data corresponding to an already coded coefficient before switching to the new probability table, is not used within each block after switching to the new probability table and not to switch between the plurality of probability tables in the direction opposite to the predetermined one direction regardless of the result of the comparison. In accordance with Equation 9-23, for H.264-compliant encoders, the switching between the plurality of tables is performed in a predetermined increasing direction (i.e., from ctxIdxInc 1 to 4) and will not reverse direction, as long as the absolute value of the corresponding encoded transform coefficient is 1 and the absolute value of the previous encoded coefficient is not greater than 1 (i.e., the switching increment ctxIdxInc for bin0 of a transform coefficient increases monotonically from 1 to 4 with each successive coefficient to be encoded and will not reverse direction).[130]

261. Similarly, in H.264-compliant encoders, whether embodied in the Amazon Coding Patents Accused Products or embodied separately, within each block, if a predetermined one of the plurality of the probability tables has been used to perform arithmetic coding, said first switching unit is configured not to switch between the plurality of probability tables regardless of the result of the comparison. Equation 9-23 mandates that no switching between the plurality of tables is performed when the table ctxIdx corresponding to ctxIdxInc = 4 has been used to encode a transform coefficient with absolute value 1 and bin0 of the next single-bit coefficient is to be coded. In such case the same ctxIdx table will be used for encoding additional trailing 1s without

[130] *See* Ex. 47, H.264 Standard, Equation 9-23, pp. 270 (09/2019).

further table switching. Additionally, after encoding a transform coefficient with an absolute value greater than 1, the table ctxIdx corresponding to ctxIdxInc = 0 will be used for subsequent coefficient coding and no further switching will occur.[131]

262. VideoLabs representatives met with Amazon representatives at least on March 12, 2020 to present VideoLabs' platform and gauge Amazon's interest in joining as a partner or member.[132] Following the meeting, VideoLabs offered to provide more detail about its patent portfolio but Amazon did not respond. At least by August 5, 2021, so that patent licensing discussions could proceed, VideoLabs provided Amazon a list of VideoLabs' patents, including all patents asserted in this First Amended Complaint.[133] On August 31, 2021, Amazon indicated that it had conducted an initial review of VideoLabs' patents, was in the process of conducting a deeper review of certain patents, and would get back to VideoLabs in a matter of weeks. But to date, months later, Amazon has not reengaged with VideoLabs.

263. Amazon of course knows how its products operate, and on information and belief, Amazon investigated the '059 Patent and its infringement of the Amazon Coding Patents Accused Products. Amazon has been given further notice of the '059 Patent and its infringement of the '059 Patent through the filing of the Complaint (Dkt. 1) on January 21, 2022, the service of infringement contentions on April 14, 2022, and the filing of this First Amended Complaint. On information and belief, Amazon is either knowingly infringing the '059 Patent or is willfully blind to its infringement, and continues to act in wanton disregard of VideoLabs' patent rights.

264. Despite becoming aware of or willfully blinding itself to its infringement of the '059 Patent, Amazon has nonetheless continued to engage in and has escalated its infringing

[131] *See* Ex. 47, H.264 Standard, Equation 9-23, p. 270 (09/2019).

[132] *See* Ex. 100 (VideoLabs presentation to Amazon).

[133] *See* Ex. 101 (VideoLabs email to Amazon attaching portfolio listing).

activities by continuing to develop, advertise, make available, and use the infringing functionalities of the Amazon Coding Patents Accused Products. On information and belief, Amazon has made no attempts to design around the '059 Patent or otherwise stop its infringing behavior.

265. Amazon's infringement of the '059 Patent therefore has been and remains willful.

266. Amazon also indirectly infringes the '059 Patent by inducing others to infringe and contributing to the infringement of others, including third-party users of the Amazon Coding Patents Accused Products in this District and throughout the United States. As described above, on information and belief, Amazon has known about the '059 Patent since at least August 5, 2021.

267. On information and belief, Amazon has actively induced the infringement of the '059 Patent under 35 U.S.C. § 271(b) by actively inducing the infringement of the Amazon Coding Patents Accused Products by third parties in the United States. Amazon knew or was willfully blind to the fact that its conduct would induce these third parties to act in a manner that infringes the '059 Patent in violation of 35 U.S.C. § 271(a).

268. Amazon actively encouraged and continues to actively encourage third parties to directly infringe the '059 Patent by, for example, marketing the Coding Patents Accused Products and infringing functionalities to consumers; working with consumers to implement, install and/or operate the Coding Patents Accused Products and infringing functionalities; fully supporting and managing consumers' continuing use of the Coding Patents Accused Products and infringing functionalities; and providing technical assistance to consumers during their continued use of the Coding Patents Accused Products and infringing functionalities.[134]

[134] *See e.g.,* Ex. 102, *Digital Service and Device Support*, AMAZON, https://www.amazon.com/gp/help/customer/display.html?nodeId=200127470 (last accessed Jan. 18, 2022) (customer service support for Amazon Prime Video, Fire TV devices, Fire Tablet devices, Amazon Kindle, and Amazon Glow); Ex. 103, *Alexa Devices Help*, AMAZON,

269. For example, Amazon induces third parties to infringe the '059 Patent by at least encouraging them to install and operate the Amazon Prime Video streaming service, which, when used, will result in infringement of the '059 Patent. Amazon advertises and promotes its Amazon Prime Video streaming service on its website and in various app stores such as Apple's app store and Android's app store in connection with the Amazon Prime Video mobile application that can be installed on consumers' respective connected iOS and Android devices (as well as others), and encourages consumers to configure and operate their mobile and computer devices in an infringing manner.[135] In response, consumers acquire, configure, and operate the Amazon Prime Video streaming service in an infringing manner.

270. On information and belief, Amazon contributorily infringes the '059 Patent under 35 U.S.C. § 271(c) by importing, selling, and/or offering to sell within the United States the

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https://www.amazon.com/gp/help/customer/display.html?nodeId=202009680 (last accessed Jan. 18, 2022) (customer service support for Amazon Echo Show and Amazon Echo Glow); Ex. 104, *Install Prime Video on Your Devices*, AMAZON, https://www.amazon.com/gp/help/customer/display.html?nodeId=GWX36LKK4FFEHMWA (last accessed Jan. 18, 2022); Ex. 105, Amazon Prime Video, *Welcome to Prime Video 2021*, YOUTUBE (Jan. 3, 2021), https://www.youtube.com/watch?v=C4vrcDgVnjE (Prime Video advertisement); Ex. 106, Amazon Fire TV, *Start Streaming with Fire TV*, YOUTUBE (May 12, 2021), https://www.youtube.com/watch?v=1NgJYYQqYqY (last accessed Jan. 18, 2022) (Fire TV advertisement); Ex. 107, Amazon News, *Introducing Amazon Glow—A Whole New Way to Bring Families Together for Fun and Learning*, YOUTUBE (Sep. 29, 2021), https://www.youtube.com/watch?v=Dlf01ksX5dI (last accessed Jan. 18, 2022) (Amazon Glow promotion); Ex. 108, *What is Elemental MediaConvert?*, AWS, https://docs.aws.amazon.com/mediaconvert/latest/ug/what-is.html (last accessed Jan. 18, 2022) (user guide for Elemental MediaConvert); Ex. 109, *AWS Elemental Server Resources*, AWS, https://aws.amazon.com/elemental-server/resources/ (last accessed Jan. 18, 2022); Ex. 110, *Amazon Elastic Transcoder Developer* Resources, AWS, https://aws.amazon.com/elastictranscoder/developer-resources/ (last accessed Jan. 18, 2022); Exs. 48-64.

[135] *See e.g.,* Ex. 111, *Prime Video – Amazon Customer Service*, AMAZON, https://www.amazon.com/gp/help/customer/display.html?nodeId=G9SY6AQJV45JFMET (last accessed Jan. 18, 2022); Ex. 104, *Install Prime Video on Your Devices*, AMAZON, https://www.amazon.com/gp/help/customer/display.html?nodeId=GWX36LKK4FFEHMWA (last accessed Jan. 18, 2022).

Amazon Coding Patents Accused Products (or components thereof) that constitute a material part of the claimed invention and are not staple articles of commerce suitable for substantial non-infringing use. For example, the hardware and/or software for decoding content with H.264 using CABAC is material, has no insubstantial non-infringing uses, and is known by Amazon to be especially made or adapted for use in a manner that infringes the '059 Patent.

COUNT IV
INFRINGEMENT OF U.S. PATENT NO. 8,605,794

271. VideoLabs incorporates by reference the foregoing paragraphs of this First Amended Complaint as if fully set forth herein.

272. VL IP is the assignee and lawful owner of all right, title, and interest in and to the '794 Patent. The '794 Patent is valid and enforceable.

273. The '794 Patent is declared essential to the MPEG LA MPEG DASH pool.

274. VideoLabs offered Amazon a license to the '794 Patent for its use of DASH on fair, reasonable, and non-discriminatory terms ("FRAND") on March 14, 2022. Amazon declined VideoLabs' FRAND offer and did not provide any counter-offer, much less a FRAND counter-offer. Accordingly, on information and belief, Amazon is an unwilling licensee of the '794 Patent, is no longer entitled to FRAND license terms, and may be enjoined from the use of the '794 Patent.

275. On information and belief, Amazon has infringed and continues to infringe the '794 Patent in violation of 35 U.S.C. § 271(a), either literally or through the doctrine of equivalents, by making, using, selling, offering for sale, and/or importing into the United States products and/or methods that practice at least claim 1 of the '794 Patent, including with respect to the Amazon '794 Accused Products.

276. On information and belief, Amazon uses the Amazon '794 Accused Products for its own business purposes. In addition, Amazon regularly conducts testing and troubleshooting of

the Amazon '794 Accused Products. Further, VideoLabs is informed and believes companies related to Amazon (e.g., AWS, Amazon, and Amazon's subsidiaries) use the '794 Amazon Accused Products.

277. On information and belief, Amazon's infringement through its use of HLS or DASH, described below, is exemplary of all of Amazon's infringement with respect to all the Amazon '794 Accused Products.

278. The Amazon '794 Accused Products directly infringe at least claim 1 of the '794 Patent by, for example, synchronizing content-related first and second data segments of data files by sequentially outputting, by a device for synchronizing content-related data in such a way that each of the content-related data segments is output together on the basis of an assignment rule assigning each of the content-related second data segments to one of the content-related first data segments.

279. The Amazon '794 Accused Products meet every limitation of claim 1 of the '794 Patent, which recites:

> 1. A method for synchronizing content-related first data segments of a first data file and content-related second data segments of a second data file, the method comprising:
>
> sequentially outputting, by a device for synchronizing content-related data, the content-related first data segments and the content-related second data segments according to their chronological sequence in such a way that each of the content-related second data segments is output together with an associated one of the content-related first data segments on the basis of an assignment rule for
>
> assigning each one of the content-related second data segments to one of the content-related first data segments.

280. The Amazon '794 Accused Products provide a method of synchronizing content-related first data segments of a first data file and content-related second data segments of a second data file. For example, Amazon supports the HLS streaming protocol.

Amazon Elastic Transcoder Now Supports HLS Content Protection

Posted On: Jan 13, 2015

You can now easily generate protected HLS streams with Amazon Elastic Transcoder and deliver them with Amazon CloudFront. With content protection for HLS, Elastic Transcoder uses encryption keys supplied by you, or generates keys on your behalf. Both methods use the AWS Key Management Service to protect the security of your keys.

There are no additional Amazon Elastic Transcoder or Amazon CloudFront charges for using these new encryption options. Standard AWS Key Management Service charges apply.

To learn more, please consult our blog and visit the HLS Content Protection chapter in the Elastic Transcoder Developer Guide.

HLS inputs now available with AWS Elemental MediaConvert

Posted On: Apr 1, 2021

AWS Elemental MediaConvert now supports using HLS (HTTP Live Streaming) packages as input. HLS is a streaming format used for video distribution across a wide range of devices including smart phones, desktop browsers, and connected TVs.

In general, you use MediaConvert to create HLS outputs for distributing content to customers. But in some cases it's beneficial to use HLS as an input format. For example, you could convert existing HLS content to a different format; re-purpose content using the clipping, stitching, or image insertion features of MediaConvert; or transcode media as part of a live-to-VOD workflow. HLS inputs can also be used with Accelerated Transcoding in MediaConvert for use cases that require faster turnaround times. To get started, check out the HLS Input section of the MediaConvert user guide.

With MediaConvert, audio and video providers can easily and reliably transcode on-demand content for broadcast and multiscreen delivery. MediaConvert functions independently or as part of AWS Media Services, a family of services that form the foundation of cloud-based workflows and offer the capabilities needed to transport, transcode, package, and deliver audio and video.

Visit the AWS region table for a full list of AWS Regions where MediaConvert is available. To learn more about MediaConvert, please visit our product page.

Amazon Kinesis Video Streams Adds Support For HLS Output Streams

by Randall Hunt | on 13 JUL 2018 | in Analytics, Artificial Intelligence, AWS DeepLens, Kinesis Video Streams | Permalink | Share

0:00 / 0:00

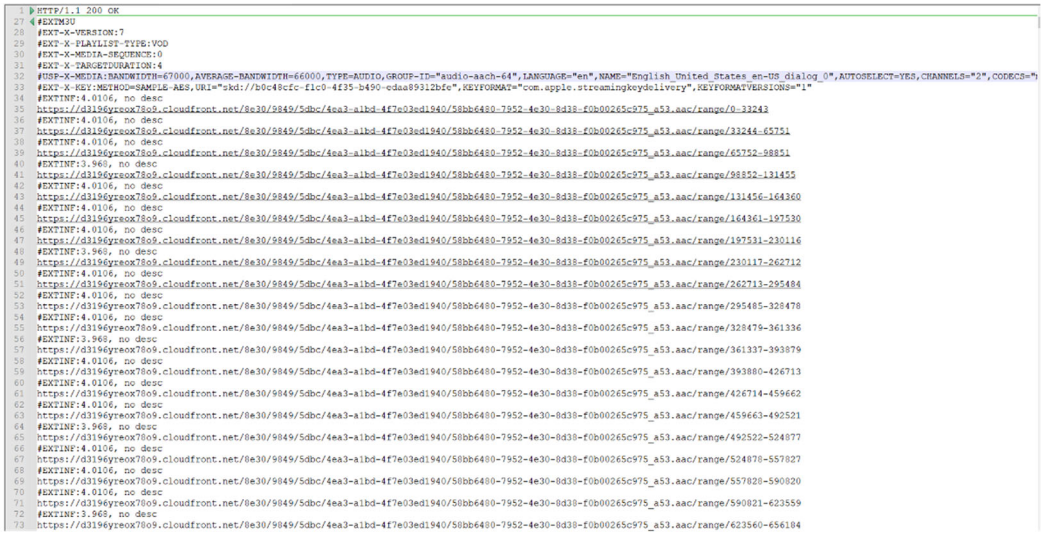
Voiced by Amazon Polly

Today I'm excited to announce and demonstrate the new HTTP Live Streams (HLS) output feature for Amazon Kinesis Video Streams (KVS). If you're not already familiar with KVS, Jeff covered the release for AWS re:Invent in 2017. In short, Amazon Kinesis Video Streams is a service for securely capturing, processing, and storing video for analytics and machine learning – from one device or millions. Customers are using Kinesis Video with machine learning algorithms to power everything from home automation and smart cities to industrial automation and security.

281. Furthermore, Amazon Prime Video provides HLS Master and Variant playlists to connected devices accessing the Amazon Prime Video streaming service, either via the Amazon Prime Video app installed on their respective connected device or by accessing the Amazon Prime Video streaming service from their web browser. Amazon also processes video with its cloud services to create and store audio segments, video segments, and HLS Master and Variant playlists. Exemplified below are representative Master and Variant playlists for the movie Hotel Transylvania 4: Transformania that are generated by Amazon and delivered to the Amazon Prime Video client running on the subscribers' connected device or web browser:

```
#EXTM3U
#EXT-X-VERSION:7
#EXT-X-MEDIA:TYPE=AUDIO,GROUP-ID="audio-aach-64",LANGUAGE="te-in",NAME="[illegible]",AUTOSELECT=YES,CHANNELS="2",URI="58bb6480-7952-4e30-8d38-f0b00265c975_a32.m3u8",AUDIO-TRACK-TYPE="te-in_di
#EXT-X-MEDIA:TYPE=AUDIO,GROUP-ID="audio-aach-64",LANGUAGE="pl-pl",NAME="Polski",AUTOSELECT=YES,CHANNELS="2",URI="58bb6480-7952-4e30-8d38-f0b00265c975_a33.m3u8",AUDIO-TRACK-TYPE="pl-pl
#EXT-X-MEDIA:TYPE=AUDIO,GROUP-ID="audio-aach-64",LANGUAGE="en-us",NAME="English [Audio Description]",AUTOSELECT=YES,CHANNELS="2",URI="58bb6480-7952-4e30-8d38-f0b00265c975_a40.m3u8",AU
#EXT-X-MEDIA:TYPE=AUDIO,GROUP-ID="audio-aach-64",LANGUAGE="pt-br",NAME="Português (Brasil)",AUTOSELECT=YES,CHANNELS="2",URI="58bb6480-7952-4e30-8d38-f0b00265c975_a41.m3u8",AUDIO-TRACK-
#EXT-X-MEDIA:TYPE=AUDIO,GROUP-ID="audio-aach-64",LANGUAGE="ta-in",NAME="[illegible]",AUTOSELECT=YES,CHANNELS="2",URI="58bb6480-7952-4e30-8d38-f0b00265c975_a52.m3u8",AUDIO-TRACK-TYPE="ta-in_dia
#EXT-X-MEDIA:TYPE=AUDIO,GROUP-ID="audio-aach-64",LANGUAGE="en-us",NAME="English",AUTOSELECT=YES,CHANNELS="2",URI="58bb6480-7952-4e30-8d38-f0b00265c975_a53.m3u8",AUDIO-TRACK-TYPE="en-us
#EXT-X-MEDIA:TYPE=AUDIO,GROUP-ID="audio-aach-64",LANGUAGE="ca-es",NAME="Català",AUTOSELECT=YES,CHANNELS="2",URI="58bb6480-7952-4e30-8d38-f0b00265c975_a54.m3u8",AUDIO-TRACK-TYPE="ca-es
#EXT-X-MEDIA:TYPE=AUDIO,GROUP-ID="audio-aacl-128",LANGUAGE="ja-jp",NAME="[illegible]",AUTOSELECT=YES,CHANNELS="2",URI="58bb6480-7952-4e30-8d38-f0b00265c975_a179.m3u8",AUDIO-TRACK-TYPE="ja-jp
#EXT-X-MEDIA:TYPE=AUDIO,GROUP-ID="audio-aacl-128",LANGUAGE="ar-001",NAME="[illegible]",AUTOSELECT=YES,CHANNELS="2",URI="58bb6480-7952-4e30-8d38-f0b00265c975_a180.m3u8",AUDIO-TRACK-TYPE="ar
#EXT-X-MEDIA:TYPE=AUDIO,GROUP-ID="audio-aacl-128",LANGUAGE="en-us",NAME="English",AUTOSELECT=YES,CHANNELS="2",URI="58bb6480-7952-4e30-8d38-f0b00265c975_a181.m3u8",AUDIO-TRACK-TYPE="en-
#EXT-X-MEDIA:TYPE=AUDIO,GROUP-ID="audio-aacl-128",LANGUAGE="nb-no",NAME="Norsk Bokmål",AUTOSELECT=YES,CHANNELS="2",URI="58bb6480-7952-4e30-8d38-f0b00265c975_a182.m3u8",AUDIO-TRACK-TYP
#EXT-X-MEDIA:TYPE=AUDIO,GROUP-ID="audio-aacl-128",LANGUAGE="pl-pl",NAME="Polski",AUTOSELECT=YES,CHANNELS="2",URI="58bb6480-7952-4e30-8d38-f0b00265c975_a183.m3u8",AUDIO-TRACK-TYPE="pl-p
#EXT-X-MEDIA:TYPE=AUDIO,GROUP-ID="audio-aacl-128",LANGUAGE="pt-pt",NAME="Português (Portugal)",AUTOSELECT=YES,CHANNELS="2",URI="58bb6480-7952-4e30-8d38-f0b00265c975_a184.m3u8",AUDIO-T
#EXT-X-MEDIA:TYPE=AUDIO,GROUP-ID="audio-aacl-128",LANGUAGE="ca-es",NAME="Català",AUTOSELECT=YES,CHANNELS="2",URI="58bb6480-7952-4e30-8d38-f0b00265c975_a185.m3u8",AUDIO-TRACK-TYPE="ca-
#EXT-X-MEDIA:TYPE=AUDIO,GROUP-ID="audio-aacl-128",LANGUAGE="hi-in",NAME="[illegible]",AUTOSELECT=YES,CHANNELS="2",URI="58bb6480-7952-4e30-8d38-f0b00265c975_a186.m3u8",AUDIO-TRACK-TYPE="hi-in_di
#EXT-X-MEDIA:TYPE=SUBTITLES,GROUP-ID="textstream-ttml-1",LANGUAGE="de-de",NAME="Deutsch",AUTOSELECT=YES,URI="https://dmqdd6hw24ucf.cloudfront.net/0469/cb29/58b6/4c4c-96cd-56f3736751e6,
#EXT-X-MEDIA:TYPE=SUBTITLES,GROUP-ID="textstream-ttml-1",LANGUAGE="el-gr",NAME="Ελληνικά",AUTOSELECT=YES,URI="https://dmqdd6hw24ucf.cloudfront.net/f177/22dd/1b1e/4488-8720-5ae14f227e7
#EXT-X-MEDIA:TYPE=SUBTITLES,GROUP-ID="textstream-ttml-1",LANGUAGE="en-us",NAME="English [CC]",AUTOSELECT=YES,URI="https://dmqdd6hw24ucf.cloudfront.net/fd87/f577/2cee/44d0-a06a-511ae7
#EXT-X-MEDIA:TYPE=SUBTITLES,GROUP-ID="textstream-ttml-1",LANGUAGE="es-419",NAME="Español (Latinoamérica)",AUTOSELECT=YES,URI="https://dmqdd6hw24ucf.cloudfront.net/2d14/d63d/3fa5/4c53-
#AIV-STREAM-INF:NOMINAL_VIDEO_BITRATE=501000,NOMINAL_AUDIO_BITRATE=64000
#EXT-X-STREAM-INF:BANDWIDTH=990000,AVERAGE-BANDWIDTH=469000,CODECS="avc1.4D401E,mp4a.40.5",RESOLUTION=720x389,FRAME-RATE=23.976,AUDIO="audio-aach-64",CLOSED-CAPTIONS=NONE,SUBTITLES="t
58bb6480-7952-4e30-8d38-f0b00265c975_v4.m3u8
#AIV-STREAM-INF:NOMINAL_VIDEO_BITRATE=800000,NOMINAL_AUDIO_BITRATE=64000
#EXT-X-STREAM-INF:BANDWIDTH=1497000,AVERAGE-BANDWIDTH=692000,CODECS="avc1.4D401E,mp4a.40.5",RESOLUTION=720x389,FRAME-RATE=23.976,AUDIO="audio-aach-64",CLOSED-CAPTIONS=NONE,SUBTITLES="
58bb6480-7952-4e30-8d38-f0b00265c975_v5.m3u8
#AIV-STREAM-INF:NOMINAL_VIDEO_BITRATE=1001000,NOMINAL_AUDIO_BITRATE=64000
#EXT-X-STREAM-INF:BANDWIDTH=1874000,AVERAGE-BANDWIDTH=812000,CODECS="avc1.4D401F,mp4a.40.5",RESOLUTION=962x520,FRAME-RATE=23.976,AUDIO="audio-aach-64",CLOSED-CAPTIONS=NONE,SUBTITLES="
58bb6480-7952-4e30-8d38-f0b00265c975_v6.m3u8
#AIV-STREAM-INF:NOMINAL_VIDEO_BITRATE=1500000,NOMINAL_AUDIO_BITRATE=64000
#EXT-X-STREAM-INF:BANDWIDTH=2758000,AVERAGE-BANDWIDTH=1087000,CODECS="avc1.4D401F,mp4a.40.5",RESOLUTION=962x520,FRAME-RATE=23.976,AUDIO="audio-aach-64",CLOSED-CAPTIONS=NONE,SUBTITLES="
58bb6480-7952-4e30-8d38-f0b00265c975_v7.m3u8
#AIV-STREAM-INF:NOMINAL_VIDEO_BITRATE=1500000,NOMINAL_AUDIO_BITRATE=128000
#EXT-X-STREAM-INF:BANDWIDTH=2824000,AVERAGE-BANDWIDTH=1152000,CODECS="avc1.4D401F,mp4a.40.2",RESOLUTION=962x520,FRAME-RATE=23.976,AUDIO="audio-aacl-128",CLOSED-CAPTIONS=NONE,SUBTITLES=
58bb6480-7952-4e30-8d38-f0b00265c975_v7.m3u8
#AIV-STREAM-INF:NOMINAL_VIDEO_BITRATE=2000000,NOMINAL_AUDIO_BITRATE=128000
#EXT-X-STREAM-INF:BANDWIDTH=3569000,AVERAGE-BANDWIDTH=1395000,CODECS="avc1.64001F,mp4a.40.2",RESOLUTION=1280x691,FRAME-RATE=23.976,AUDIO="audio-aacl-128",CLOSED-CAPTIONS=NONE,SUBTITLE
58bb6480-7952-4e30-8d38-f0b00265c975_v8.m3u8
#EXT-X-I-FRAME-STREAM-INF:BANDWIDTH=117000,AVERAGE-BANDWIDTH=26000,CODECS="avc1.4D4016",RESOLUTION=512x276,URI="58bb6480-7952-4e30-8d38-f0b00265c975_v2_iframe.m3u8"
#EXT-X-I-FRAME-STREAM-INF:BANDWIDTH=198000,AVERAGE-BANDWIDTH=42000,CODECS="avc1.4D401E",RESOLUTION=651x352,URI="58bb6480-7952-4e30-8d38-f0b00265c975_v3_iframe.m3u8"
#EXT-X-I-FRAME-STREAM-INF:BANDWIDTH=276000,AVERAGE-BANDWIDTH=58000,CODECS="avc1.4D401E",RESOLUTION=720x389,URI="58bb6480-7952-4e30-8d38-f0b00265c975_v4_iframe.m3u8"
#EXT-X-I-FRAME-STREAM-INF:BANDWIDTH=323000,AVERAGE-BANDWIDTH=76000,CODECS="avc1.4D401E",RESOLUTION=720x389,URI="58bb6480-7952-4e30-8d38-f0b00265c975_v5_iframe.m3u8"
#EXT-X-I-FRAME-STREAM-INF:BANDWIDTH=433000,AVERAGE-BANDWIDTH=101000,CODECS="avc1.4D401F",RESOLUTION=962x520,URI="58bb6480-7952-4e30-8d38-f0b00265c975_v6_iframe.m3u8"
#EXT-X-I-FRAME-STREAM-INF:BANDWIDTH=472000,AVERAGE-BANDWIDTH=129000,CODECS="avc1.4D401F",RESOLUTION=962x520,URI="58bb6480-7952-4e30-8d38-f0b00265c975_v7_iframe.m3u8"
#EXT-X-I-FRAME-STREAM-INF:BANDWIDTH=699000,AVERAGE-BANDWIDTH=157000,CODECS="avc1.64001F",RESOLUTION=1280x691,URI="58bb6480-7952-4e30-8d38-f0b00265c975_v8_iframe.m3u8"
#EXT-X-SESSION-KEY:METHOD=SAMPLE-AES,KEYFORMATVERSIONS="1",KEYFORMAT="com.apple.streamingkeydelivery",URI="skd://b0c48cfc-f1c0-4f35-b490-edaa89312bfe"
```

Exemplary Master Playlist



```
HTTP/1.1 200 OK
#EXTM3U
#EXT-X-VERSION:7
#EXT-X-PLAYLIST-TYPE:VOD
#EXT-X-MEDIA-SEQUENCE:0
#EXT-X-TARGETDURATION:4
#USP-X-MEDIA:BANDWIDTH=67000,AVERAGE-BANDWIDTH=66000,TYPE=AUDIO,GROUP-ID="audio-aach-64",LANGUAGE="en",NAME="English_United_States_en-US_dialog_0",AUTOSELECT=YES,CHANNELS="2",CODECS="
#EXT-X-KEY:METHOD=SAMPLE-AES,URI="skd://b0c48cfc-f1c0-4f35-b490-edaa89312bfe",KEYFORMAT="com.apple.streamingkeydelivery",KEYFORMATVERSIONS="1"
#EXTINF:4.0106, no desc
https://d3196yreox78o9.cloudfront.net/8e30/9849/5dbc/4ea3-a1bd-4f7e03ed1940/58bb6480-7952-4e30-8d38-f0b00265c975_a53.aac/range/0-33243
#EXTINF:4.0106, no desc
https://d3196yreox78o9.cloudfront.net/8e30/9849/5dbc/4ea3-a1bd-4f7e03ed1940/58bb6480-7952-4e30-8d38-f0b00265c975_a53.aac/range/33244-65751
#EXTINF:4.0106, no desc
https://d3196yreox78o9.cloudfront.net/8e30/9849/5dbc/4ea3-a1bd-4f7e03ed1940/58bb6480-7952-4e30-8d38-f0b00265c975_a53.aac/range/65752-98851
#EXTINF:3.968, no desc
https://d3196yreox78o9.cloudfront.net/8e30/9849/5dbc/4ea3-a1bd-4f7e03ed1940/58bb6480-7952-4e30-8d38-f0b00265c975_a53.aac/range/98852-131455
#EXTINF:4.0106, no desc
https://d3196yreox78o9.cloudfront.net/8e30/9849/5dbc/4ea3-a1bd-4f7e03ed1940/58bb6480-7952-4e30-8d38-f0b00265c975_a53.aac/range/131456-164360
#EXTINF:4.0106, no desc
https://d3196yreox78o9.cloudfront.net/8e30/9849/5dbc/4ea3-a1bd-4f7e03ed1940/58bb6480-7952-4e30-8d38-f0b00265c975_a53.aac/range/164361-197530
#EXTINF:4.0106, no desc
https://d3196yreox78o9.cloudfront.net/8e30/9849/5dbc/4ea3-a1bd-4f7e03ed1940/58bb6480-7952-4e30-8d38-f0b00265c975_a53.aac/range/197531-230116
#EXTINF:3.968, no desc
https://d3196yreox78o9.cloudfront.net/8e30/9849/5dbc/4ea3-a1bd-4f7e03ed1940/58bb6480-7952-4e30-8d38-f0b00265c975_a53.aac/range/230117-262712
#EXTINF:4.0106, no desc
https://d3196yreox78o9.cloudfront.net/8e30/9849/5dbc/4ea3-a1bd-4f7e03ed1940/58bb6480-7952-4e30-8d38-f0b00265c975_a53.aac/range/262713-295484
#EXTINF:4.0106, no desc
https://d3196yreox78o9.cloudfront.net/8e30/9849/5dbc/4ea3-a1bd-4f7e03ed1940/58bb6480-7952-4e30-8d38-f0b00265c975_a53.aac/range/295485-328478
#EXTINF:4.0106, no desc
https://d3196yreox78o9.cloudfront.net/8e30/9849/5dbc/4ea3-a1bd-4f7e03ed1940/58bb6480-7952-4e30-8d38-f0b00265c975_a53.aac/range/328479-361336
#EXTINF:3.968, no desc
https://d3196yreox78o9.cloudfront.net/8e30/9849/5dbc/4ea3-a1bd-4f7e03ed1940/58bb6480-7952-4e30-8d38-f0b00265c975_a53.aac/range/361337-393879
#EXTINF:4.0106, no desc
https://d3196yreox78o9.cloudfront.net/8e30/9849/5dbc/4ea3-a1bd-4f7e03ed1940/58bb6480-7952-4e30-8d38-f0b00265c975_a53.aac/range/393880-426713
#EXTINF:4.0106, no desc
https://d3196yreox78o9.cloudfront.net/8e30/9849/5dbc/4ea3-a1bd-4f7e03ed1940/58bb6480-7952-4e30-8d38-f0b00265c975_a53.aac/range/426714-459662
#EXTINF:4.0106, no desc
https://d3196yreox78o9.cloudfront.net/8e30/9849/5dbc/4ea3-a1bd-4f7e03ed1940/58bb6480-7952-4e30-8d38-f0b00265c975_a53.aac/range/459663-492521
#EXTINF:3.968, no desc
https://d3196yreox78o9.cloudfront.net/8e30/9849/5dbc/4ea3-a1bd-4f7e03ed1940/58bb6480-7952-4e30-8d38-f0b00265c975_a53.aac/range/492522-524877
#EXTINF:4.0106, no desc
https://d3196yreox78o9.cloudfront.net/8e30/9849/5dbc/4ea3-a1bd-4f7e03ed1940/58bb6480-7952-4e30-8d38-f0b00265c975_a53.aac/range/524878-557827
#EXTINF:4.0106, no desc
https://d3196yreox78o9.cloudfront.net/8e30/9849/5dbc/4ea3-a1bd-4f7e03ed1940/58bb6480-7952-4e30-8d38-f0b00265c975_a53.aac/range/557828-590820
#EXTINF:4.0106, no desc
https://d3196yreox78o9.cloudfront.net/8e30/9849/5dbc/4ea3-a1bd-4f7e03ed1940/58bb6480-7952-4e30-8d38-f0b00265c975_a53.aac/range/590821-623559
#EXTINF:3.968, no desc
https://d3196yreox78o9.cloudfront.net/8e30/9849/5dbc/4ea3-a1bd-4f7e03ed1940/58bb6480-7952-4e30-8d38-f0b00265c975_a53.aac/range/623560-656184
```

Exemplary Audio Variant Playlist

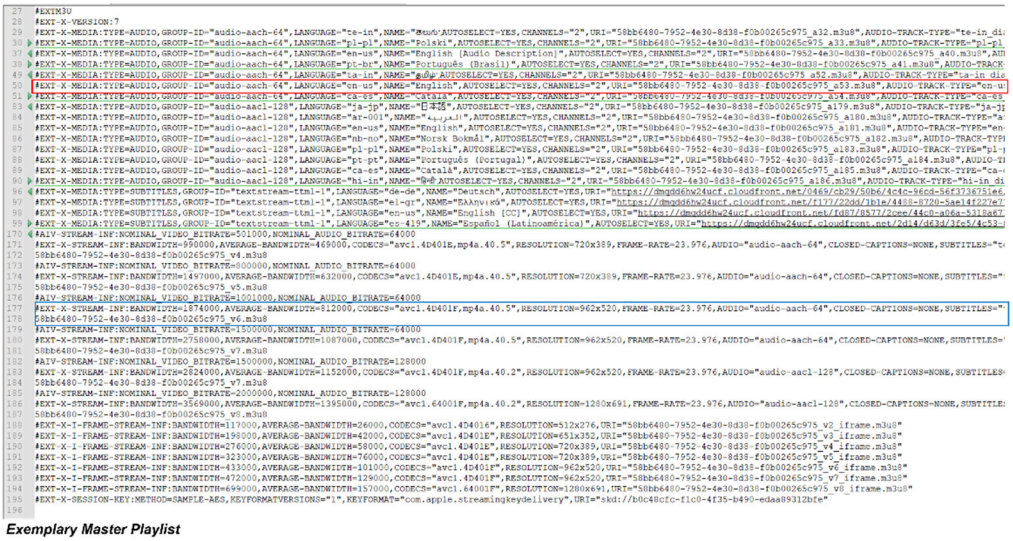
```
HTTP/1.1 200 OK
#EXTM3U
#EXT-X-VERSION:7
#EXT-X-PLAYLIST-TYPE:VOD
#EXT-X-MEDIA-SEQUENCE:0
#EXT-X-INDEPENDENT-SEGMENTS
#EXT-X-TARGETDURATION:5
#USP-X-MEDIA:BANDWIDTH=1807000,AVERAGE-BANDWIDTH=746000,TYPE=VIDEO,GROUP-ID="video-avc3-718",NAME="video",AUTOSELECT=YES,CODECS="avc1.4D401F",RESOLUTION=962x520,FRAME-RATE=23.976
#EXT-X-KEY:METHOD=SAMPLE-AES,URI="skd://b0c48cfc-f1c0-4f35-b490-edaa89312bfe",KEYFORMAT="com.apple.streamingkeydelivery",KEYFORMATVERSIONS="1"
#EXTINF:2.9195, no desc
https://d3196yreox78o9.cloudfront.net/8e30/9849/5dbc/4ea3-a1bd-4f7e03ed1940/58bb6480-7952-4e30-8d38-f0b00265c975_v6.ts/range/0-72567
#EXTINF:2.9612, no desc
https://d3196yreox78o9.cloudfront.net/8e30/9849/5dbc/4ea3-a1bd-4f7e03ed1940/58bb6480-7952-4e30-8d38-f0b00265c975_v6.ts/range/72568-139119
#EXTINF:4.9632, no desc
https://d3196yreox78o9.cloudfront.net/8e30/9849/5dbc/4ea3-a1bd-4f7e03ed1940/58bb6480-7952-4e30-8d38-f0b00265c975_v6.ts/range/139120-193639
#EXTINF:4.9632, no desc
https://d3196yreox78o9.cloudfront.net/8e30/9849/5dbc/4ea3-a1bd-4f7e03ed1940/58bb6480-7952-4e30-8d38-f0b00265c975_v6.ts/range/193640-320351
#EXTINF:4.3376, no desc
https://d3196yreox78o9.cloudfront.net/8e30/9849/5dbc/4ea3-a1bd-4f7e03ed1940/58bb6480-7952-4e30-8d38-f0b00265c975_v6.ts/range/320352-633559
#EXTINF:4.3793, no desc
https://d3196yreox78o9.cloudfront.net/8e30/9849/5dbc/4ea3-a1bd-4f7e03ed1940/58bb6480-7952-4e30-8d38-f0b00265c975_v6.ts/range/633560-934735
#EXTINF:4.7964, no desc
https://d3196yreox78o9.cloudfront.net/8e30/9849/5dbc/4ea3-a1bd-4f7e03ed1940/58bb6480-7952-4e30-8d38-f0b00265c975_v6.ts/range/934736-1175751
#EXTINF:4.7964, no desc
https://d3196yreox78o9.cloudfront.net/8e30/9849/5dbc/4ea3-a1bd-4f7e03ed1940/58bb6480-7952-4e30-8d38-f0b00265c975_v6.ts/range/1175752-1528063
#EXTINF:4.8381, no desc
https://d3196yreox78o9.cloudfront.net/8e30/9849/5dbc/4ea3-a1bd-4f7e03ed1940/58bb6480-7952-4e30-8d38-f0b00265c975_v6.ts/range/1528064-2066871
#EXTINF:4.9632, no desc
https://d3196yreox78o9.cloudfront.net/8e30/9849/5dbc/4ea3-a1bd-4f7e03ed1940/58bb6480-7952-4e30-8d38-f0b00265c975_v6.ts/range/2066872-2464303
#EXTINF:4.9632, no desc
https://d3196yreox78o9.cloudfront.net/8e30/9849/5dbc/4ea3-a1bd-4f7e03ed1940/58bb6480-7952-4e30-8d38-f0b00265c975_v6.ts/range/2464304-3093351
#EXTINF:4.9632, no desc
https://d3196yreox78o9.cloudfront.net/8e30/9849/5dbc/4ea3-a1bd-4f7e03ed1940/58bb6480-7952-4e30-8d38-f0b00265c975_v6.ts/range/3093352-3746463
#EXTINF:4.9633, no desc
https://d3196yreox78o9.cloudfront.net/8e30/9849/5dbc/4ea3-a1bd-4f7e03ed1940/58bb6480-7952-4e30-8d38-f0b00265c975_v6.ts/range/3746464-4571031
#EXTINF:4.9632, no desc
https://d3196yreox78o9.cloudfront.net/8e30/9849/5dbc/4ea3-a1bd-4f7e03ed1940/58bb6480-7952-4e30-8d38-f0b00265c975_v6.ts/range/4571032-5221135
#EXTINF:3.7954, no desc
https://d3196yreox78o9.cloudfront.net/8e30/9849/5dbc/4ea3-a1bd-4f7e03ed1940/58bb6480-7952-4e30-8d38-f0b00265c975_v6.ts/range/5221136-5549383
#EXTINF:3.8371, no desc
https://d3196yreox78o9.cloudfront.net/8e30/9849/5dbc/4ea3-a1bd-4f7e03ed1940/58bb6480-7952-4e30-8d38-f0b00265c975_v6.ts/range/5549384-5925759
#EXTINF:4.9632, no desc
https://d3196yreox78o9.cloudfront.net/8e30/9849/5dbc/4ea3-a1bd-4f7e03ed1940/58bb6480-7952-4e30-8d38-f0b00265c975_v6.ts/range/5925760-6163767
#EXTINF:2.9195, no desc
https://d3196yreox78o9.cloudfront.net/8e30/9849/5dbc/4ea3-a1bd-4f7e03ed1940/58bb6480-7952-4e30-8d38-f0b00265c975_v6.ts/range/6163768-6380719
#EXTINF:2.9612, no desc
https://d3196yreox78o9.cloudfront.net/8e30/9849/5dbc/4ea3-a1bd-4f7e03ed1940/58bb6480-7952-4e30-8d38-f0b00265c975_v6.ts/range/6380720-6648807
#EXTINF:3.2115, no desc
https://d3196yreox78o9.cloudfront.net/8e30/9849/5dbc/4ea3-a1bd-4f7e03ed1940/58bb6480-7952-4e30-8d38-f0b00265c975_v6.ts/range/6648808-7205663
#EXTINF:3.2532, no desc
```

Exemplary Video Variant Playlist

282. HLS provides a reliable, cost-effective means of delivering continuous and long-form video over the Internet. It allows a receiver to adapt the bit rate of the media to the current network conditions in order to maintain uninterrupted playback at the best possible quality. To allow this, HLS provides for a multimedia presentation to be represented by a media playlist or a Master playlist. The media playlist is usually used when there is only one encoded bitrate of the multimedia presentation. Where several encoded bitrates of the multimedia presentation exist, the Master playlist provides a set of Variant streams, each of which describes a different version of

the same content. The Variant stream includes a Variant media playlist that specifies media (either video and/or audio) encoded at a particular bitrate, in a particular format, and at a particular resolution (for video).[136]

283. The Amazon '794 Accused Products make use of HLS's Master and Variant playlists which allow a server to offer different encodings of the same presentation. For example, the HLS Master Playlist file generated by Amazon for Amazon Prime Video clients desiring to stream a content program from the Amazon Prime Video streaming service references multiple variant playlists, at least one which describes a first data file that specifies media encoded at a particular bit rate, in a particular format, and at a particular resolution for media containing video (video playlist) (blue outlining below); at least another which describes a second data file that specifies media encoded at a particular bit rate, in a particular format, for media containing audio (audio playlist) (red outlining below).

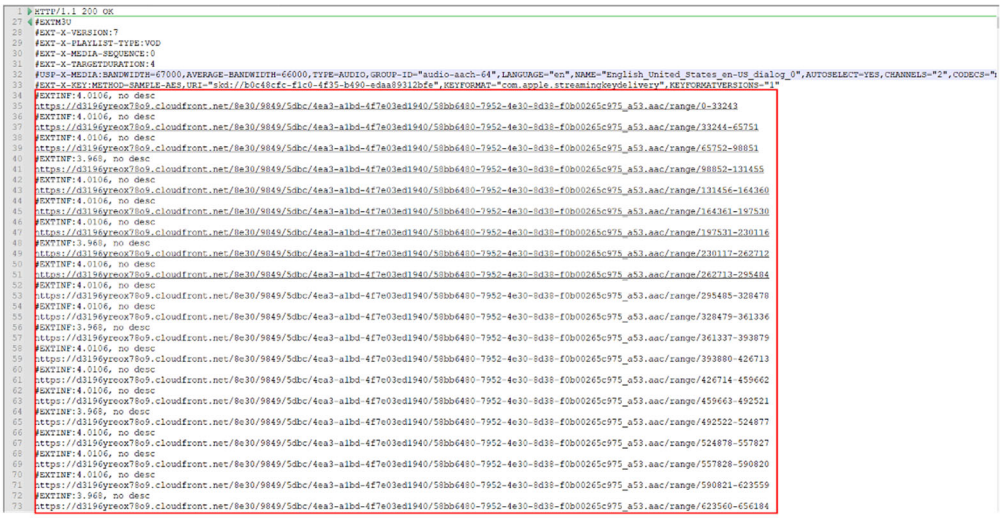


Exemplary Master Playlist

284. In the Amazon '794 Accused Products, the HLS Master Playlist file uses the "EXT-X-MEDIA" and "EXT-X-STREAM-INF" tags to relate the variant streams of a media content

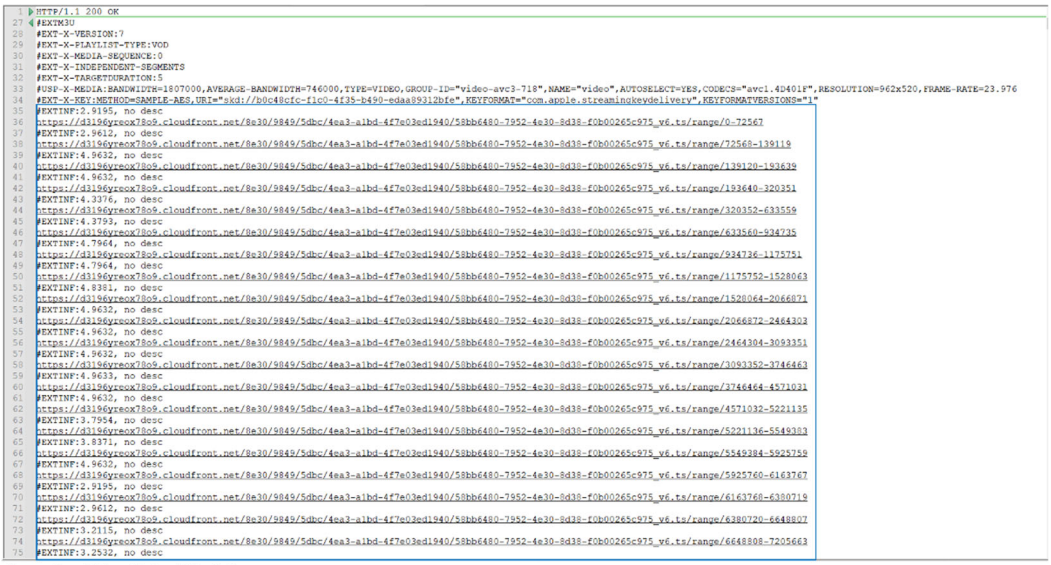
[136] *See* Ex. 113, HTTP Live Streaming 2nd Edition (Nov. 2021) (hereinafter "HLS Spec").

item, such as the different video bitrate encodes for the content program, and one or more related audio encodes for the content program allowing the Amazon '794 Accused Products to synchronize the acquisition and loading of audio and video segments for multiple representations of media content, such as, primary English audio and 962 x 520 resolution video in the below example from Amazon Prime Video.[137] The Variant playlist manifests reference respective audio and video media segments for a the content program Hotel Transylvania 4: Transformania (red and blue highlighting below, respectively).



Exemplary Audio Variant Playlist

[137] *See* Ex. 113, HLS Spec, Sections 4.4.6.1 and 4.4.6.2, pp. 36-46.



Exemplary Video Variant Playlist

285. The Amazon '794 Accused Products sequentially output each media stream, including its content-related first and second data segments, according to their chronological sequence, by a device for synchronizing content-related data. The HLS Variant playlists employed by the Amazon '794 Accused Products contain segment references that provide a chronological ordering to the listed segments, and approximate duration information for each segment, together with additional segment and stream metadata that enable the HLS client application to order and assign the different content-related data segments relative to each other and with respect to the HLS relative media presentation timeline.

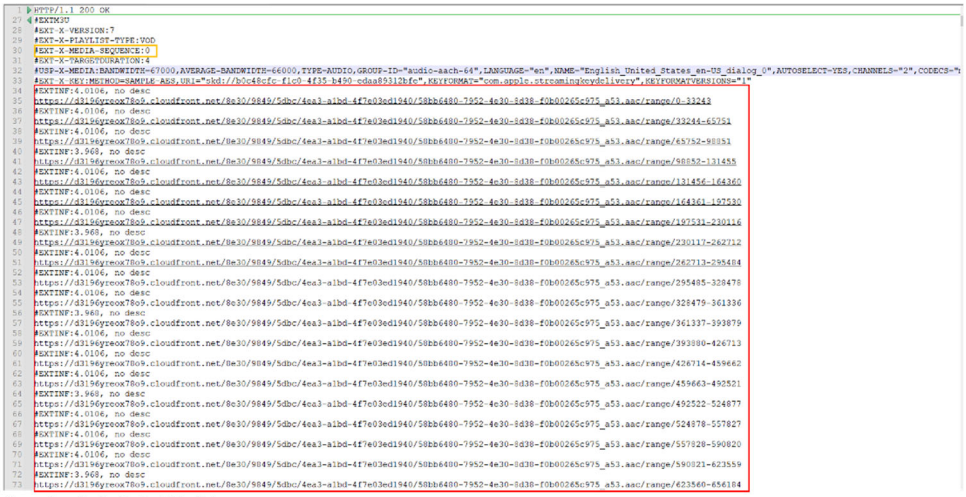
286. In particular, each individual segment in the Variant playlist has a unique integer Media Sequence Number.[138] The Media Sequence Number of the first segment in the Variant playlist is either 0 or declared in the playlist.[139] The Media Sequence Number of every other segment is equal to the Media Sequence Number of the segment that precedes it plus one.[140] The

[138] *See* Ex. 113, HLS Spec, Section 3, p. 6.

[139] *See* Ex. 113, HLS Spec, Section 4.4.3.2, p. 18.

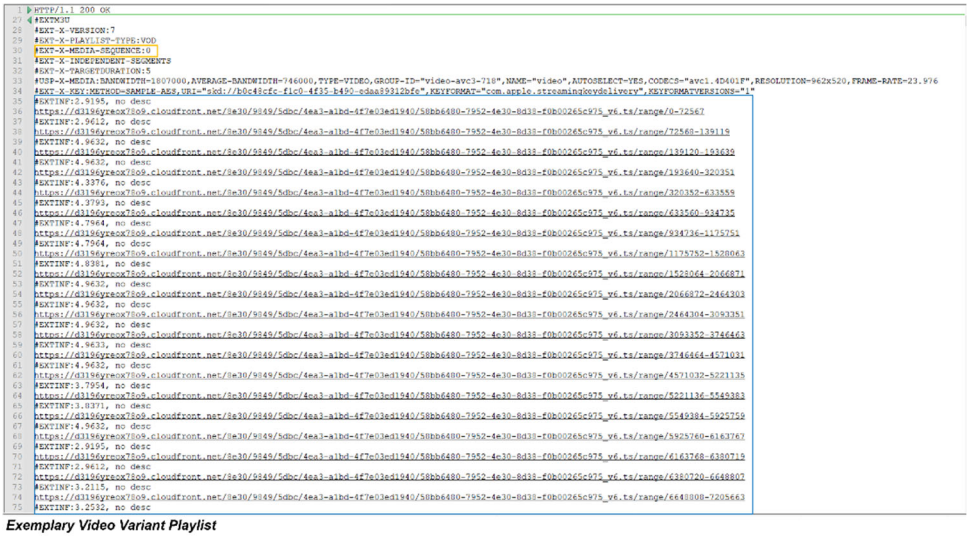
[140] *See* Ex. 113, HLS Spec, Section 3, p. 6.

respective declared Media Sequence Numbers in the audio and video Variant playlists for the exemplary content program Hotel Transylvania 4: Transformania are shown below (yellow highlighting):



```
HTTP/1.1 200 OK
#EXTM3U
#EXT-X-VERSION:7
#EXT-X-PLAYLIST-TYPE:VOD
#EXT-X-MEDIA-SEQUENCE:0
#EXT-X-TARGETDURATION:4
#USP-X-MEDIA:BANDWIDTH=67000,AVERAGE-BANDWIDTH=66000,TYPE-AUDIO,GROUP-ID="audio-aach-64",LANGUAGE="en",NAME="English_United_States_en-US_dialog_0",AUTOSELECT-YES,CHANNELS="2",CODECS="
#EXT-X-KEY:METHOD=SAMPLE-AES,URI="skd://b0c48cfc-f1c0-4f35-b490-cdaa85312bfe",KEYFORMAT="com.apple.streamingkeydelivery",KEYFORMATVERSIONS="1"
#EXTINF:4.0106, no desc
https://d3196yreox78o9.cloudfront.net/8e30/9849/5dbc/4ea3-a1bd-4f7e03ed1940/58bb6480-7952-4e30-8d38-f0b00265c975_a53.aac/range/0-33243
#EXTINF:4.0106, no desc
https://d3196yreox78o9.cloudfront.net/8e30/9849/5dbc/4ea3-a1bd-4f7e03ed1940/58bb6480-7952-4e30-8d38-f0b00265c975_a53.aac/range/33244-65751
#EXTINF:4.0106, no desc
https://d3196yreox78o9.cloudfront.net/8e30/9849/5dbc/4ea3-a1bd-4f7e03ed1940/58bb6480-7952-4e30-8d38-f0b00265c975_a53.aac/range/65752-98851
#EXTINF:3.968, no desc
https://d3196yreox78o9.cloudfront.net/8e30/9849/5dbc/4ea3-a1bd-4f7e03ed1940/58bb6480-7952-4e30-8d38-f0b00265c975_a53.aac/range/98852-131455
#EXTINF:4.0106, no desc
https://d3196yreox78o9.cloudfront.net/8e30/9849/5dbc/4ea3-a1bd-4f7e03ed1940/58bb6480-7952-4e30-8d38-f0b00265c975_a53.aac/range/131456-164360
#EXTINF:4.0106, no desc
https://d3196yreox78o9.cloudfront.net/8e30/9849/5dbc/4ea3-a1bd-4f7e03ed1940/58bb6480-7952-4e30-8d38-f0b00265c975_a53.aac/range/164361-197530
#EXTINF:4.0106, no desc
https://d3196yreox78o9.cloudfront.net/8e30/9849/5dbc/4ea3-a1bd-4f7e03ed1940/58bb6480-7952-4e30-8d38-f0b00265c975_a53.aac/range/197531-230116
#EXTINF:3.968, no desc
https://d3196yreox78o9.cloudfront.net/8e30/9849/5dbc/4ea3-a1bd-4f7e03ed1940/58bb6480-7952-4e30-8d38-f0b00265c975_a53.aac/range/230117-262712
#EXTINF:4.0106, no desc
https://d3196yreox78o9.cloudfront.net/8e30/9849/5dbc/4ea3-a1bd-4f7e03ed1940/58bb6480-7952-4e30-8d38-f0b00265c975_a53.aac/range/262713-295484
#EXTINF:4.0106, no desc
https://d3196yreox78o9.cloudfront.net/8e30/9849/5dbc/4ea3-a1bd-4f7e03ed1940/58bb6480-7952-4e30-8d38-f0b00265c975_a53.aac/range/295485-328478
#EXTINF:4.0106, no desc
https://d3196yreox78o9.cloudfront.net/8e30/9849/5dbc/4ea3-a1bd-4f7e03ed1940/58bb6480-7952-4e30-8d38-f0b00265c975_a53.aac/range/328479-361336
#EXTINF:3.968, no desc
https://d3196yreox78o9.cloudfront.net/8e30/9849/5dbc/4ea3-a1bd-4f7e03ed1940/58bb6480-7952-4e30-8d38-f0b00265c975_a53.aac/range/361337-393879
#EXTINF:4.0106, no desc
https://d3196yreox78o9.cloudfront.net/8e30/9849/5dbc/4ea3-a1bd-4f7e03ed1940/58bb6480-7952-4e30-8d38-f0b00265c975_a53.aac/range/393880-426713
#EXTINF:4.0106, no desc
https://d3196yreox78o9.cloudfront.net/8e30/9849/5dbc/4ea3-a1bd-4f7e03ed1940/58bb6480-7952-4e30-8d38-f0b00265c975_a53.aac/range/426714-459662
#EXTINF:4.0106, no desc
https://d3196yreox78o9.cloudfront.net/8e30/9849/5dbc/4ea3-a1bd-4f7e03ed1940/58bb6480-7952-4e30-8d38-f0b00265c975_a53.aac/range/459663-492521
#EXTINF:3.968, no desc
https://d3196yreox78o9.cloudfront.net/8e30/9849/5dbc/4ea3-a1bd-4f7e03ed1940/58bb6480-7952-4e30-8d38-f0b00265c975_a53.aac/range/492522-524877
#EXTINF:4.0106, no desc
https://d3196yreox78o9.cloudfront.net/8e30/9849/5dbc/4ea3-a1bd-4f7e03ed1940/58bb6480-7952-4e30-8d38-f0b00265c975_a53.aac/range/524878-557827
#EXTINF:4.0106, no desc
https://d3196yreox78o9.cloudfront.net/8e30/9849/5dbc/4ea3-a1bd-4f7e03ed1940/58bb6480-7952-4e30-8d38-f0b00265c975_a53.aac/range/557828-590820
#EXTINF:4.0106, no desc
https://d3196yreox78o9.cloudfront.net/8e30/9849/5dbc/4ea3-a1bd-4f7e03ed1940/58bb6480-7952-4e30-8d38-f0b00265c975_a53.aac/range/590821-623559
#EXTINF:3.968, no desc
https://d3196yreox78o9.cloudfront.net/8e30/9849/5dbc/4ea3-a1bd-4f7e03ed1940/58bb6480-7952-4e30-8d38-f0b00265c975_a53.aac/range/623560-656184
```

Exemplary Audio Variant Playlist



```
HTTP/1.1 200 OK
#EXTM3U
#EXT-X-VERSION:7
#EXT-X-PLAYLIST-TYPE:VOD
#EXT-X-MEDIA-SEQUENCE:0
#EXT-X-INDEPENDENT-SEGMENTS
#EXT-X-TARGETDURATION:5
#USP-X-MEDIA:BANDWIDTH=1807000,AVERAGE-BANDWIDTH=746000,TYPE-VIDEO,GROUP-ID="video-avc3-710",NAME="video",AUTOSELECT-YES,CODECS="avc1.4D401F",RESOLUTION=962x520,FRAME-RATE=23.976
#EXT-X-KEY:METHOD=SAMPLE-AES,URI="skd://b0c48cfc-f1c0-4f35-b490-cdaa85312bfe",KEYFORMAT="com.apple.streamingkeydelivery",KEYFORMATVERSIONS="1"
#EXTINF:2.9195, no desc
https://d3196yreox78o9.cloudfront.net/8e30/9849/5dbc/4ea3-a1bd-4f7e03ed1940/58bb6480-7952-4e30-8d38-f0b00265c975_v6.ts/range/0-72567
#EXTINF:2.9612, no desc
https://d3196yreox78o9.cloudfront.net/8e30/9849/5dbc/4ea3-a1bd-4f7e03ed1940/58bb6480-7952-4e30-8d38-f0b00265c975_v6.ts/range/72568-139119
#EXTINF:4.9632, no desc
https://d3196yreox78o9.cloudfront.net/8e30/9849/5dbc/4ea3-a1bd-4f7e03ed1940/58bb6480-7952-4e30-8d38-f0b00265c975_v6.ts/range/139120-193639
#EXTINF:4.9632, no desc
https://d3196yreox78o9.cloudfront.net/8e30/9849/5dbc/4ea3-a1bd-4f7e03ed1940/58bb6480-7952-4e30-8d38-f0b00265c975_v6.ts/range/193640-320351
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https://d3196yreox78o9.cloudfront.net/8e30/9849/5dbc/4ea3-a1bd-4f7e03ed1940/58bb6480-7952-4e30-8d38-f0b00265c975_v6.ts/range/320352-633559
#EXTINF:4.3793, no desc
https://d3196yreox78o9.cloudfront.net/8e30/9849/5dbc/4ea3-a1bd-4f7e03ed1940/58bb6480-7952-4e30-8d38-f0b00265c975_v6.ts/range/633560-934735
#EXTINF:4.7964, no desc
https://d3196yreox78o9.cloudfront.net/8e30/9849/5dbc/4ea3-a1bd-4f7e03ed1940/58bb6480-7952-4e30-8d38-f0b00265c975_v6.ts/range/934736-1175751
#EXTINF:4.7964, no desc
https://d3196yreox78o9.cloudfront.net/8e30/9849/5dbc/4ea3-a1bd-4f7e03ed1940/58bb6480-7952-4e30-8d38-f0b00265c975_v6.ts/range/1175752-1528063
#EXTINF:4.8381, no desc
https://d3196yreox78o9.cloudfront.net/8e30/9849/5dbc/4ea3-a1bd-4f7e03ed1940/58bb6480-7952-4e30-8d38-f0b00265c975_v6.ts/range/1528064-2066871
#EXTINF:4.9632, no desc
https://d3196yreox78o9.cloudfront.net/8e30/9849/5dbc/4ea3-a1bd-4f7e03ed1940/58bb6480-7952-4e30-8d38-f0b00265c975_v6.ts/range/2066872-2464303
#EXTINF:4.9632, no desc
https://d3196yreox78o9.cloudfront.net/8e30/9849/5dbc/4ea3-a1bd-4f7e03ed1940/58bb6480-7952-4e30-8d38-f0b00265c975_v6.ts/range/2464304-3093351
#EXTINF:4.9632, no desc
https://d3196yreox78o9.cloudfront.net/8e30/9849/5dbc/4ea3-a1bd-4f7e03ed1940/58bb6480-7952-4e30-8d38-f0b00265c975_v6.ts/range/3093352-3746463
#EXTINF:4.9633, no desc
https://d3196yreox78o9.cloudfront.net/8e30/9849/5dbc/4ea3-a1bd-4f7e03ed1940/58bb6480-7952-4e30-8d38-f0b00265c975_v6.ts/range/3746464-4571031
#EXTINF:4.9632, no desc
https://d3196yreox78o9.cloudfront.net/8e30/9849/5dbc/4ea3-a1bd-4f7e03ed1940/58bb6480-7952-4e30-8d38-f0b00265c975_v6.ts/range/4571032-5221135
#EXTINF:3.7954, no desc
https://d3196yreox78o9.cloudfront.net/8e30/9849/5dbc/4ea3-a1bd-4f7e03ed1940/58bb6480-7952-4e30-8d38-f0b00265c975_v6.ts/range/5221136-5549383
#EXTINF:3.8371, no desc
https://d3196yreox78o9.cloudfront.net/8e30/9849/5dbc/4ea3-a1bd-4f7e03ed1940/58bb6480-7952-4e30-8d38-f0b00265c975_v6.ts/range/5549384-5925759
#EXTINF:4.9632, no desc
https://d3196yreox78o9.cloudfront.net/8e30/9849/5dbc/4ea3-a1bd-4f7e03ed1940/58bb6480-7952-4e30-8d38-f0b00265c975_v6.ts/range/5925760-6163767
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https://d3196yreox78o9.cloudfront.net/8e30/9849/5dbc/4ea3-a1bd-4f7e03ed1940/58bb6480-7952-4e30-8d38-f0b00265c975_v6.ts/range/6163768-6380719
#EXTINF:2.9612, no desc
https://d3196yreox78o9.cloudfront.net/8e30/9849/5dbc/4ea3-a1bd-4f7e03ed1940/58bb6480-7952-4e30-8d38-f0b00265c975_v6.ts/range/6380720-6648807
#EXTINF:3.2115, no desc
https://d3196yreox78o9.cloudfront.net/8e30/9849/5dbc/4ea3-a1bd-4f7e03ed1940/58bb6480-7952-4e30-8d38-f0b00265c975_v6.ts/range/6648808-7205663
#EXTINF:3.2532, no desc
```

Exemplary Video Variant Playlist

287. The Media Sequence Number, segment duration information, and additional segment and stream metadata is used to generate an approximate media presentation timeline to align the content segments and output them sequentially to the video and audio playback buffers on the client device.

288. The Amazon ’794 Accused Products sequentially output the first and second data

segments according to their chronological sequence in such a way that each of the content-related second data segments is output together with an associated one of the content-related first data segments on the basis of an assignment rule for associating related audio and video media content components. In accordance with the mandates of HLS, assignment of audio and video content segments is based on rules that specify their position and order on the relative media presentation timeline.[141]

289. Playback of content in the client application on the subscribers' connected device, or in the subscribers' browser, consists of a three-step process: (1) loading and parsing the manifest to create a list of segments for the various content types, associating an approximate position on the overall media presentation timeline for each; (2) using the resulting segment lists and approximate timing information to load the appropriate content segments into a playback buffer sufficient to begin content presentation by the presentation engine; and (3) managing the playback buffer as a presentation continues, including the loading of subsequent segments for consumption, and the removal of segments which have been presented and are no longer needed.

290. Sequential, synchronized, chronological output to the media playback buffers is accomplished, for example, by the HLS client application parsing the variant playlists and associating each individual video and audio segment to the media presentation timeline on the basis of the approximate presentation duration information and the chronologically ordered video and audio segment lists in conjunction with other segment and stream metadata specified in the variant manifests. Collectively, at least this metadata serves as an assignment rule that assigns each one of the content-related second data segments (i.e., the audio segments) to one of the

[141] *See* Ex. 113, HLS Spec, Sections 6.3.2, 6.3.3, 6.3.4.5, 6.3.4.6, pp. 61-64.

content-related first data segments (i.e., the video segments) on the media presentation timeline. This is the case during playback and also during the creation and storage of HLS files.

291. As another example, Amazon supports the DASH streaming protocol.

Amazon Elastic Transcoder Now Supports MPEG-DASH

Posted On: May 24, 2016

You can now use Amazon Elastic Transcoder to create MPEG-DASH streams. MPEG-DASH is a standard for HTTP based adaptive bitrate streaming of video. With Elastic Transcoder support for MPEG-DASH, you can now reach a wide range of DASH-compatible devices (from desktop to mobile and OTT) with fewer output renditions created using the same easy workflows that Elastic Transcoder supports for HLS and Smooth Streaming. This enables you to simplify your video processing workflows and helps improve cost efficiency.

To produce MPEG-DASH output for your assets, generate the required video-only and audio-only outputs using the newly available system presets, and select the "MPEG-DASH" option for the playlist format when creating a transcoding job. You can then deliver the outputs by streaming them directly from S3 or through a CDN like Amazon CloudFront for low latency and high data transfer speeds.

To learn more, please consult the Elastic Transcoder Developer Guide.

Kinesis Video Streams adds support for Dynamic Adaptive Streaming over HTTP (DASH) and H.265 video

Posted On: Jul 12, 2019

Amazon Kinesis Video Streams Dynamic Adaptive Streaming over HTTP (DASH) capability enables developers to playback their ingested video streams using the industry-standard, HTTP-based media streaming protocol.

As devices stream their video into Kinesis Video Streams, developers can use the fully-managed DASH capability to playback live and recorded video from their streams. Developers can now also stream, store, and process H.265 video for playback and Machine Leaning based processing.

The DASH-based playback capability is fully managed, so you do not have to build any cloud-based infrastructure or software to playback the media captured by Amazon Kinesis Video streams. You can simply create a streaming session using the new APIs and leverage webplayers such as VideoJS or GoogleShaka player, modern web browsers, or video players for mobile platforms such as Android (Exoplayer) and iOS (AVMediaPlayer), that are compatible with the fragmented MP4 (FMP4) format.

H.265 video offers superior compression over H.264 encoded video allowing developers to deliver high quality video at lower bitrates. Developers can stream and store H.265 video generated by compatible edge devices into Kinesis Video streams and then process it for generating machine learning based insights or playback the video using Amazon Kinesis Video Streams' HTTP Live Streaming (HLS) or DASH capabilities.

To learn more, please refer to the developer documentation.

Refer to the AWS global region table for Amazon Kinesis Video Streams availability.

Announcing New AWS Elemental MediaConvert Features for Accelerated Transcoding, DASH, and AVC Video Quality

Posted On: Oct 9, 2019

Today, AWS Elemental MediaConvert adds support for several new features, including improved video quality with single- and multi-pass HQ (High Quality) encoding for H.264 (AVC), expanded Accelerated Transcoding capabilities, and the On Demand profile for DASH output groups.

With improvements to "Single-Pass HQ" and "Multi-Pass HQ" using AVC (Advanced Video Coding), better video quality (VQ) can be achieved compared to previous outputs without increasing the peak bitrate, or the same VQ can be achieved with a lower peak bitrate. Greater compression efficiency reduces storage and delivery costs, and improved VQ increases viewer satisfaction.

Accelerated Transcoding has two new features. First is the ability to frame capture JPEG files for jobs with Accelerated Transcoding enabled, generating thumbnails for video outputs that can be used for metadata or other purposes with the benefit of faster turnaround times. In addition, Accelerated Transcoding has a new "Preferred" mode, where jobs that don't qualify for acceleration fall back to standard transcoding mode rather than failing. This eases operations as transcoding jobs are resubmitted automatically without any intervention.

Finally, the On Demand profile is available to DASH (Dynamic Adaptive Streaming over HTTP) output groups. To use this profile, simply set the MPD (Media Presentation Description) manifest profile to "On-demand" instead of "Main." This setting increases compatibility with DASH players and DASH-capable devices, broadening your streaming options.

With AWS Elemental MediaConvert, video providers with any size content library can easily and reliably transcode on-demand content for broadcast and multiscreen delivery. MediaConvert functions independently or as part of AWS Elemental Media Services, a family of services that form the foundation of cloud-based workflows and offer the capabilities needed to transport, transcode, package, and deliver video.

Visit the AWS region table for a full list of AWS Regions where AWS Elemental MediaConvert is available. To learn more about MediaConvert, please visit https://aws.amazon.com/mediaconvert/.

292. Furthermore, Amazon Prime Video provides Media Presentation Descriptions ("MPDs") to connected devices accessing the Amazon Prime Video streaming service, either via the Amazon Prime Video app installed on their respective connected device or by accessing the Amazon Prime Video streaming service from their web browser. Amazon also processes video with its cloud services to create and store audio segments, video segments, MPDs, and related information and metadata. Below is a representative MPD from Amazon Prime Video for the Amazon Prime Video program *Upload* that is generated by Amazon and delivered to the Amazon Prime Video client running on the subscribers' connected device or web browser:

293. DASH is an adaptive bitrate streaming technique that enables high quality streaming of media content over the Internet delivered from conventional HTTP web servers. It works by breaking the content into a sequence of small segments and serving each segment individually. Since the content is made available at a variety of different bitrates, while the content is being played back the client uses an adaptive bitrate algorithm to automatically select the segment with the highest bitrate possible that can be obtained in time for playback without causing stalls or re-buffering events in the playback.

294. Devices accessing Amazon Prime Video perform a method for synchronizing content-related first data segments of a first data file and content-related second data segments of a second data file. In that regard, to deliver MPEG-DASH streaming content to the client application, for example, Amazon first transcodes each content program available on its OTT streaming service into multiple distinct bitrate/resolution audio and video encodes. The different program encodes are maintained on Amazon's content delivery network and each of the adaptations and representations thereof are specified in a MPEG-DASH content manifest (an MPD) in accordance with MPEG-DASH standard requirements [indicated in green below].[142]

[142] *See* DASH Standard, § 5.3.1.1 (4th ed. 2019-12).

5.3.1.1 Overview

A Media Presentation as described in the MPD consists of a sequence of one or more Periods as described in subclause 5.3.2.

— Each Period contains one or more Adaptation Sets as described in subclause 5.3.3. In case an Adaptation Set contains multiple media content components, then each media content component is described individually as defined in subclause 5.3.4.

— Each Adaptation Set contains one or more Representations as described in subclause 5.3.5.

— Adaptation Sets, Representations and Sub-Representations share common attributes and elements that are described in subclause 5.3.7.

— Each Period may contain one or more Subsets that restrict combination of Adaptation Sets for presentation. Subsets are described in subclause 5.3.8.

— Each Representation consists of one or more Segments described in Clause 6. Segment Information is introduced in subclause 5.3.9. Segments contain media data and/or metadata to access, decode and present the included media content. Representations may also include Sub-Representations as defined in subclause 5.3.6 to describe and extract partial information from a Representation.

— Each Segment consists of one or more Subsegments. Subsegments are described in subclause 6.2.3.2.

Section 5.3.1.1 Hierarchical Data Model, Overview

295. The Amazon MPD specifies content-related data segments of a first data file, for example, the video segments of the content program [indicated in red above], and content-related data segments of a second data file, for example, the audio segments of the content program [indicated in blue above]. Amazon makes use of MPEG-DASH's SegmentBase indexRange attribute in its MPDs to reference the location of the ISOBMFF *sidx* (segment index) box.[143] This box contains information about the sub-segments and random access points for seeking, etc. The MPEG-DASH client (i.e., the Amazon Prime Video app or the programmed web browser) parses the sub-segment information in the *sidx* box to construct the full list of content-related video and audio segments for Amazon Prime Video content The MPEG-DASH client utilizes the information in the *sidx* box to fetch the appropriate sub-segment(s) from the media file on-demand as playback continues or a seek happens.

[143] *See, e.g.*, DASH Standard, § 5.3.9.2.

296. For example, when the DASH client parses the Representation metadata in the Amazon Prime Video MPD it obtains the sub-segment list for the video file identified by the BaseURL reference contained in the Representation [indicated in gold above] from the *sidx* box which is addressed at the specified indexRange [indicated in purple above]. The DASH client similarly parses the Representation metadata for the audio file identified by the BaseURL reference contained in the Representation [indicated in brown above] from the respective *sidx* box which is similarly addressed at the specified indexRange [indicated in black above].

297. The presentation time of each access unit within the program is mapped to a global common presentation timeline, the Media Presentation timeline, for synchronization of different media components.[144]

> DASH defines different timelines. One of the key features in DASH is that encoded versions of different media content components share a common timeline. The presentation time of each access unit within the media content is mapped to the global common presentation timeline for synchronization of different media components and to enable seamless switching of different coded versions of the same media components. This timeline is referred as Media Presentation timeline. The Media Segments themselves contain accurate Media Presentation timing information enabling synchronization of components and seamless switching.

Section 4.3 DASH Data Model

[144] *See* DASH Standard § 4.3.

298. The DASH client application on the subscribers' connected device, or the DASH application programmed into the web browser when accessing Amazon Prime Video, sequentially outputs the content-related first data segments and the content-related second data segments according to their chronological sequence. This is done in such a way that each of the content-related second data segments (i.e., the audio segments) is output together with an associated one of the content-related first data segments (i.e., the video segments) on the basis of an assignment rule that assigns each one of the content-related second data segments (i.e., the audio segments) to one of the content-related first data segments (i.e., the video segments).

299. Playback of content in the DASH client application on the subscribers' connected device or in the subscribers' browser consists of a three-step process: (1) loading and parsing the manifest to create a list of segments for the various content types, associating an approximate position on the overall Media Presentation timeline for each; (2) using the resulting segment lists and approximate timing information to load the appropriate content segments into a playback buffer sufficient to begin content presentation by the presentation engine; and (3) managing the playback buffer as a presentation continues, including the loading of subsequent segments for consumption, and the removal of segments which have been presented and are no longer needed.

300. Sequential, synchronized, chronological output to the media playback buffers is accomplished, for example, by the Amazon Prime Video DASH client application parsing the MPD manifest and associating each individual video and audio segment to the Media Presentation timeline on the basis of the approximate presentation duration information and the chronologically ordered video and audio segment lists obtained from the ISOBMFF *sidx* boxes. Collectively, at least this metadata serves as an assignment rule that assigns each one of the content-related second

data segments (i.e., the audio segments) to one of the content-related first data segments (i.e., the video segments) on the Media Presentation timeline.

301. VideoLabs representatives met with Amazon representatives at least on March 12, 2020 to present VideoLabs' platform and gauge Amazon's interest in joining as a partner or member.[145] Following the meeting, VideoLabs offered to provide more detail about its patent portfolio but Amazon did not respond. At least by August 5, 2021, so that patent licensing discussions could proceed, VideoLabs provided Amazon a list of VideoLabs' patents, including all patents asserted in this First Amended Complaint.[146] On August 31, 2021, Amazon indicated that it had conducted an initial review of VideoLabs' patents, was in the process of conducting a deeper review of certain patents, and would get back to VideoLabs in a matter of weeks. But to date, months later, Amazon has not reengaged with VideoLabs.

302. Amazon of course knows how its products operate, and on information and belief, Amazon investigated the '794 Patent and its infringement of the Amazon '794 Accused Products. Amazon has been given further notice of the '794 Patent and its infringement of the '794 Patent through the filing of the Complaint (Dkt. 1) on January 21, 2022, the service of infringement contentions on April 14, 2022, and the filing of this First Amended Complaint. On information and belief, Amazon is either knowingly infringing the '794 Patent or is willfully blind to its infringement, and continues to act in wanton disregard of VideoLabs' patent rights.

303. Despite becoming aware of or willfully blinding itself to its infringement of the '794 Patent, Amazon has nonetheless continued to engage in and has escalated its infringing activities by continuing to develop, advertise, make available, and use the infringing functionalities

[145] *See* Ex. 100 (VideoLabs presentation to Amazon).

[146] *See* Ex. 101 (VideoLabs email to Amazon attaching portfolio listing).

of the Amazon '794 Accused Products. On information and belief, Amazon has made no attempts to design around the '794 Patent or otherwise stop its infringing behavior.

304. Amazon's infringement of the '794 Patent therefore has been and remains willful.

305. Amazon also indirectly infringes the '794 Patent by inducing others to infringe and contributing to the infringement of others, including third-party users of the Amazon '794 Accused Products in this District and throughout the United States. As described above, on information and belief, Amazon has known about the '794 Patent since at least August 5, 2021.

306. On information and belief, Amazon has actively induced the infringement of the '794 Patent under 35 U.S.C. § 271(b) by actively inducing the infringement of the Amazon '794 Accused Products by third parties in the United States. Amazon knew or was willfully blind to the fact that its conduct would induce these third parties to act in a manner that infringes the '794 Patent in violation of 35 U.S.C. § 271(a).

307. Amazon actively encouraged and continues to actively encourage third parties to directly infringe the '794 Patent by, for example, marketing the '794 Accused Products to consumers; working with consumers to implement, install and/or operate the '794 Accused Products; fully supporting and managing consumers' continuing use of the '794 Accused Products; and providing technical assistance to consumers during their continued use of the '794 Accused Products.[147]

[147] *See e.g.,* Ex. 104, *Install Prime Video on Your Devices*, AMAZON, https://www.amazon.com/gp/help/customer/display.html?nodeId=GWX36LKK4FFEHMWA (last accessed Jan. 18, 2022); Ex. 105, Amazon Prime Video, *Welcome to Prime Video 2021*, YOUTUBE (Jan. 3, 2021), https://www.youtube.com/watch?v=C4vrcDgVnjE (Prime Video advertisement); Ex. 109, *AWS Elemental Server Resources*, AWS, https://aws.amazon.com/elemental-server/resources/ (last accessed Jan. 18, 2022); Ex. 110, *Amazon Elastic Transcoder Developer Resources*, AWS, https://aws.amazon.com/elastictranscoder/developer-resources/ (last accessed Jan. 18, 2022); Ex.

308. For example, Amazon induces third parties to infringe the '794 Patent by encouraging them to install and operate the Amazon Prime Video streaming service, which alone and/or in combination with the third parties' devices constitutes infringement of the '794 Patent. Amazon advertises and promotes its Amazon Prime Video streaming service on its website and in various app stores such as Apple's app store and Android's app store in connection with the Amazon Prime Video mobile application that can be installed on consumers' respective connected iOS and Android devices (as well as others), and encourages consumers to configure and operate their mobile and computer devices in an infringing manner.[148] In response, consumers acquire, configure, and operate the Amazon Prime Video streaming service in an infringing manner.

309. Amazon further induces third parties to infringe by encouraging its customers to employ many features and functionalities of HLS and DASH. For example, Amazon tells its customers that the "great thing about HLS is that it is an industry standard and really easy to leverage in existing web players . . ., or even render[] natively in mobile apps . . . ."[149] As another example, Amazon tells its customers that "MPEG-DASH is a standard for HTTP based adaptive bitrate streaming of video. With Elastic Transcoder support for MPEG-DASH, you can now reach a wide range of DASH-compatible devices (from desktop to mobile and OTT) with fewer output renditions created using the same easy workflows that Elastic Transcoder supports for HLS and

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114, *Getting Started with Amazon Kinesis*, AWS, https://aws.amazon.com/kinesis/getting-started/?nc=sn&loc=3 (last accessed Jan. 18, 2022).

[148] *See e.g.,* Ex. 111 *Prime Video – Amazon Customer Service*, AMAZON, https://www.amazon.com/gp/help/customer/display.html?nodeId=G9SY6AQJV45JFMET (last accessed Jan. 18, 2022); Ex. 104, *Install Prime Video on Your Devices*, AMAZON, https://www.amazon.com/gp/help/customer/display.html?nodeId=GWX36LKK4FFEHMWA (last accessed Jan. 18, 2022).

[149] *See* Ex. 115, Randall Hunt, *Amazon Kinesis Video Streams Adds Support For HLS Output Streams*, AWS NEWS BLOG (Jul. 13, 2018), https://aws.amazon.com/blogs/aws/amazon-kinesis-video-streams-adds-support-for-hls-output-streams/ (last visited Jan. 18, 2022).

Smooth Streaming. This enables you to simplify your video processing workflows and helps improve cost efficiency."[150]

310. On information and belief, Amazon contributorily infringes the '794 Patent under 35 U.S.C. § 271(c) by importing, selling, and/or offering to sell within the United States the Amazon '794 Accused Products (or components thereof) that constitute a material part of the claimed invention and are not staple articles of commerce suitable for substantial non-infringing use. For example, the hardware and/or software for sequentially outputting content-related data segments is material, has no insubstantial non-infringing uses, and is known by Amazon to be especially made or adapted for use in a manner that infringes the '794 Patent.

COUNT V
INFRINGEMENT OF U.S. PATENT NO. 7,266,682

311. VideoLabs incorporates by reference the foregoing paragraphs of this First Amended Complaint as if fully set forth herein.

312. VL IP is the assignee and lawful owner of all right, title, and interest in and to the '682 Patent. The '682 Patent is valid and enforceable.

313. On information and belief, Amazon has infringed and continues to infringe the '682 Patent in violation of 35 U.S.C. § 271(a), either literally or through the doctrine of equivalents, by using methods and/or taking steps that practice at least claim 1 of the '682 Patent, including with respect to the Amazon '682 Accused Products.

314. On information and belief, Amazon uses the Amazon '682 Accused Products for its own business purposes. In addition, Amazon regularly conducts testing and troubleshooting of

[150] Ex. 135, Kinesis Video Streams adds support for Dynamic Adaptive Streaming over HTTP (DASH) and H.265 video, https://aws.amazon.com/about-aws/whats-new/2019/07/kinesis-video-streams-adds-support-for-dynamic-adaptive-streaming-over-http-dash-and-h-2-6-5-video/ (last accessed Apr. 20, 2022).

the Amazon '682 Accused Products. Further, VideoLabs is informed and believes companies related to Amazon (e.g., AWS, Amazon, and Amazon's subsidiaries) use the '682 Amazon Accused Products.

315. On information and belief, Amazon's infringement through its use of WebRTC, described below, is exemplary of all of Amazon's infringement with respect to all the Amazon '682 Accused Products.

316. The Amazon '682 Accused Products directly infringe at least claim 1 of the '682 Patent by, for example, performing SRTP/SRTCP authentication via streaming using the WebRTC standard.

317. The Amazon '682 Accused Products meet every limitation of claim 1 of the '682 Patent, which recites:

> 1. A method for transmitting data from a transmitter to a receiver, comprising:
>
> providing transmitter-to-receiver authentication at a Real Time Transport Protocol (RTP) packet level as an application protocol on an application layer by inserting, at the transmitter, authentication data at end of a whole RTP packet payload;
>
> ascertaining, by the receiver, whether the receiver knows the transmitter based on the RTP packet level authentication data; and
>
> accepting, by the receiver, the whole RTP packet payload, if the receiver knows the transmitter, and otherwise rejecting the whole RTP packet payload.

318. The Amazon '682 Accused Products practice a method for transmitting data from a transmitter to a receiver. The WebRTC framework provides support for direct interactive rich communication using audio, video, text, collaboration, games, etc., between two peers' web

browsers.[151]

319. The Amazon '682 Accused Products provide transmitter-to-receiver authentication at a Real Time Transport Protocol (RTP) packet level as an application protocol on an application layer. The accused WebRTC Products provide secure authentication by using RTP payloads. *See* WebRTC Spec at 8 ("WebRTC Endpoints . . . MUST employ the full RTP/SAVPF profile to protect all RTP and RTPC packets that are generated (i.e., implementations MUST use SRTP and SRTCP)"). SRTP, a profile of RTP, is a real-time transport protocol which provides confidentiality, message authentication, and replay protection to the RTP traffic and to the control traffic for RTP, RTCP (the Real-time Transport Control Protocol).[152] SRTP is an application protocol operating on an application layer of the standard OSI model, residing between the RTP application and the transport layer.[153]

320. WebRTC uses DTLS-SRTP to add encryption, message authentication and integrity, and replay attack protection. As such, SRTP is a key component of the security in WebRTC. With WebRTC, SRTP is used for encrypting media streams. The image below illustrates the role of SRTP in WebRTC.[154]

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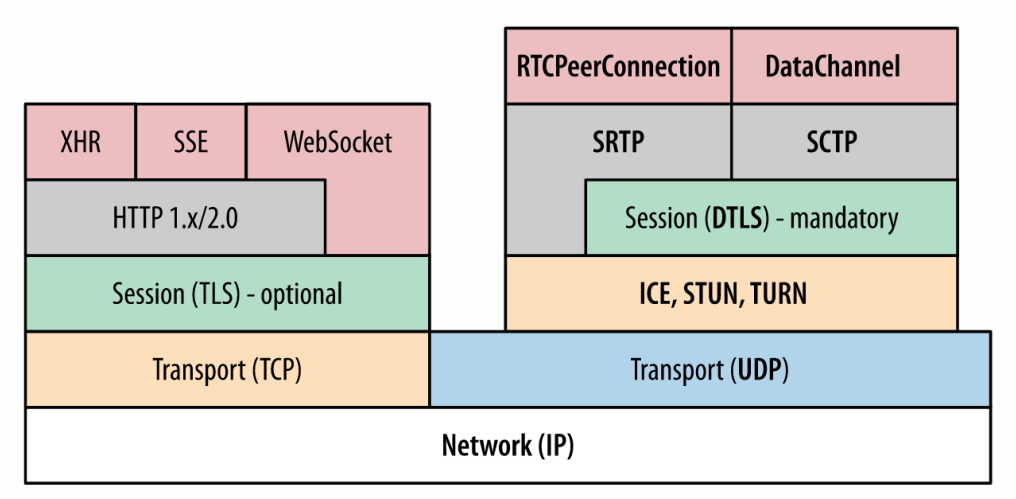
[151] *See* Ex. 116, RTCWEB Working Group, Web Real-Time Communication (WebRTC): Media Transport and Use of RTP (June 12, 2015) (hereinafter "WebRTC Spec"), at 1.

[152] *See* Ex. 37, *The Secure Real-time Transport Protocol,* IETF (Mar. 2004) (hereinafter "RFC 3711"), at 3, available at https://datatracker.ietf.org/doc/html/rfc3711 (last visited Jan. 20, 2022).

[153] *See* Ex. 37, RFC 3711, Section 3, p. 5.

[154] *See* Ex. 137, Ilya Grigorik, *High Performance Browser Networking, WebRTC: Browser APIs and Protocols*, at Figure 18-3, available at https://hpbn.co/webrtc/.

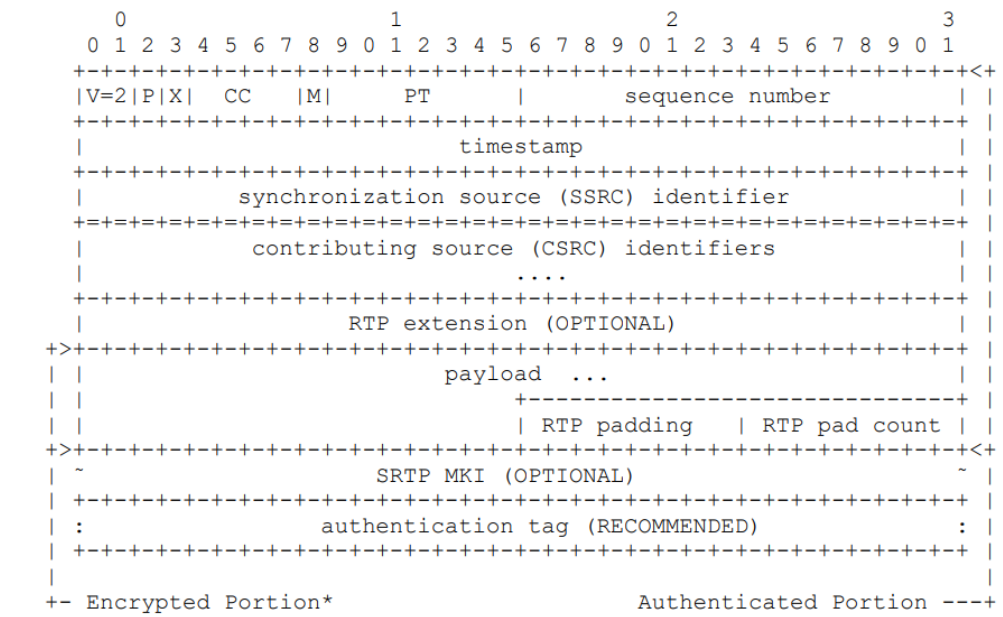


321. Amazon provides this authentication by inserting, at the transmitter, authentication data at end of a whole RTP packet payload. As shown below, Amazon inserts an authentication tag at the end of a whole RTP packet payload. The authentication tag is used to carry message authentication data.[155]

[155] *See* RFC 3711, Section 3.1, pp. 6-7.

3.1. Secure RTP

The format of an SRTP packet is illustrated in Figure 1.



Ex. 37, RFC 3711, at 6.

322. Further, the Amazon '682 Accused Products ascertain, by the receiver, whether the receiver knows the transmitter based on the RTP packet level authentication data. In WebRTC, "[t]o authenticate and decrypt an SRTP packet, the receiver SHALL do" tasks including "verification of the authentication tag," which is performed "using the rollover counter . . . , the authentication algorithm indicated in the cryptographic context, and the session authentication key."[156]

323. Finally, the Amazon '682 Accused Products accept, by the receiver, the whole RTP packet payload, if the receiver knows the transmitter, and otherwise reject the whole RTP packet payload. Specifically, at the receiver, "[i]f the result is 'AUTHENTICATION FAILURE' . . . , the packet MUST be discarded from further processing."[157] However, if the authentication is

[156] *See* Ex. 37, RFC 3711, Section 3.3, p. 12.

[157] *See* Ex. 37, RFC 3711, Section 3.3, p. 12.

successful, the receiver "[d]ecrypt[s] the Encrypted Portion of the packet . . . using the decryption algorithm indicated in the cryptographic context, the session encryption key and salt (if used)… with the index [of the SRTP packet]."[158]

324. On information and belief, to the extent applicable, VideoLabs has complied with 35 U.S.C. § 287(a) with respect to the '682 Patent.

325. VideoLabs representatives met with Amazon representatives at least on March 12, 2020 to present VideoLabs' platform and gauge Amazon's interest in joining as a partner or member.[159] Following the meeting, VideoLabs offered to provide more detail about its patent portfolio but Amazon did not respond. At least by August 5, 2021, so that patent licensing discussions could proceed, VideoLabs provided Amazon a list of VideoLabs' patents, including all patents asserted in this First Amended Complaint.[160] On August 31, 2021, Amazon indicated that it had conducted an initial review of VideoLabs' patents, was in the process of conducting a deeper review of certain patents, and would get back to VideoLabs in a matter of weeks. But to date, months later, Amazon has not reengaged with VideoLabs.

326. Amazon of course knows how its products operate, and on information and belief, Amazon investigated the '682 Patent and its infringement of the Amazon '682 Accused Products. Amazon has been given further notice of the '682 Patent and its infringement of the '682 Patent through the filing of the Complaint (Dkt. 1) on January 21, 2022, the service of infringement contentions on April 14, 2022, and the filing of this First Amended Complaint. On information and belief, Amazon is either knowingly infringing the '682 Patent or is willfully blind to its infringement, and continues to act in wanton disregard of VideoLabs' patent rights.

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[158] *See* Ex. 37, RFC 3711, Section 3.3, p. 12.

[159] *See* Ex. 100 (VideoLabs presentation to Amazon).

[160] *See* Ex. 101 (VideoLabs email to Amazon attaching portfolio listing).

327. Despite becoming aware of or willfully blinding itself to its infringement of the '682 Patent, Amazon has nonetheless continued to engage in and has escalated its infringing activities by continuing to develop, advertise, make available, and use the infringing functionalities of the Amazon '682 Accused Products. On information and belief, Amazon has made no attempts to design around the '682 Patent or otherwise stop its infringing behavior.

328. Amazon's infringement of the '682 Patent therefore has been and remains willful.

329. Amazon also indirectly infringes the '682 Patent by inducing others to infringe and contributing to the infringement of others, including third party users of the Amazon '682 Accused Products in this District and throughout the United States. As described above, on information and belief, Amazon has known about the '682 Patent since at least August 5, 2021.

330. On information and belief, Amazon has actively induced the infringement of the '682 Patent under 35 U.S.C. § 271(b) by actively inducing third parties in the United States to use methods and/or take steps that practice at least claim 1 of the '682 Patent with respect to the '682 Accused Products. Amazon knew or was willfully blind to the fact that its conduct would induce these third parties to act in a manner that infringes the '682 Patent in violation of 35 U.S.C. § 271(a).

331. Amazon actively encouraged and continues to actively encourage third parties to directly infringe the '682 Patent by, for example, marketing the '682 Accused Products and WebRTC to consumers; working with consumers to implement, install and/or operate the '682 Accused Products and WebRTC; fully supporting and managing consumers' continuing use of the

'682 Accused Products and WebRTC; and providing technical assistance to consumers during their continued use of the '682 Accused Products and WebRTC.[161]

332. On information and belief, Amazon contributorily infringes the '682 Patent under 35 U.S.C. § 271(c) by importing, selling, and/or offering to sell within the United States the Amazon '682 Accused Products (or components thereof) that constitute a material part of the claimed invention and are not staple articles of commerce suitable for substantial non-infringing use. For example, the hardware and/or software for using WebRTC is material, has no insubstantial non-infringing uses, and is known by Amazon to be especially made or adapted for use that practices at least claim 1 of the '682 Patent with respect to the '682 Accused Products.

COUNT VI
INFRINGEMENT OF U.S. PATENT NO. 6,880,156

333. VideoLabs incorporates by reference the foregoing paragraphs of this First Amended Complaint as if fully set forth herein.

334. VL IP is the assignee and lawful owner of all right, title, and interest in and to the '156 Patent. The '156 Patent is valid and enforceable.

335. On information and belief, Amazon has infringed and continues to infringe the '156 Patent in violation of 35 U.S.C. § 271(a), either literally or through the doctrine of equivalents, by

[161] *See e.g.,* Ex. 103, *Alexa Devices Help*, AMAZON, https://www.amazon.com/gp/help/customer/display.html?nodeId=202009680 (last accessed Jan. 18, 2022) (customer service support for Amazon Echo Spot, Amazon Echo Glow, and Amazon Connect); Ex. 114, *Getting Started with Amazon Kinesis*, AWS, https://aws.amazon.com/kinesis/getting-started/?nc=sn&loc=3 (last accessed Jan. 18, 2022); Ex. 117, Amazon Web Services, *How to Set Up an Amazon Chime Account For Your Organization*, YouTube (Jul. 19, 2022), https://www.youtube.com/watch?v=Ri8BVRNCrRQ (last accessed Jan. 18, 2022); Ex. 118, Amazon Alexa, *Meet the All-new Echo Show 8*, YOUTUBE (May 12, 2021), https://www.youtube.com/watch?v=lWL2XazFn74 (last accessed Jan. 18, 2022); Ex. 119, *Getting Support From an Amazon Chime Administrator,* AWS, https://docs.aws.amazon.com/chime/latest/ug/chime-getting-support.html (last accessed Jan. 18, 2022).

using methods and/or taking steps that practice at least claim 10 of the '156 Patent, including with respect to the Amazon '156 Accused Products.

336. On information and belief, Amazon uses the Amazon '156 Accused Products for its own business purposes. In addition, Amazon regularly conducts testing and troubleshooting of the Amazon '156 Accused Products. Further, VideoLabs is informed and believes companies related to Amazon (e.g., AWS, Amazon, and Amazon's subsidiaries) use the '156 Amazon Accused Products.

337. On information and belief, Amazon's infringement through its use of Auto Scaling, described below, is exemplary of all of Amazon's infringement with respect to all the Amazon '156 Accused Products.

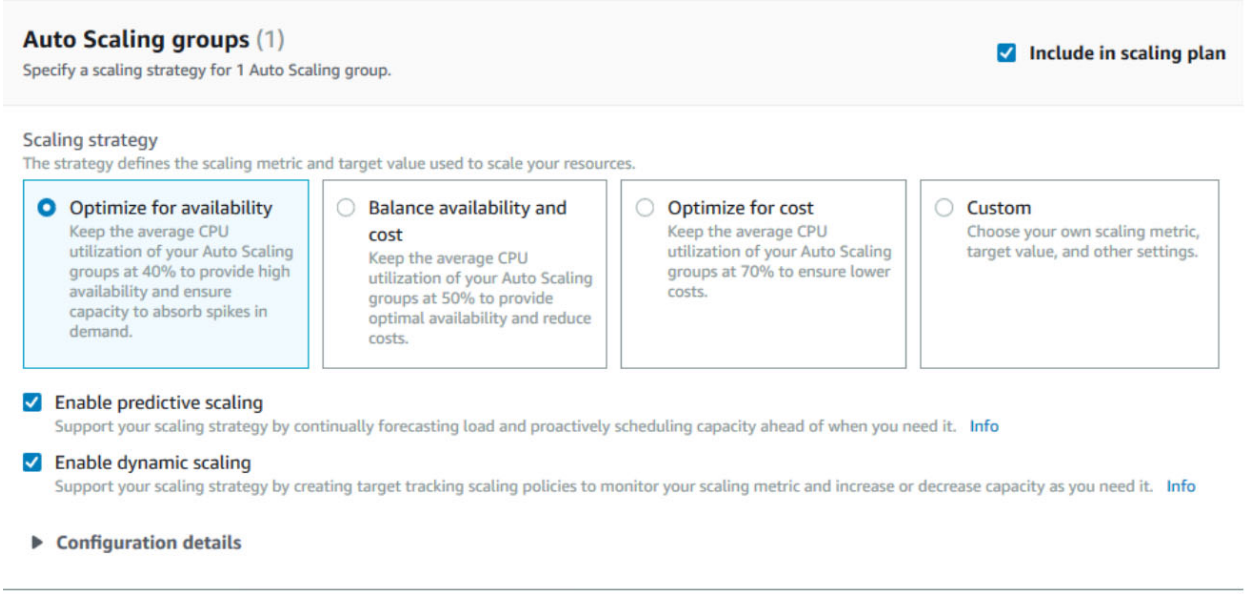
338. The Amazon '156 Accused Products directly infringe at least claim 10 of the '156 Patent by, for example, adapting the number of server applications within a server by measuring a load on the server, detecting when the load exceeds an activation threshold (based at least in part on a ratio of a current number of connections per unit time to a past number of connections per unit time), and employing a system allocator to activate an additional server application on the server connected to the server via the system allocator.

339. AWS Auto Scaling (and Amazon EC2 Auto Scaling) meet every limitation of claim 10 of the '156 Patent, which recites:

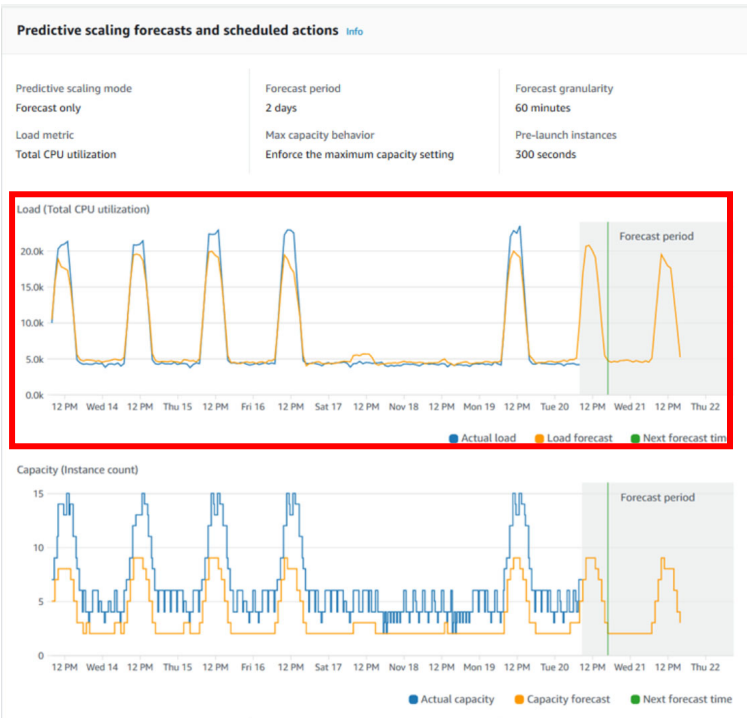
> 10. A method of adapting the number of server applications within a server, the method comprising:
>
> measuring a load on the server;
>
> detecting when the load exceeds an activation threshold; and
>
> in response to the detecting step, employing a system allocator to activate an additional server application on the server;
>
> wherein the additional Server application is connected to the Server via the System allocator and wherein an activation threshold is based at least in part on a ratio of a

current number of connections per unit time to a past number of connections per unit time.

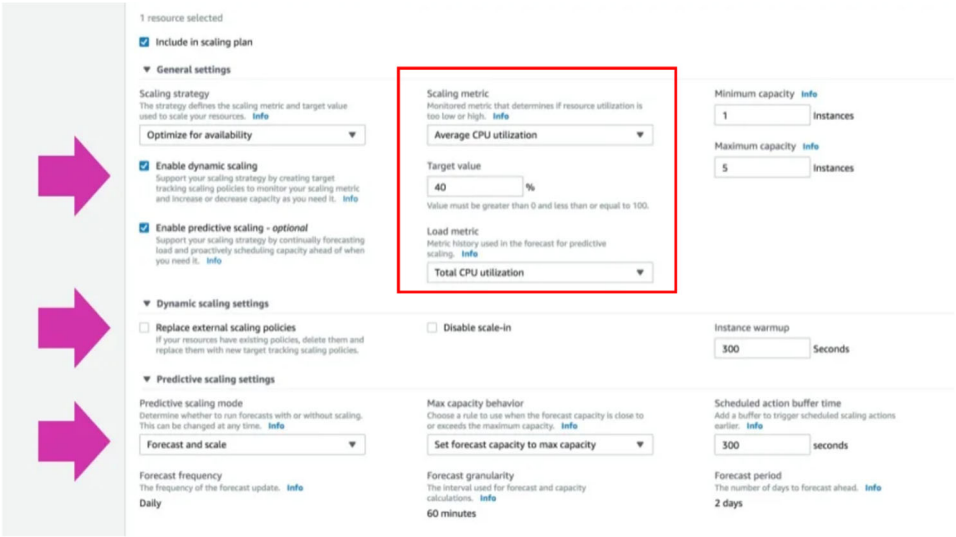
340. AWS Auto Scaling provides a method of adapting the number of server applications within a server, through use of predictive scaling to adapt the number of active or inactive server application instances on its cloud platform, based on configured Auto Scaling Groups.



341. AWS Auto Scaling measures a load on the server, as the Auto Scaling Groups are configured to continuously monitor server load to schedule scaling actions based on predictive analytics.



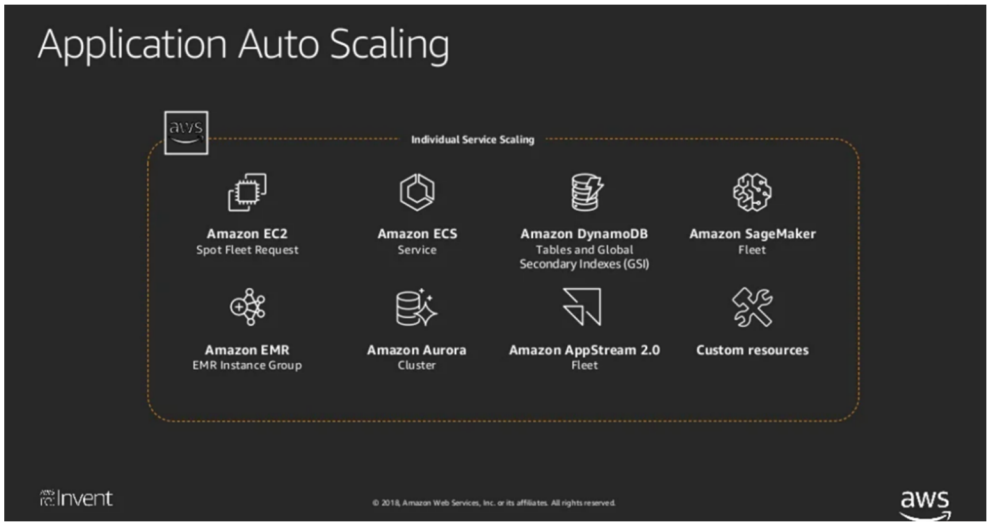
342. AWS Auto Scaling detects when the load exceeds an activation threshold. Auto Scaling groups in AWS Auto Scaling are configured to adhere to specified scaling metrics that detect when server load exceeds an activation threshold.[162]



[162] *See How To Use Predictive Scaling (API331-R1) – AWS re:Invent 2018*, https://www.slideshare.net/AmazonWebServices/how-to-use-predictive-scaling-api331r1-aws-reinvent-2018 (last accessed January 20, 2022).

343. AWS Auto Scaling, in response to the detecting step, employs a system allocator to activate an additional server application on the server. For example, AWS Auto Scaling employs an auto scaling API to auto scale additional server application instances, depending on the AWS services utilized.[163]

[163] *See How To Use Predictive Scaling (API331-R1) – AWS re:Invent 2018*, https://www.slideshare.net/AmazonWebServices/how-to-use-predictive-scaling-api331r1-aws-reinvent-2018 (last accessed January 20, 2022); *see also* Ex. 120, *AWS Application Auto Scaling User Guide*, https://docs.aws.amazon.com/autoscaling/application/userguide/what-is-application-auto-scaling.html (last accessed January 20, 2022).



What is Application Auto Scaling?

Application Auto Scaling is a web service for developers and system administrators who need a solution for automatically scaling their scalable resources for individual AWS services beyond Amazon EC2. Application Auto Scaling allows you to configure automatic scaling for the following resources:

- AppStream 2.0 fleets
- Aurora replicas
- Amazon Comprehend document classification and entity recognizer endpoints
- DynamoDB tables and global secondary indexes
- Amazon Elastic Container Service (ECS) services
- ElastiCache for Redis clusters (replication groups)
- Amazon EMR clusters
- Amazon Keyspaces (for Apache Cassandra) tables
- Lambda function provisioned concurrency
- Amazon Managed Streaming for Apache Kafka (MSK) broker storage
- Amazon Neptune clusters
- SageMaker endpoint variants
- Spot Fleet requests
- Custom resources provided by your own applications or services. For more information, see the GitHub repository.

344. The additional server application(s) activated on the server by AWS Auto Scaling are connected to the server via the system allocator. For example, new instances within an AWS Auto Scaling Group are configured using one of several launch template configurations. The launch template includes the parameters required to launch an instance, such as the ID of the Amazon Machine Image (AMI) and an instance type. When required, the system allocator will launch a new instance based, in part, on the configuration specified in the launch template for the

Auto Scaling Group.[164] Server application resources that can be scaled by AWS Auto Scaling are registered before they are connected to the server via the system allocator.[165]

345. The activation threshold of the detecting step employed by AWS Auto Scaling is based at least in part on a ratio of a current number of connections per unit time to a past number of connections per unit time. For example, AWS Auto Scaling uses an installed CloudWatch agent to track individual server and application metrics and report tracked metrics to the AWS Auto Scaling service to manage predictive scaling on the AWS Cloud.[166] The number of TCP connections is one of the metrics that can be used for predictive scaling.[167] Custom metrics can also be defined and monitored with CloudWatch.[168]

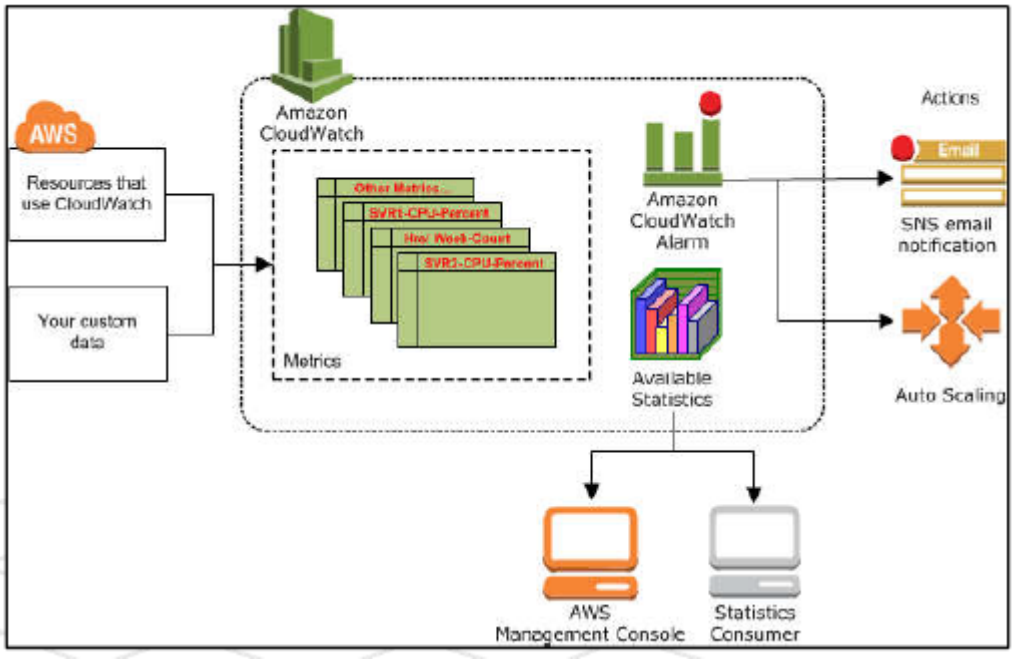
[164] *See* Ex. 121, *Amazon EC2 Auto Scaling, Launch Templates and Launch Configurations*, https://docs.aws.amazon.com/autoscaling/ec2/userguide/configuring-lifecycle-hook-notifications.html (last accessed January 20, 2022).

[165] *See* Ex. 122, *Application Auto Scaling API Reference, RegisterScalableTarget*, https://docs.aws.amazon.com/autoscaling/application/APIReference/API_RegisterScalableTarget.html (last accessed January 20, 2022).

[166] *See* Ex. 123, *Amazon CloudWatch User Guide, How Amazon CloudWatch Works*, https://docs.aws.amazon.com/AmazonCloudWatch/latest/monitoring/cloudwatch_architecture.html (last accessed January 20, 2022).

[167] *See* Ex. 124, *Elastic Load Balancing Application Load Balancers, CloudWatch Metrics,* https://docs.aws.amazon.com/elasticloadbalancing/latest/application/load-balancer-cloudwatch-metrics.html (last accessed January 20, 2022).

[168] *See* Ex. 125, *AMS Advanced User Guide, Creating Custom CloudWatch Metrics and Alarms*, https://docs.aws.amazon.com/managedservices/latest/userguide/custom-cloudwatch-events.html (last accessed January 20, 2022).



346. On information and belief, to the extent applicable, VideoLabs has complied with 35 U.S.C. § 287(a) with respect to the '156 Patent.

347. VideoLabs representatives met with Amazon representatives at least on March 12, 2020 to present VideoLabs' platform and gauge Amazon's interest in joining as a partner or member.[169] Following the meeting, VideoLabs offered to provide more detail about its patent portfolio but Amazon did not respond. At least by August 5, 2021, so that patent licensing discussions could proceed, VideoLabs provided Amazon a list of VideoLabs' patents, including all patents asserted in this First Amended Complaint.[170] On August 31, 2021, Amazon indicated that it had conducted an initial review of VideoLabs' patents, was in the process of conducting a deeper review of certain patents, and would get back to VideoLabs in a matter of weeks. But to date, months later, Amazon has not reengaged with VideoLabs.

[169] *See* Ex. 100 (VideoLabs presentation to Amazon).

[170] *See* Ex. 101 (VideoLabs email to Amazon attaching portfolio listing).

348. Amazon of course knows how its products operate, and on information and belief, Amazon investigated the '156 Patent and its infringement of the Amazon '156 Accused Products. Amazon has been given further notice of the '156 Patent and its infringement of the '156 Patent through the filing of the Complaint (Dkt. 1) on January 21, 2022, the service of infringement contentions on April 14, 2022, and the filing of this First Amended Complaint. On information and belief, Amazon is either knowingly infringing the '156 Patent or is willfully blind to its infringement, and continues to act in wanton disregard of VideoLabs' patent rights.

349. Despite becoming aware of or willfully blinding itself to its infringement of the '156 Patent, Amazon has nonetheless continued to engage in and has escalated its infringing activities by continuing to develop, advertise, make available, and use the infringing functionalities of the Amazon '156 Accused Products. On information and belief, Amazon has made no attempts to design around the '156 Patent or otherwise stop its infringing behavior.

350. Amazon's infringement of the '156 Patent therefore has been and remains willful.

351. Amazon also indirectly infringes the '156 Patent by inducing others to infringe and contributing to the infringement of others, including third-party users of the Amazon '156 Accused Products in this District and throughout the United States. As described above, on information and belief, Amazon has known about the '156 Patent since at least August 5, 2021.

352. On information and belief, Amazon has actively induced the infringement of the '156 Patent under 35 U.S.C. § 271(b) by actively inducing third parties in the United States to use methods and/or take steps that practice at least claim 10 of the '156 Patent with respect to the '156 Accused Products. Amazon knew or was willfully blind to the fact that its conduct would induce these third parties to act in a manner that infringes the '156 Patent in violation of 35 U.S.C. § 271(a).

353. Amazon actively encouraged and continues to actively encourage third parties to directly infringe the '156 Patent by, for example, marketing the '156 Accused Products to consumers; working with consumers to implement, install and/or operate the '156 Accused Products; fully supporting and managing consumers' continuing use of the '156 Accused Products; and providing technical assistance to consumers during their continued use of the '156 Accused Products.[171]

354. Amazon induces third parties to infringe the '156 Patent at least by encouraging them to use AWS Auto Scaling, which constitutes infringement of the '156 Patent. For example, Amazon advertises and promotes AWS Auto Scaling on its website. Amazon advertises that AWS Auto Scaling allows third party users to "optimize performance, costs, or balance between" those two considerations, which "can help you optimize your utilization and cost efficiencies when consuming AWS services so you only pay for the resources you actually need. When demand drops, AWS Auto Scaling will automatically remove any excess resource capacity so you avoid overspending."[172] AWS further advertises that "AWS Auto Scaling continually monitors resources underlying your application to make sure that they are operating at your desired performance levels. When demand spikes, AWS Auto Scaling automatically increases the capacity of constrained resources so you maintain a high quality of service."[173] In response, consumers acquire, configure, and operate the AWS Auto Scaling in an infringing manner.

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[171] *See e.g.,* Ex. 87, *AWS Auto Scaling*, AWS, https://aws.amazon.com/autoscaling/ (last visited Jan. 19, 2022). (promoting AWS Auto Scaling); Ex. 126, *AWS Auto Scaling Resources*, AWS, https://aws.amazon.com/autoscaling/resources/ (last accessed Jan. 18, 2022); Ex. 127, Amazon EC2 Auto Scaling Resources, AWS, https://aws.amazon.com/ec2/autoscaling/resources/ (last accessed Jan. 18, 2022).

[172] *See* Ex. 87, *AWS Auto Scaling*, AWS, https://aws.amazon.com/autoscaling/ (last accessed Jan. 18, 2022).

[173] *Id*.

355. On information and belief, Amazon contributorily infringes the '156 Patent under 35 U.S.C. § 271(c) by importing, selling, and/or offering to sell within the United States the Amazon '156 Accused Products (or components thereof) that constitute a material part of the claimed invention and are not staple articles of commerce suitable for substantial non-infringing use. For example, the hardware and/or software for using Auto Scaling is material, has no insubstantial non-infringing uses, and is known by Amazon to be especially made or adapted for use that practices at least claim 10 of the '156 Patent with respect to the '156 Accused Products.

COUNT VII
INFRINGEMENT OF U.S. PATENT NO. 7,440,559

356. VideoLabs incorporates by reference the foregoing paragraphs of this First Amended Complaint as if fully set forth herein.

357. VL IP is the assignee and lawful owner of all right, title, and interest in and to the '559 Patent. The '559 Patent is valid and enforceable.

358. On information and belief, Amazon has infringed and continues to infringe the '559 Patent in violation of 35 U.S.C. § 271(a), either literally or through the doctrine of equivalents, by making, using, selling, offering for sale, and/or importing into the United States products and/or methods that practice at least claims 1 and 13 of the '559 Patent, including with respect to the Amazon '559 Accused Products.

359. On information and belief, Amazon uses the Amazon '559 Accused Products for its own business purposes. In addition, Amazon regularly conducts testing and troubleshooting of the Amazon '559 Accused Products. Further, VideoLabs is informed and believes companies related to Amazon (e.g., AWS, Amazon, and Amazon's subsidiaries) use the '559 Amazon Accused Products.

360. On information and belief, Amazon's infringement through certain uses of Amazon Prime Video, described below, are exemplary of all of Amazon's infringement with respect to all the Amazon '559 Accused Products.

361. The Amazon Prime Video streaming service directly infringes claim 1 of the '559 Patent, for example, by providing one or more servers configured to receive, from a remote terminal accessing the Amazon Prime Video streaming service, content status information, including content bookmark information, and configured to receive server status information regarding available content from a source of content, and in response to the content status information, instructing the terminal to perform actions, such as download control instructions, based on the terminal status information and the server status information, to control the flow of content to the terminal.

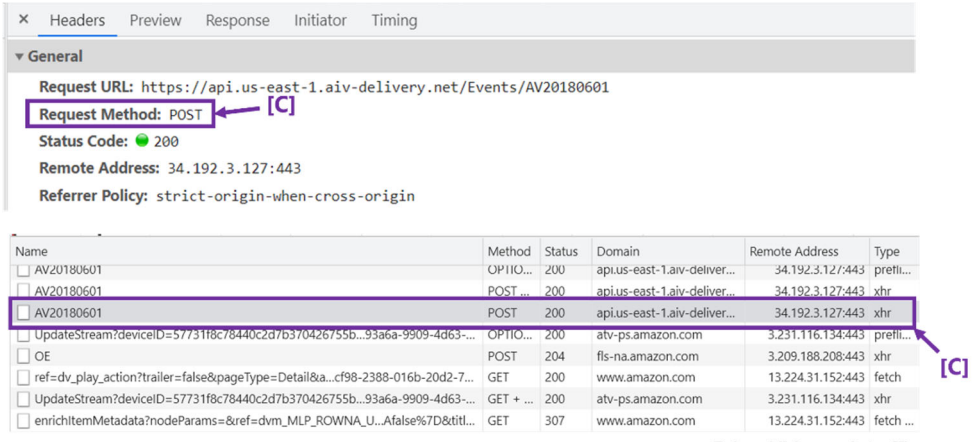
362. The Amazon Prime Video streaming service meets every limitation of at least claim 1 of the '559 Patent, which recites:

> 1. An apparatus comprising:
>
> a processor configured to receive, from a terminal located remote from the apparatus, a content status including terminal status information, and configured to receive server status information regarding a source of content, wherein the server status information comprises a listing of at least one piece of content available from the source, wherein the processor is configured to send, to the terminal, a response to the content status that instructs the terminal to perform one or more actions to thereby control the flow of content to the terminal based upon the terminal status information and the server status information, and
>
> wherein the at least one piece of content available from the source, and the content for which the processor is configured to control the flow, comprise multimedia content.

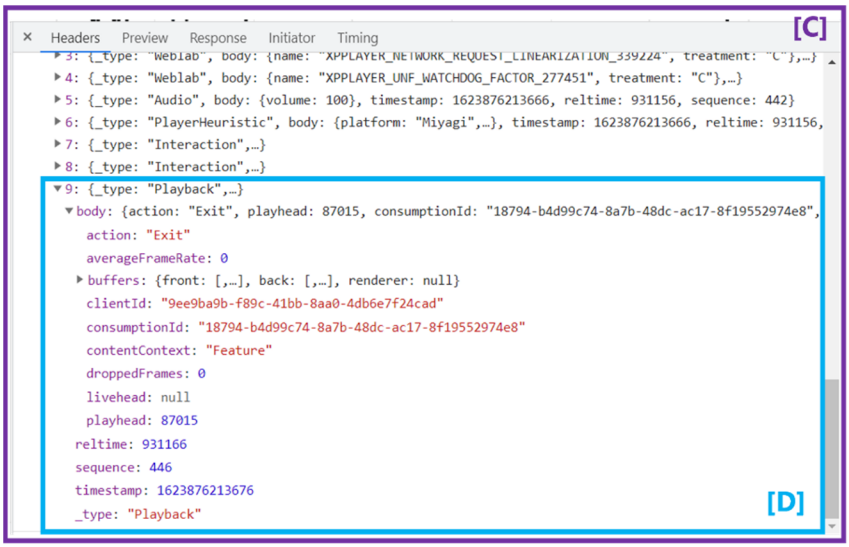
363. The architecture of the Amazon Prime Video streaming service generally constitutes a back-end control plane, which controls and manages the myriad of microservices employed by Amazon to manage and deliver streaming content to Amazon Prime Video

subscribers, a terminal application, accessible directly from a subscriber's browser, or via the Amazon Prime Video app installed on one or more of a subscriber's connected devices, and a content distribution network in which implementations of Amazon's content library are stored, distributed and managed, and subsequently delivered, to Amazon Prime Video subscribers on demand.

364. The Amazon back-end control plane incorporates a processor configured to receive, from a terminal located remote from the apparatus, a content status including terminal status information. During a streaming session with a remote terminal accessing the Amazon Prime Video streaming service using, for example, a browser, or via the Amazon Prime Video application installed on the subscriber's connected device, the remote terminal routinely provides content status messages to Amazon servers in the back-end control plane. One such content status message provided in this regard is a content status message provided by the remote terminal to the Amazon domain *api.us.east-1.aiv-delivery.net*, via an API message [reference C below]. This content status message is provided to the Amazon Prime Video servers in the back-end control plane via a HTTPS POST method and includes, in its message payload, terminal status information about the content the Amazon Prime Video subscriber is watching or has recently finished watching [reference D below].



Prime Video web traffic

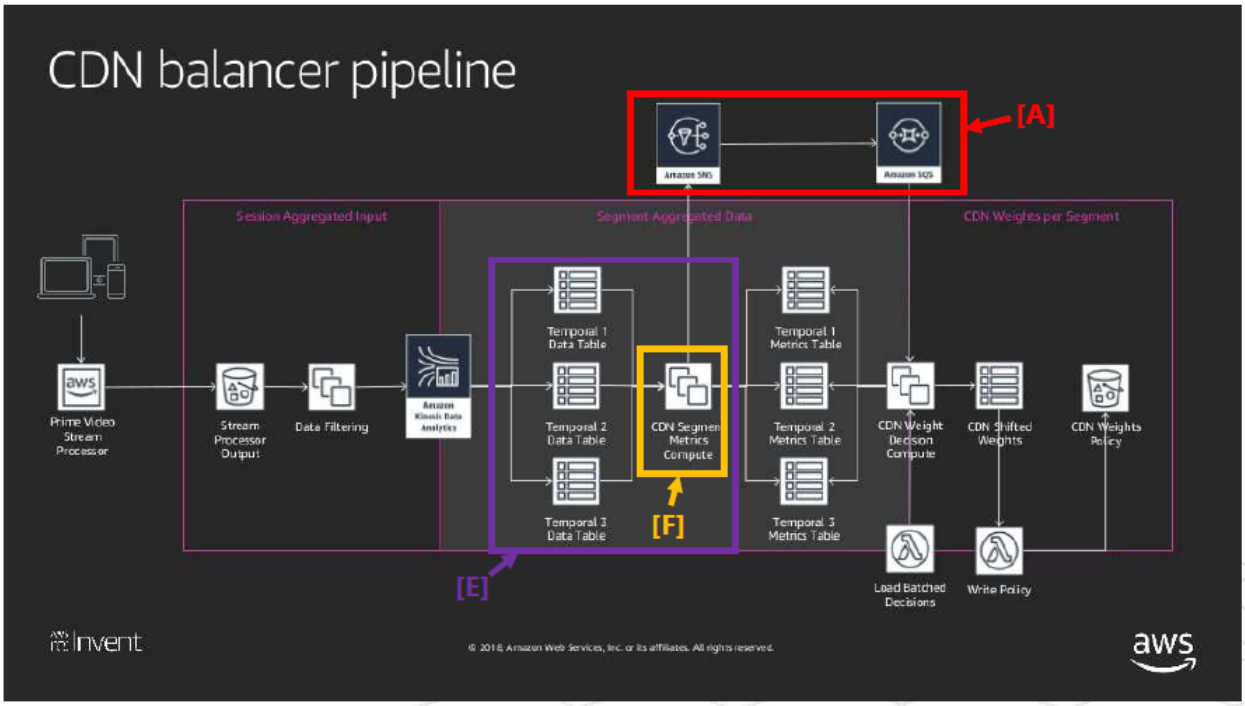


Prime Video web traffic

365. The content status message received by the Amazon servers in the back-end control plane from the remote terminal specifies, among other terminal status information, the view progress within the content being consumed at the remote terminal. For example, the terminal status information relating to the view progress in the above example is specified by an API schema defined by Amazon and includes the parameter *playhead* (indicated in the above example as 87015). Amazon maintains this terminal status information in its back-end control plane and uses this information at least to manage the content bookmarking feature in its OTT streaming service.

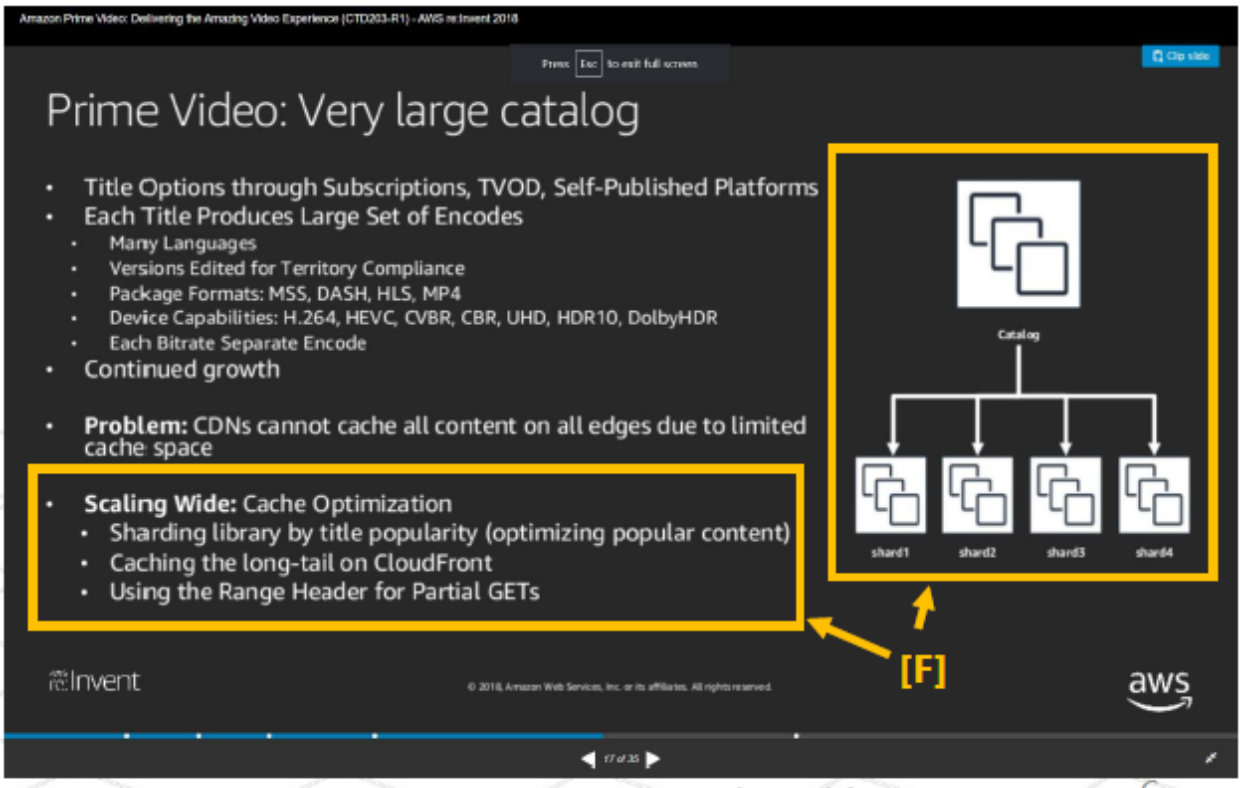
366. The Amazon back-end control plane also incorporates a processor configured to receive server status information regarding a source of content, wherein the server status information comprises a listing of at least one piece of content available from the source. For example, the Amazon back-end control plane manages status information received from the origin servers hosting Amazon content within its content delivery network. This status information includes a listing of cached content available from the source [reference F below] and enables

Amazon to identify the preferred CDN host (e.g., Limelight, Cloudfront, Akamai) [reference E below] to deliver the requested content to the Amazon Prime Video subscriber.[174]

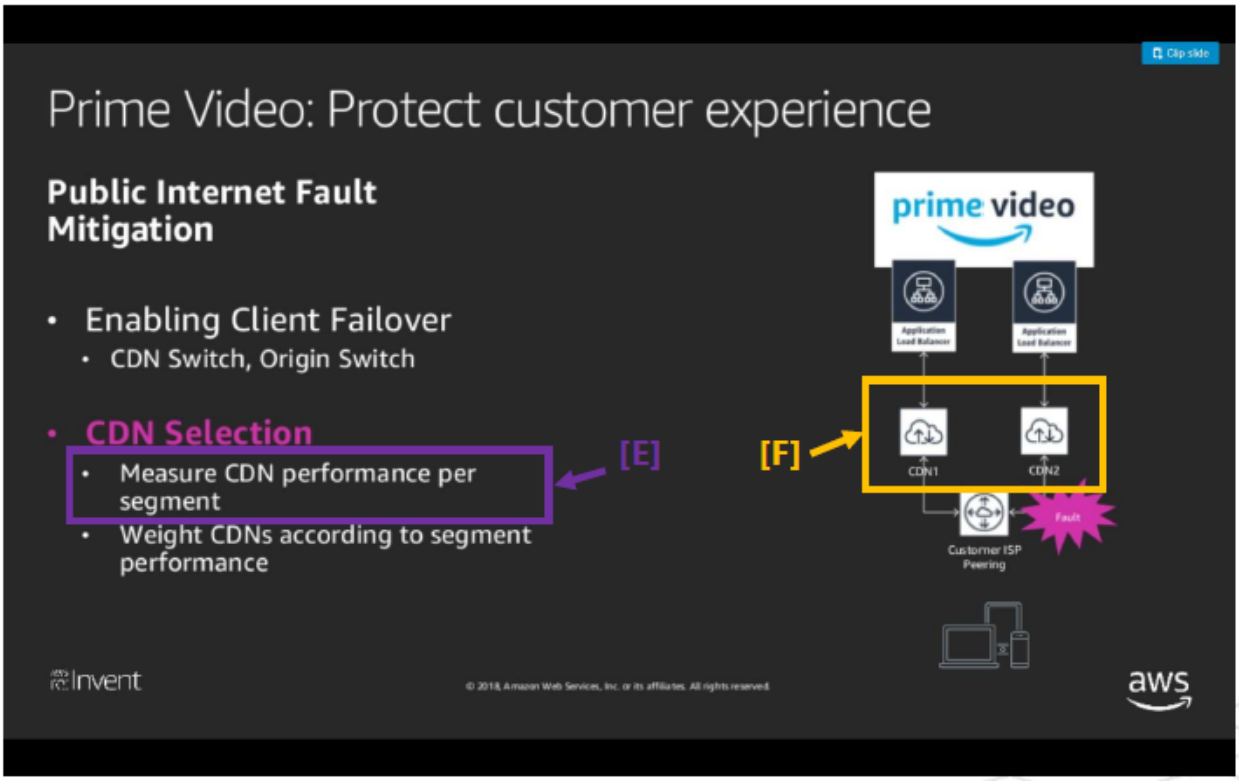


Amazon Prime Video - AWS Re:Invent 2018

[174] *See generally Amazon Prime Video: Delivering the Amazing Video Experience (CTD203-R1) – AWS re:Invent 2018,* https://www.slideshare.net/AmazonWebServices/amazon-prime-video-delivering-the-amazing-video-experience-ctd203r1-aws-reinvent-2018 (last accessed January 20, 2022).

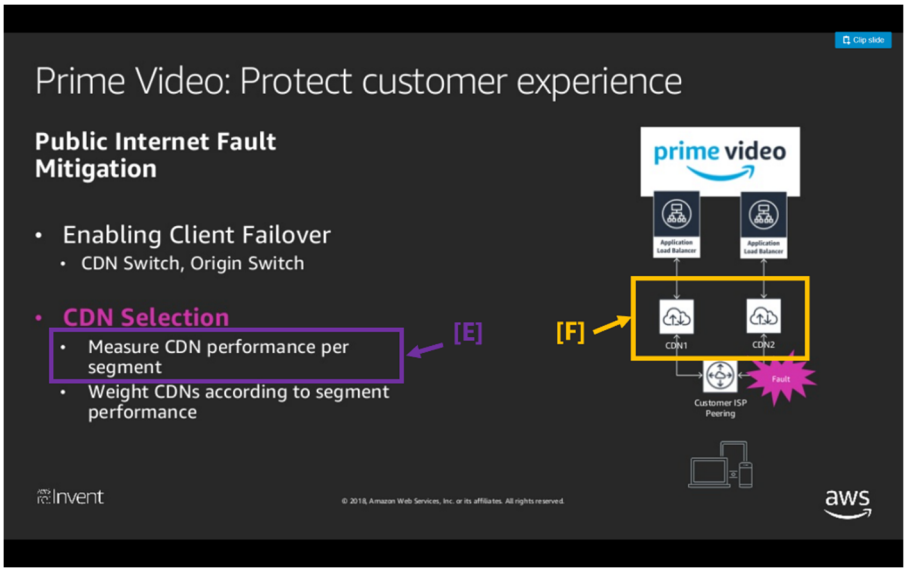


Amazon Prime Video - AWS Re:Invent 2018



Amazon Prime Video - AWS Re:Invent 2018

367. The status information received by the Amazon back-end control plane also includes status information from the CDNs including segment stream metrics [reference E below] and enables Amazon to identify the preferred CDN host (e.g., Limelight, Cloudfront, Akamai) [reference F below] to deliver the requested content to the Amazon Prime Video subscriber.[175]

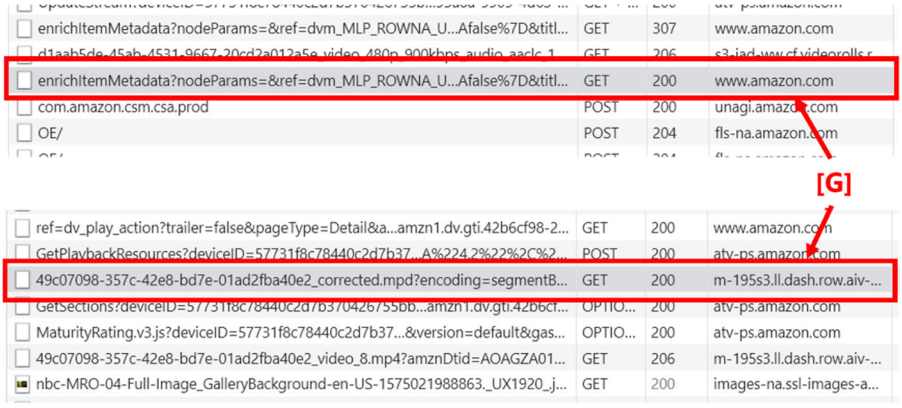


Selected CDNs serving requested content program listed in playback resources metadata

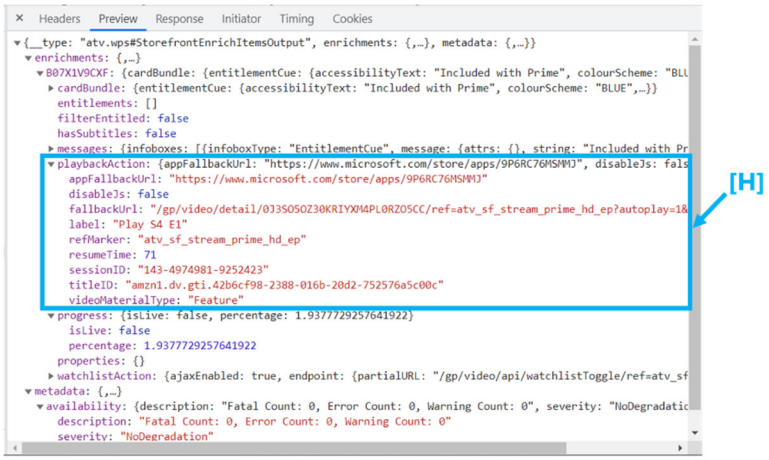
368. The Amazon back-end control plane processor is further configured to send, to the terminal, a response to the content status that instructs the terminal to perform one or more actions

[175] *See generally Amazon Prime Video: Delivering the Amazing Video Experience (CTD203-R1) – AWS re:Invent 2018,* https://www.slideshare.net/AmazonWebServices/amazon-prime-video-delivering-the-amazing-video-experience-ctd203r1-aws-reinvent-2018 (last accessed January 20, 2022).

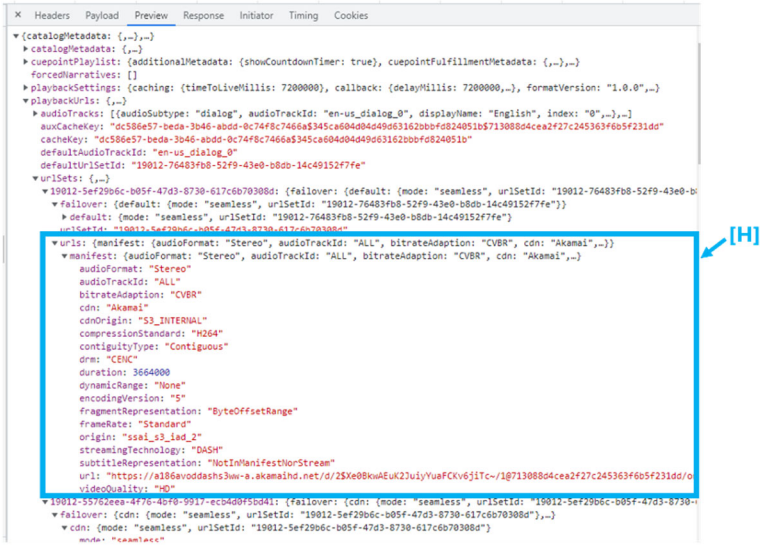
to thereby control the flow of content to the terminal based upon the terminal status information and the server status information. For example, when the Amazon Prime Video subscriber requests to stream the content program from the Amazon Prime Video streaming service, the Amazon back-end control plane sends to the subscriber's terminal a response to the content status [reference G below]. The response is sent, for example, as payload information in a JSON container to the subscriber's terminal that includes information to instruct the terminal to perform one or more actions to thereby control the flow of content to the terminal based upon the terminal status information and the server status information. The response includes, among other information, the bookmark metadata and the reference URL for the content manifest [reference H below].



Amazon Prime Video web traffic

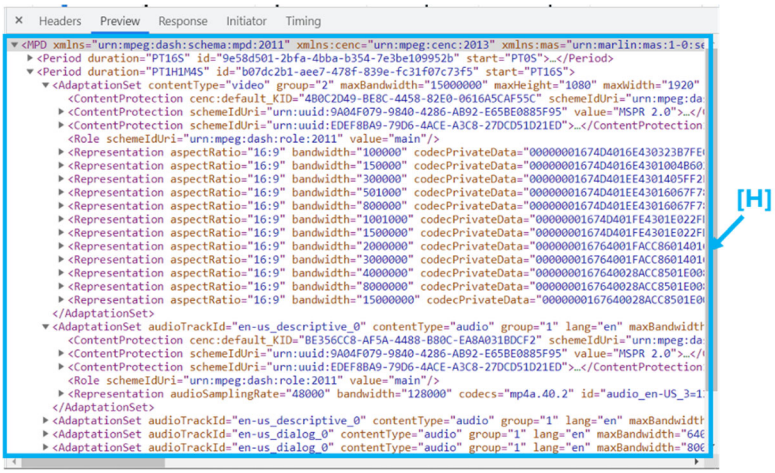


Amazon Prime Video web traffic



Amazon Prime Video web traffic

369. The content manifest URL reference instructs the terminal from where to obtain the full content manifest for the program. The Amazon Prime Video application and/or the Amazon Prime Video browser, under the programming control by Amazon, carries out the URL reference instructions to obtain the full content manifest for the program. The full content manifest includes a detailed listing of the individual audio and video segments for the content program at variable bitrates [reference H below].



Amazon Prime Video web traffic

370. The bookmark metadata in combination with the manifest file information collectively instruct the Amazon Prime Video streaming client terminal to begin downloading

individual audio and video segments for the content program from the optimal content source starting with the segment number corresponding to the *resumeTime* segment by issuing a series of consecutive HTTP GET requests to the designated content source at specific time intervals thereby controlling the flow of multimedia content to the terminal [reference I below].

Amazon Prime Video web traffic

371. At least one piece of content available from the source, and the content for which the processor is configured to control the flow, comprise multimedia content. As noted, all of the content available for streaming from the Amazon Prime Video streaming service is multimedia content.

372. On information and belief, the "Skip Ads," "Skip Intro," "Skip Recap," and "Next Episode" features operate substantially the same as described above, and thus infringe for substantially the same reasons.

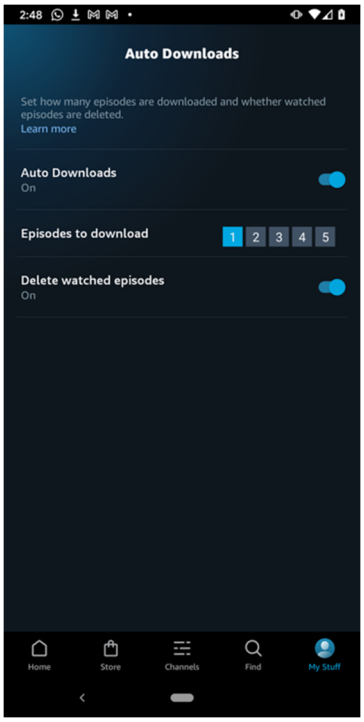
373. The Amazon Prime Video streaming service also directly infringes claim 13 of the '559 Patent, for example, by receiving, at a network entity, from a remote terminal accessing the Amazon Prime Video streaming service, content status information, including information about Amazon Prime Video content resident on the remote terminal, and in response to the content status information, instructing the terminal to perform actions, such as download control actions, based on the terminal status information, to control the flow of content to the terminal.

374. The Amazon Prime Video streaming service meets every limitation of at least claim 13 of the '559 Patent, which recites:

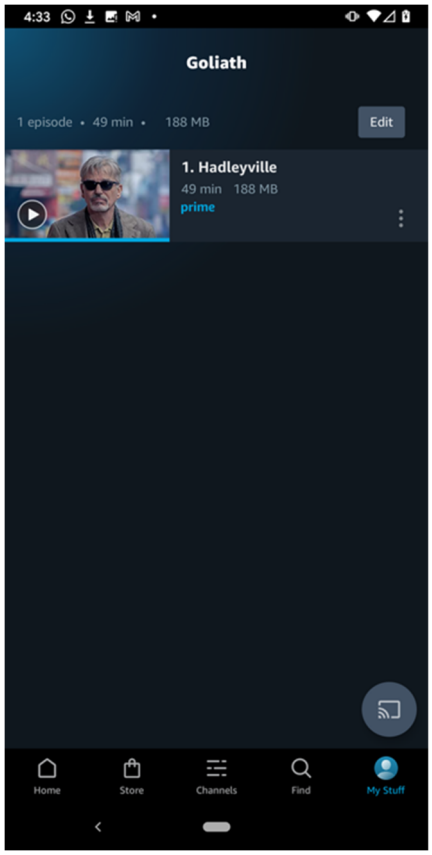
> 13. A method for controlling a flow of content, the method comprising:
>
> receiving, at a network entity from a terminal located remote therefrom, a content status including terminal status information comprising a listing of at least one piece of content stored in a memory of the terminal; and
>
> sending, from the network entity to the terminal, a response to the content status that instructs the terminal to perform one or more actions to thereby control the flow of content to the terminal based upon the terminal status information,
>
> wherein the at least one piece of content stored in the memory of the terminal, and the content for which the flow is controlled, comprise multimedia content.

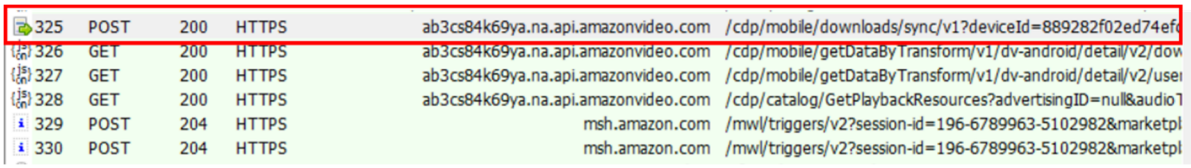
375. The architecture of the Amazon Prime Video streaming service generally constitutes a back-end control plane, which controls and manages the myriad of microservices employed by Amazon to manage and deliver streaming content to Amazon Prime Video subscribers, a terminal application, accessible directly from a subscriber's browser, or via the Amazon Prime Video app installed on one or more of a subscriber's connected devices, and a content distribution network in which implementations of Amazon's content library are stored, distributed and managed, and subsequently delivered, to Amazon Prime Video subscribers on demand.

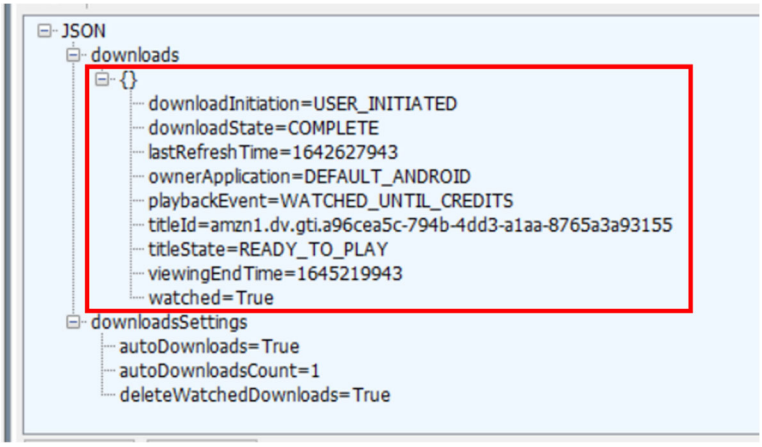
376. The Amazon back-end control plane is configured to receive, from a remote terminal, a content status including terminal status information that comprises a listing of at least one piece of content stored in the memory of the terminal. Amazon Prime Video has enabled an automatic download feature for subscribers' access to offline content viewing. By default, once a Prime Video subscriber has downloaded and watched an episode of a TV show on his or her connected device, the Amazon Prime Video app will begin downloading the next series of episodes for offline viewing. For example, the subscriber can configure the automatic download of between 1 and 5 additional episodes.



377. To support this automatic download feature in Amazon Prime Video, after an Amazon Prime Video subscriber has finished watching an offline episode of a TV show on his or her connected device, the Amazon Prime Video back-end control plane receives, from the Amazon Prime Video app running on the remote terminal, a content status message that includes the identification of at least one of the previously downloaded content items. One such content status message provided in this regard is a content status message provided by the remote terminal to the Amazon domain *ab3cs84k69ya.na.api.amazonvideo.com* via an API "sync" message. This content status message is provided to the Amazon Prime Video servers in the back-end control plane via a HTTPS POST method and includes, in its message payload, terminal status information about the offline content the Amazon Prime Video subscriber has recently finished watching.

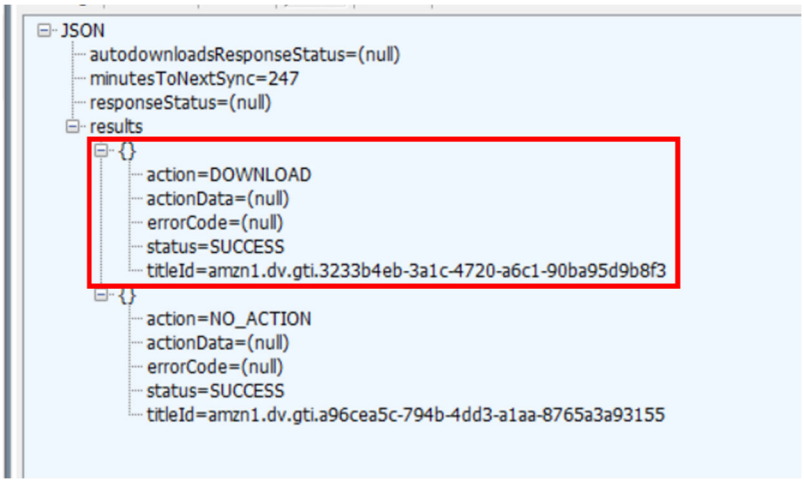




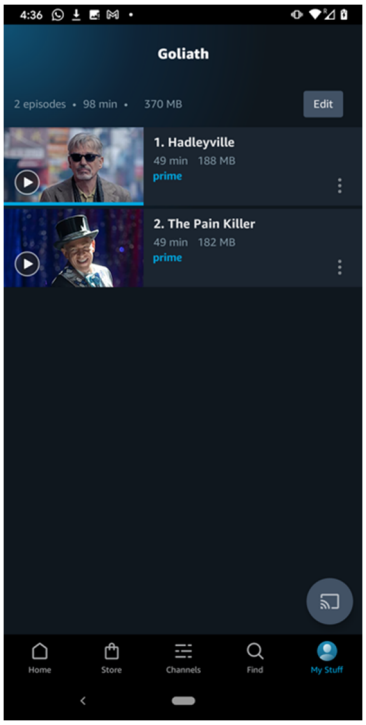


378. The Amazon back-end control plane is further configured to send, to the terminal, a response to the content status that instructs the terminal to perform one or more actions to thereby

control the flow of content to the terminal based upon the terminal status information. For example, after the Amazon back-end control plane receives the content status from the remote terminal, the back-end control plane issues a response to the content status. The response is sent, for example, as payload information in a JSON container to the subscriber's terminal that includes information to instruct the terminal to perform a download action to thereby control the flow of additional episodic content to the terminal based upon the terminal status information and in order to support the automatic download feature of the Amazon Prime Video service.



379. The response instructs the terminal to automatically download the next episode(s) of the TV show (for example, the episode represented by the titleId field in the instruction). The Amazon Prime Video app then carries out the automatic download instruction and obtains the referenced episode(s) for local storage and offline viewing. In such way, the flow of content to the terminal can be controlled by the Amazon Prime Video back-end control plane.



380. At least one piece of content stored in the memory of the remote terminal, and the content for which the flow is controlled, comprise multimedia content. As noted, all of the content available for streaming and offline viewing from Amazon Prime Video is multimedia content.

381. VideoLabs representatives met with Amazon representatives at least on March 12, 2020 to present VideoLabs' platform and gauge Amazon's interest in joining as a partner or member.[176] Following the meeting, VideoLabs offered to provide more detail about its patent portfolio but Amazon did not respond. At least by August 5, 2021, so that patent licensing discussions could proceed, VideoLabs provided Amazon a list of VideoLabs' patents, including all patents asserted in this First Amended Complaint.[177] On August 31, 2021, Amazon indicated that it had conducted an initial review of VideoLabs' patents, was in the process of conducting a deeper review of certain patents, and would get back to VideoLabs in a matter of weeks. But to

[176] *See* Ex. 100 (VideoLabs presentation to Amazon).

[177] *See* Ex. 101 (VideoLabs email to Amazon attaching portfolio listing).

date, months later, Amazon has not reengaged with VideoLabs.

382. Amazon of course knows how its products operate, and on information and belief, Amazon investigated the '559 Patent and its infringement of the Amazon '559 Accused Products. Amazon has been given further notice of the '559 Patent and its infringement of the '559 Patent through the filing of the Complaint (Dkt. 1) on January 21, 2022, the service of infringement contentions on April 14, 2022, and the filing of this First Amended Complaint. On information and belief, Amazon is either knowingly infringing the '559 Patent or is willfully blind to its infringement, and continues to act in wanton disregard of VideoLabs' patent rights.

383. Despite becoming aware of or willfully blinding itself to its infringement of the '559 Patent, Amazon has nonetheless continued to engage in and has escalated its infringing activities by continuing to develop, advertise, make available, and use the infringing functionalities of the Amazon '559 Accused Products. On information and belief, Amazon has made no attempts to design around the '559 Patent or otherwise stop its infringing behavior.

384. Amazon's infringement of the '559 Patent therefore has been and remains willful.

385. Amazon also indirectly infringes the '559 Patent by inducing others to infringe and contributing to the infringement of others, including third-party users of the Amazon '559 Accused Products in this District and throughout the United States. As described above, on information and belief, Amazon has known about the '559 Patent since at least August 5, 2021.

386. On information and belief, Amazon has actively induced the infringement of the '559 Patent under 35 U.S.C. § 271(b) by actively inducing the infringement of the Amazon '559 Accused Products by third parties in the United States. Amazon knew or was willfully blind to the fact that its conduct would induce these third parties to act in a manner that infringes the '559 Patent in violation of 35 U.S.C. § 271(a).

387. Amazon actively encouraged and continues to actively encourage third parties to directly infringe the '559 Patent by, for example, marketing the Amazon Prime Video streaming service and infringing functionalities to consumers; working with consumers to implement, install and operate the Amazon Prime Video streaming service and infringing functionalities; fully supporting and managing consumers' continuing use of the Amazon Prime Video streaming service and infringing functionalities; and providing technical assistance to consumers during their continued use of the Amazon Prime Video streaming service and infringing functionalities.[178]

388. Amazon induces third parties to infringe the '559 Patent at least by encouraging them to install and operate the Amazon Prime Video streaming service, which, when used, will result in infringement of the '559 Patent. For example, Amazon advertises and promotes its Amazon Prime Video streaming service on its website and in various app stores such as Apple's app store and Android's app store in connection with the Amazon Prime Video mobile application that can be installed on consumers' respective connected iOS and Android devices (as well as others), and encourages consumers to use their mobile and computer devices in an infringing manner.[179] In response, consumers acquire, configure, and operate the Amazon Prime Video streaming service in an infringing manner.

389. Further, Amazon encourages the use of the bookmark feature by promoting the ability to continue watching content. This includes the use of an entire "Continue watching" panel in Prime, where previously watched content can be resumed and a status indicator indicates how

[178] *See e.g.,* Ex. 111, *Prime Video – Amazon Customer Service*, AMAZON, https://www.amazon.com/gp/help/customer/display.html?nodeId=G9SY6AQJV45JFMET (last accessed Jan. 20, 2022); Ex. 104, *Install Prime Video on Your Devices*, AMAZON, https://www.amazon.com/gp/help/customer/display.html?nodeId=GWX36LKK4FFEHMWA (last accessed Jan. 20, 2022); Exs. 92-94.

[179] *Id*.

far into content the user has progressed.[180] Amazon also encourages the use of its automatic downloads feature. Amazon advertises the feature, includes Downloads as a main menu option, instructs users on how to use the downloads feature, and enables automatic downloads as the default.[181]

390. On information and belief, Amazon contributorily infringes the '559 Patent under 35 U.S.C. § 271(c) by importing, selling, and/or offering to sell within the United States the Amazon '559 Accused Products (or components thereof) that constitute a material part of the claimed invention and are not staple articles of commerce suitable for substantial non-infringing use. For example, Amazon Prime Video, and the code for sending, receiving, and/or processing status information, are material, have no insubstantial non-infringing uses, and are known by Amazon to be especially made or adapted for use in a manner that infringes the '559 Patent.

PRAYER FOR RELIEF

WHEREFORE, VideoLabs prays for judgment as follows:

a) That Amazon directly and/or indirectly infringes the '878, '238, '059, '794, '682, '156, and '559 Patents;

b) That such infringement is willful;

c) That Amazon and its respective officers, directors, agents, partners, servants, employees, attorneys, licensees, successors, and assigns, and those in active concert or

[180] Ex. 128, *How to Clear Continue Watching List on Amazon Prime Video*, BingeGauge (Mar. 31, 2021), https://www.bingegauge.com/clear-continue-watching-list-amazon-prime-video/ (last visited Jan. 20, 2022).

[181] *See, e.g.*, Ex 129, https://www.amazon.com/gp/help/customer/display.html?nodeId=GTDVUQFMY3GTZVX7; Ex. 130, https://www.amazon.com/b?ie=UTF8&node=16043727011; Ex. 93, *Amazon Prime Video Enables Auto-Download Feature*, DIGITALTV (Sep. 10, 2020), https://www.digitaltveurope.com/2020/09/10/amazon-prime-video-enables-auto-download-feature/ (last visited Jan. 20, 2022).

participation with any of them, be permanently enjoined from engaging in infringing activities with respect to the '878, '238, '059, '794, '682, '156, and '559 Patents;

d) In the alternative, in the event injunctive relief is not granted as requested by VideoLabs, an award of a mandatory future royalty payable on each future product sold by Amazon that is found to infringe one or more claims of the '878, '238, '059, '794, '682, '156, and '559 Patents, and on all future products which are not colorably different from products found to infringe;

e) That Amazon be required to pay VideoLabs' damages in an amount adequate to compensate VideoLabs for Amazon's infringement, but in no event less than a reasonable royalty under 35 U.S.C. § 284, including supplemental damages for any continuing post-verdict infringement up until entry of judgment and beyond, with accounting, as needed;

f) That VideoLabs be awarded all statutory and actual damages to which it is entitled, including the profits reaped by Amazon through its illegal conduct, and prejudgment and post-judgment interest;

g) That VideoLabs be awarded enhanced damages, up to and including trebling of the damages awarded to VideoLabs;

h) That VideoLabs be awarded recovery of the costs of this suit, including reasonable attorneys' fees; and

i) That VideoLabs be awarded such other and further relief as this Court deems just and proper.

DEMAND FOR JURY TRIAL

391. VideoLabs hereby demands a jury trial on its claims for patent infringement and

any and all issues triable of right before a jury.

Dated: April 21, 2022

Respectfully submitted,

/s/ Taylor N. Mauze

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CERTIFICATE OF SERVICE

I hereby certify that a true and correct copy of the above document was served on April 21, 2022 on all counsel of record via the Court's CM/ECF system.

/s/ Taylor N. Mauze
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