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UNITED STATES DISTRICT COURT

CENTRAL DISTRICT OF CALIFORNIA

DIVX, LLC, a Delaware limited liability company, Plaintiff, v. HULU, LLC, a Delaware corporation, Defendant.	Case No. 2:19-cv-1606 **COMPLAINT FOR PATENT INFRINGEMENT** **DEMAND FOR JURY TRIAL**

Plaintiff DivX, LLC ("Plaintiff" or "DivX"), by its attorneys, for its complaint against Defendant Hulu, LLC ("Defendant" or "Hulu") for patent infringement alleges as follows:

INTRODUCTION

1. Since 2000, DivX has been setting the standard for high-quality digital video. DivX® technology helps people around the world enjoy digital media on their own terms.

2. DivX is one of the first companies to enable successful delivery of high-quality digital video over the internet. For nearly 20 years, DivX has been developing innovative technology to enable quality digital entertainment experiences for consumers—making internet video high-quality, secure, easy, and enjoyable for consumers to watch on any device.

3. Today, consumers expect to play high-quality video from the internet on any device at the touch of a button. However, when DivX's engineers accomplished this feat almost 20 years ago, they had to overcome significant technical obstacles to do so. Through those efforts, DivX engineers invented foundational technologies that made high-quality internet video possible long before platforms like Netflix or Hulu existed.

4. DivX began by improving video compression technology that made it possible to transmit large video files over the internet. It created technology allowing those video files to be played on a wide variety of consumer electronics devices, and it licensed that technology to consumer electronics manufacturers. It next developed Digital Rights Management (DRM) technology, including encryption for video files, to protect valuable video content so that content producers would be comfortable making their original works available on the internet. Finally, building on all of these technologies, DivX launched Stage6, one of the first platforms for streaming high-quality, user-created and professional video

over the internet. All of this work paved the way (and provided a roadmap) for today's proliferation of internet video streaming on consumer devices.

5. As a result of the many DivX innovations relating to internet video and streaming media, consumer electronics (CE) companies have licensed DivX's technologies and integrated them into more than one billion devices worldwide.

6. DivX's investments in research and development for internet video led to technical innovations that shaped internet video as the world knows it today. DivX patented these inventions and today has a portfolio of over 300 issued patents and patent applications.

7. Hulu is a leading premium streaming service offering live and on-demand TV and movies, with and without commercials, both in and outside the home. Hulu has more than 25 million subscribers in the United States.[1] Hulu's video streaming success depends upon the technical innovations developed and patented by DivX, including DivX technologies enabling:

- a streaming ecosystem of many consumer devices;
- efficient compression for high-quality video delivery and playback;
- efficient and effective digital rights management (DRM) to protect video content from unauthorized use and copying; and
- video playback features that make internet video easier and more enjoyable for consumers to access.

Without these DivX innovations, Hulu would not enjoy the success that it does today.

8. DivX brings this lawsuit to seek fair compensation from Hulu for its unauthorized and unlicensed use of DivX's patented technology.

[1] https://www.hulu.com/press/about.

NATURE OF THE ACTION

9. This complaint alleges patent infringement. DivX alleges that Hulu has infringed and continues to infringe, directly and/or indirectly, seven DivX patents: U.S. Patent Nos. 7,295,673 (the "'673 patent"), 8,139,651 (the "'651 patent"), 8,472,792 (the "'792 patent"), 9,270,720 (the "'720 patent"), 9,998,515 (the "'515 patent"), 10,212,486 (the "'486 patent"), and 10,225,588 (the "'588 patent"), copies of which are attached as Exhibits 1-7 (collectively, the "DivX Patents").

10. The DivX Patents cover foundational internet video streaming technologies for delivering secure digital video content to a variety of consumer electronic devices and enabling content viewing on those devices. These technologies are necessary for Hulu to deliver the viewing experience that its users expect and to obtain and distribute content for its streaming service. The DivX Patents disclose technologies that enable many benefits, including:

- receipt and playback of streaming digital video on a wide variety of consumer electronic devices;
- high-quality video playback, including 4K high-resolution video, without stalls;
- robust and efficient DRM; and
- features that improve user experience, including trick play and fast start.

11. Hulu directly infringes the DivX Patents by making, using, offering to sell, selling, and/or importing into the United States internet video streaming technology, software, and services that practice the inventions claimed in the DivX Patents.

12. Hulu indirectly infringes at least six of the DivX Patents by inducing its consumer end-users to directly infringe those DivX Patents. Hulu induces infringement by providing software (the Hulu application) that, when used by consumers or other content viewers to stream digital video to televisions, personal

computers, phones, tablets, and other devices, as directed and intended by Hulu, causes those users to make, use, and practice the inventions claimed in the DivX Patents.

13. DivX seeks damages and other relief for Hulu's infringement of the DivX Patents.

THE PARTIES

14. DivX is a Delaware limited liability company. Its principal place of business is 4350 La Jolla Village Drive, Suite 950, San Diego, California, 92122. DivX owns patents covering foundational internet video streaming technologies, including those asserted here.

15. Hulu, LLC, is a Delaware limited liability company[2] with its corporate address at 2500 Broadway, Santa Monica, California, 90404.[3]

16. Upon information and belief, Hulu is a global leader in the market for streaming video content, which includes films, television series, and other video content. Upon information and belief, Hulu designs, operates, tests, manufactures, uses, offers for sale, sells, and/or imports into the United States—including into the Central District of California—video streaming software and services that generate billions of dollars of revenue for Hulu each year.

JURISDICTION AND VENUE

17. This is an action for patent infringement under the Patent Laws of the United States, 35 U.S.C. § 1 et seq., over which this Court has subject matter jurisdiction pursuant to 28 U.S.C. §§ 1331 and 1338(a).

18. This Court has both general and specific jurisdiction over Hulu because Hulu is headquartered and has committed acts within the Central District of California giving rise to this action and has established minimum contacts with this

[2] https://icis.corp.delaware.gov/Ecorp/EntitySearch/NameSearch.aspx.

[3] https://www.bloomberg.com/profiles/companies/3276470Z:US-hulu-llc.

forum such that the exercise of jurisdiction over Hulu would not offend traditional notions of fair play and substantial justice. Defendant Hulu, directly and through subsidiaries and intermediaries (including distributors, retailers, franchisees and others), has committed and continues to commit acts of patent infringement in this District, by, among other things, making, using, testing, selling, licensing, importing, and/or offering for sale/license products and services that infringe the DivX Patents.

19. Venue is proper in this district and division under 28 U.S.C. §§ 1391(b)-(d) and 1400(b) because Hulu is headquartered and has committed acts of infringement in the Central District of California and has a regular and established physical place of business and employees in the Central District of California.

FACTUAL BACKGROUND

I. DivX

20. Established in 2000, DivX pioneered the delivery of high-quality digital video content to consumers over the internet. Among other things, DivX has invented technologies for video compression, transmission, playback, and security that enable distribution of high-quality video over the internet for playback on a wide variety of consumer devices.

21. DivX distributes consumer software implementing its technologies, and licenses its software to CE manufacturers. DivX has licensed and integrated its software into more than one billion consumer electronic devices. Consumers have downloaded DivX's software more than one billion times. DivX continues to invest in research and development for internet video streaming innovations today.

A. DivX's Origin

22. In 1999, Jérôme Rota, a compositing infographist and video engineer, wanted to compress digital video files in order to be able to share them over the internet.

23. Frustrated with the restrictions and limitations of existing digital video technologies, Mr. Rota created code enabling the MPEG-4 (Moving Picture Experts Group Phase 4 Standard) video codec to be used in a more open way. Mr. Rota modified the MPEG-4 codec for use outside of Windows Media Player (.asf-restricted implementation), enabling it in .avi (audio video interleaved) formatted files.

24. Mr. Rota distributed this code for free online, using the moniker "DivX ;-)"—a play on the now-defunct Circuit City's Digital Video Express DVD service. The DivX ;-) code proved popular and soon became synonymous with how to compress digital video content.

25. Around that same time, Jordan Greenhall, a former Mp3.com executive, learned of the DivX ;-) code. He wanted to create a company around this disruptive technology and be the first to market technology that enabled the efficient transfer and distribution of high-quality digital video content over the internet.

26. Mr. Greenhall contacted Mr. Rota in March 2000 and the two began to build a team of software engineers. Around September 2000, Mr. Greenhall and others co-founded DivXNetworks, Inc., the predecessor business of plaintiff DivX, LLC.

27. DivX's initial goal was to build an internet video solution—or, perhaps more accurately, an internet video revolution. It identified two ways to achieve its early goal: (1) distribute software, including a video codec, to consumers to make it easier to use and share video with each other over the internet; and (2) create a system for video delivery over the internet from a server to multiple users, later called the DivX Open Video System (OVS). Thus, DivX set off to create a mechanism for encoding digital video content for easy distribution via the internet.

B. The DivX Software

28. DivX recognized that consumers wanted *accessible, high-quality* digital video content. To satisfy this demand, DivX created a new implementation of the MPEG-4 video standard. In 2001, after starting from scratch, DivX released the DivX Codec 4.0 to replace the earlier DivX ;-) code. A "codec" is a computer program for encoding—that is, compressing—and decoding digital video files. Over the next decade, DivX released numerous new versions of the DivX Codec (collectively, the "DivX Software").

29. The DivX Software functioned like a master translator for digital video files, allowing for variations in codecs, containers, and playback across different file types on different devices. It allowed consumers to compress, decode, and play back digital video using a standard program.

30. DivX offered its DivX Software for free. At the same time, access to and use of digital video became more widespread as computing power increased. These factors led to widespread adoption of the DivX Software and a large base of DivX users.

31. The DivX Software, in its latest form, combines the DivX Codec, video player, and video converter into what is known as the DivX "Consumer Bundle." DivX offers the Consumer Bundle for free to allow consumers to continue to enjoy high-quality video playback (via the DivX Player), to convert video (via the DivX Converter), and to cast media from a computer to a TV (via the DivX Media Server). DivX also sells a "DivX Pro" version of the DivX Software, which includes additional advanced features.

C. The DivX OVS

32. Around November 2000, Mr. Greenhall hired Eric Grab to lead a team of engineers focused on building an online video consumer service and application called the Open Video System ("OVS") that would allow protected digital video content to travel over the internet.

33. Mr. Grab is a named inventor on the '673, '920, and '588 patents.

34. In 2001, DivX launched the DivX OVS, which could ingest, store, protect, transmit, and authenticate secure digital video content. Consumers could access content using DivX OVS, through the DivX Player.

35. The DivX OVS was one of the world's first MPEG-4 full-screen internet video playback systems with state-of-the-art compression capabilities. It allowed the first DVD-like quality digital video content to securely travel over the internet.

36. The DivX OVS enabled companies possessing video content, such as studios—the content holders—to allow consumers to download and play back videos using the DivX OVS. DivX allowed content holders and distributors to build internet video websites using DivX Software to support the backend system and video playback.

D. Meeting Competing Needs: The DivX Internet Video Ecosystem and the DivX DRM

37. As the DivX Software and the DivX OVS gained popularity in the market, DivX's continued growth depended on its ability to balance competing needs among (1) content holders, (2) CE manufacturers, and (3) consumers. Content holders demanded better security, CE manufacturers demanded better performance, and consumers demanded greater accessibility and improved user experience—in particular, the ability to watch video on devices other than personal computers, such as televisions (and later, smartphones and tablets).

38. Content holders (including studios) demanded additional content protection before agreeing to license the DivX OVS. To put the studios at ease, DivX invested substantial resources in developing state-of-the-art content protection technology. From 2000 to 2005, DivX met with many studios about content distribution, including Disney, Warner Bros., Sony, Universal, and Paramount Pictures.

39. DivX created a system, with input from the studios and CE manufacturers, that met the studios' needs for security and solved the problems associated with internet delivery of secure studio content to CE devices and personal computers (PCs). The DivX DRM technology evolved to solve these problems. The DivX DRM established an elegant system that allowed each content holder to authorize playback of its content on multiple manufacturers' devices.

40. DivX's role in operating the DRM allowed DivX to focus on quality, standardization, and optimization.

41. Leading content distributors responded to DivX's technology. Throughout the mid-2000s, DivX was approached by several companies to discuss using DivX's technology to power online video content delivery platforms. Those companies included Blockbuster, Netflix, Amazon, and others.

E. DivX's Stage6 Platform

42. In 2006, DivX launched Stage6, an internet streaming platform and HTTP-based website for high-resolution user-generated and professional video. The platform incorporated DivX's proprietary technologies. This type of platform went on to become the core of adaptive bitrate streaming (ABS) systems.

43. Stage6 provided internet video users with a higher-resolution alternative to platforms like YouTube. Upon information and belief, at that time Stage6 was the only platform supporting high-resolution video. It allowed users to upload, share, and view high-resolution videos with DivX's Software. Stage6 allowed for uploading of much larger video files than platforms like YouTube; therefore, users could upload and share much larger video files. DivX made significant investments in bandwidth to facilitate this user experience.

44. Even in 2007, Stage6 supported streaming of 720p and 1080p high-definition video. The quality of the high-resolution video playback on Stage6

surprised reviewers, with one commenting "DivX has clearly got something right with web playback of higher-resolution video!"[4]

45. Stage6 enjoyed rapid user traffic growth, and by January 2008, it had over 10,000,000 monthly views. However, increased traffic resulted in increased bandwidth costs to DivX; DivX shut down Stage6 in February 2008 to focus its human resources and capital on the core DivX businesses.

F. DivX's CE Software & Certification Program

46. Beginning around 2002, CE manufacturers began receiving requests from consumers to implement functionality to enable playback of DivX video files.

47. CE manufacturers reached out to DivX to discuss OVS technology implementation in CE devices.

48. To meet CE manufacturers' needs—driven by consumer demand—DivX created a CE software development kit ("SDK") that would allow DVD players and other media players to play DivX files (on CD, DVD, USB, or network) while incorporating a secure DRM protocol.

49. DivX began testing CE devices to determine whether they could successfully use the DivX SDK to play DivX files. This testing matured into the DivX Certification Program. DivX developed Certification Test Kits ("CTKs") for CE manufacturers to certify their licensed devices.

50. DivX Certification was valuable to CE manufacturers, who could use the certification to demonstrate to consumers that their devices could play DivX files as well as a broad range of other video files. DivX also ensured that its video files would play on a wide range of devices by requiring its CE SDK licensees, also known as DivX Partners, to certify their devices using the CTKs.

[4] *DivX Stage6 (beta)—the high-def rival to YouTube*, Hexus.net, May 1, 2007.

51. DivX licensed its technology in the DivX SDKs through various DivX Profiles, including DivX Home Theater, DivX HD, DivX Plus HD, DivX HEVC Ultra HD, DivX Plus Streaming, DivX Mobile, and DivX Mobile Theater.

52. DivX has integrated its technology into more than one billion consumer electronic devices via the DivX SDKs.

53. To this day, DivX has numerous CE licensees for its SDKs and CTKs, including leading digital television, smartphone, in-car video device, DVD / Blu-ray disc, integrated circuit (IC), and original equipment manufacturers. DivX continues to invest in research and development to innovate in the area of video technology.

54. The DivX innovations relating to compression, playback, trick play, fast start, security, high quality, and easy access made video delivery to consumer electronics devices over the internet possible and is the foundation of streaming technology today.

G. Industry Interest in DivX's Technologies

55. DivX's internet video technologies attracted the interest of many companies interested in launching video streaming services.

II. Hulu

56. Today, Hulu claims to be "the leading premium streaming service offering live and on-demand TV and movies, with and without commercials, both in and outside the home."[5] It further claims to be the only "service that gives viewers instant access to current shows from every major U.S. broadcast network; libraries of hit TV series and films; and acclaimed Hulu Originals."[6] Hulu "aggregates acquired television and film entertainment content and original content

[5] https://www.hulu.com/press/about/.

[6] *Id.*

produced by Hulu and distributes it digitally to internet-connected devices."[7] In May 2017, Hulu launched an OTT service, which offers live streams of broadcast and cable channels, including the major broadcast networks.[8]

57. Hulu launched in 2008 by NBC Universal, Fox Broadcasting Company, and 20th Century Fox.

58. Hulu strives to deliver an ecosystem that is easy to use and supports many devices.[9] For example, Hulu touts its ability to permit members to "watch thousands of shows and movies anytime, anywhere."[10] Further, "[a]s a Hulu subscriber, you'll be able to stream your favorite content from the comfort of your very own couch to the confines of public transportation using any one of our supported devices."[11] Hulu streaming software allows users to instantly watch content from Hulu through any internet-connected device that offers the Hulu app, such as smart TVs, game consoles, streaming media players, smartphones, and tablets.[12]

59. The Hulu streaming ecosystem includes numerous playback devices and operating systems.[13]

[7] The Walt Disney Company, Inc. 2017 10-K, available at https://www.sec.gov/Archives/edgar/data/1001039/000100103917000198/fy2017_q4x10k.htm.

[8] *Id.*

[9] https://medium.com/hulu-tech-blog/building-the-hulu-experience-in-the-living-room-10eabf5391d6.

[10] https://www.hulu.com/welcome?orig_referrer=https%3A%2F%2Fwww.google.%20com%2F.

[11] https://help.hulu.com/en-us/supported-devices.

[12] *Id.*

[13] *Id.*; https://medium.com/hulu-tech-blog/introducing-the-hulu-technical-landscape-93f4c136c568.

60. Hulu employs storage, transcoding, and distribution techniques to optimize delivery of content at maximum quality and speed.[14]

61. Hulu further claims that it provides efficient compression for high-quality video and continuous streaming. For example, Hulu's "Live TV offering needs to deliver video to a variety of devices, which means the service needs to produce both Dynamic Adaptive Streaming over HTTP (MPEG-DASH) and Apple's HTTP Live Streaming (HLS) media formats. At a high level, our system must ingest contribution streams from vendors, remux and repackage the video segments, and publish them to the CDN origin. In addition to the video workflow, the service needs to be capable of processing ad and program markers from the ingested stream to present live assets as programs (not simply as channels) with accurate start and end times as well as identify sections of the program that are ads."[15]

[14] https://medium.com/hulu-tech-blog/the-challenges-of-live-linear-video-ingest-part-one-live-versus-on-demand-system-requirements-89238f3af4f6.

[15] https://medium.com/hulu-tech-blog/the-challenges-of-live-linear-video-ingest-

62. In addition, Hulu provides that an advantage of its technology is adaptive bitrate streaming. It claims that it can be streamed at a variety of different quality levels, which will adjust automatically depending on the user's internet speed, ensuring the best quality possible for streaming.[16]

63. Hulu also relies on DRM software for authorizing the playback of copyrighted material. In particular, Hulu states that "content protection is critical for both MPEG-DASH and HLS formats. Our live ingest service needs to encrypt media segments with AES-128 based on MPEG Common Encryption (CENC) specification, package them in fMP4 and MPEG-TS file formats, and apply commercial DRM across all streaming formats."[17]

THE DIVX PATENTS

64. DivX solely owns all rights, titles, and interests in and to the DivX Patents, each described below.

I. The '673 Patent

65. The '673 patent, entitled "Method and System for Securing Compressed Digital Video," was duly and legally issued on November 13, 2007, from a patent application filed July 8, 2003, with Eric W. Grab and Adam H. Li as the named inventors. The '673 patent claims priority to U.S. Provisional Application No. 60/420,500, filed on October 23, 2002.

66. The inventions recited in the '673 patent enable Hulu to stream video to a diverse array of consumer devices while protecting the video content with

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part-one-live-versus-on-demand-system-requirements-89238f3af4f6.

[16] https://help.hulu.com/en-us/video-quality; https://www.digitaltrends.com/movies/how-does-hulu-work/; https://medium.com/hulu-tech-blog/the-challenges-of-live-linear-video-ingest-part-one-live-versus-on-demand-system-requirements-89238f3af4f6.

[17] https://medium.com/hulu-tech-blog/the-challenges-of-live-linear-video-ingest-part-one-live-versus-on-demand-system-requirements-89238f3af4f6.

secure encryption and decryption, allowing Hulu to both offer its service on a diverse device ecosystem and provide high-quality video content. Specifically, the '673 patent is directed to a partial frame encryption architecture that enables improved, more efficient streaming of encrypted video to any device, providing secure decryption without decoding.

67. The '673 patent addresses a technical problem. Digital video files can be very large and therefore difficult to transmit over networks. Compressing those files "reduce[s] the bandwidth required to transmit digital video." *See, e.g.*, '673 patent, 1:46-49. But there is a tradeoff—modern compression and decompression techniques require a significant amount of processing power. *See, e.g.*, *id.* at 1:63-2:9. Video files must also be secure to protect the content, which requires encrypting and decrypting the files—further increasing the processing power needed to play back video and increasing the cost and complexity of the playback device. The '673 patent explains that a need existed for providing adequate security while also limiting the resources consumed during video decryption. *See, e.g.*, *id.* at 3:39-50.

68. The '673 patent claims specific ways to solve this problem with secure compressed digital video content that requires less processing power to decrypt—specifically, selective partial frame encryption. The '673 patent describes creating a set of encrypted frames "by encrypting selected parts of selected frames of the sequence of frames in accordance with a frame encryption function" and generating "frame decryption information necessary to decrypt the set of encrypted frames." *See, e.g.*, *id.* at 3:59-63; *see also* 3:66-4:2; 5:25-32.

69. In particular, claim 1 of the '673 patent recites generating, storing, and using a frame encryption key and generating frame decryption information to produce a protected stream of compressed video content. '673 patent, claim 1. Claim 1 recites a novel solution of synchronizing decryption information with encrypted frames for frame-based encryption to provide secure digital video while

reducing processing resources consumed during decryption in a manner that was not well-understood, routine, or conventional at the time of the '673 patent. *Id.*

II. The '651 Patent

70. The '651 patent, entitled "Video Deblocking Filter," was duly and legally issued on March 20, 2012, from a patent application filed May 26, 2010, with Cheng Huang as the named inventor. The '651 patent claims priority to U.S. Provisional Application No. 60/611,513, filed on September 20, 2005.

71. The inventions recited in the '651 patent allow Hulu's users to stream high-resolution 4K content with smooth playback and without flaws in the video. Specifically, the '651 patent is directed to a multidimensional adaptive deblocking filter that allows for more efficient compression, creating a higher-quality 4K streaming video experience.

72. The '651 patent addresses a technical problem. Compressing digital video to make it smaller comes with the downside of potentially losing visual information and degrading the quality of playback. *See, e.g.*, '651 patent, 1:27-34. To overcome this problem, a "deblocking filter" can be used by the computing system when reconstructing compressed digital video to produce better image quality. *See, e.g.*, *id.* at 1:29-34. However, multiple types of deblocking filters existed, and if the wrong one was applied by the computing system, the process could make the image quality worse, not better. *See, e.g.*, *id.* at 1:48-49; 1:60-63; 1:67-2:3. Selecting the appropriate filter to apply to a given video frame, therefore, is critical. Accordingly, a need existed for an improved method of accurately and efficiently selecting the appropriate deblocking filter to apply based on the digital video data itself.

73. The '651 patent claims specific ways of solving this problem with improved methods of inspecting a boundary of a block of video data in a frame using a computing system and selecting the appropriate deblocking filter to apply to produce the best visual result based on that data. *See, e.g.*, *id.* at 7:65-8:5; 8:38-43.

74. In particular, claim 1 of the '651 patent recites identifying a block boundary, analyzing the boundary by inspecting pixels from multiple rows and multiple columns "that encompass pixels immediately adjacent to at least two sides of the block boundary and includes at least one pixel that is not immediately adjacent to the block boundary," and selecting the appropriate filter. *Id.* at claim 1. Claim 1 recites a novel solution for more efficiently processing digital video data to improve the visual quality of the video in a manner that was not well-understood, routine, or conventional at the time of the '651 patent.

III. The '792 Patent

75. The '792 patent, entitled "Multimedia Distribution System," was duly and legally issued on June 25, 2013, from a patent application filed October 24, 2005, with Abou Ul Aala Ahsan, Steve R. Bramwell, and Brian T. Fudge as the named inventors.

76. The inventions recited in the '792 patent enable playback features that video streaming users expect, enjoy, and use to navigate digital video easily, and they improve the user experience by reducing delays in loading and playing a video when it is selected by the user. Specifically, the '792 patent is directed to providing an abridged video index that improves the user playback experience by enabling chunk-based adaptive bitrate streaming, "trick play," and "fast start" functionality.

77. The '792 patent addresses a technical problem. Originally, multimedia, like video, was transmitted over the internet with a single index for all the content in the multimedia file. As internet multimedia became more sophisticated and complex, the size of this index and the computing resources needed to process it increased. The process of obtaining the index therefore was time- and resource-consuming and either delayed the start of video playback for the user or prevented the user from using desirable technical playback features like seeking, fast-forward, and rewind. Accordingly, a need existed for an improved multimedia file format and systems for generating, distributing, and decoding multimedia files with an

improved index structure that can enable desirable playback features while reducing the computing resources, and associated delays, required to obtain and process the index.

78. The '792 patent claims a solution to this problem with an improved, novel index structure that solves the technical problems and resource-intensive computing issues associated with complex video files. *See, e.g.*, '792 patent, 15:10-16:36; 48:21-49:42. This technical solution enables desired video playback features like starting video immediately and the ability to fast forward, rewind, and skip scenes. *See, e.g., id.* at 16:16-29; 48:21-37.

79. In particular, claim 9 of the '792 patent recites an encoder for encoding a multimedia file that comprises a memory including "a full index" and a processor configured to generate an "abridged index," enabling trick play functionality and improved playback within the video file. *Id.* at claim 9. Claim 9 recites a novel solution for more efficiently processing multimedia files to enable desirable playback features in a manner that was not well-understood, routine, or conventional at the time of the '792 patent.

IV. The '720 Patent

80. The '720 patent, entitled "Systems and Methods for Automatically Generating Top Level Index Files," was duly and legally issued on February 23, 2016, from a patent application filed July 21, 2014, with Jason Braness, Evan Wallin, and Ederson Ferreira as the named inventors. The '720 patent claims priority to U.S. Provisional Application No. 61/529,403, filed on August 31, 2011.

81. The inventions recited in the '720 patent enable Hulu to offer adaptive bitrate streaming services that perform smoothly and without stalls when switching among video streams of different resolution during playback on a user's device. Specifically, the '720 patent is directed to a playback server system that automatically generates a top-level index file tailored to a particular playback

device that the playback device uses to request a streaming file, improving adaptive bitrate streaming.

82. The '720 patent addresses a technical problem related to "adaptive bitrate streaming," a popular digital video streaming method. "Adaptive bit rate streaming or adaptive streaming involves detecting the present streaming conditions . . . in real time and adjusting the quality of the streamed media accordingly." *See, e.g.*, '720 patent, 1:30-45. Many different types of consumer devices can play back video delivered over the internet, including computers, mobile phones, Blu-ray players, television, and set-top boxes. *See, e.g.*, *id.* at 9:1-8. All of these devices have different characteristics and technical capabilities for video playback. *See, e.g.*, *id.* at 7:55-62; 11:46-66; 12:20-31. Adaptive bitrate streaming further increases the complexity of digital video delivery by enabling the playback device to switch among different quality streams based on changes in device conditions. *See, e.g.*, *id.* at 1:30-45; 12:20-31. Each playback device needs a separate index file for each piece of video content that a user will watch using adaptive bitrate streaming. *See, e.g.*, *id.* at 12:20-40. The computing resources needed to compile and maintain a separate index for each combination of content and device make such a system infeasible. Further, using the same index for devices with different characteristics would produce poor playback, including video stalls, on many devices. Accordingly, a need existed for an efficient system to automatically generate index files for different playback devices for adaptive bitrate streaming based on device characteristics in order to improve the performance of the computing devices playing back video.

83. The '720 patent claims a solution to this problem with systems and methods for automatically generating a top-level index file for a particular playback device and particular video content for use in adaptive bitrate streaming. The '720 patent describes filtering the streams associated with requested content using criteria specific to the playback device, to generate a top-level index file. *See, e.g.*,

id. at 2:24-28. The "top level index is a file that describes the location and content of container files containing streams of media (for example, audio, video, metadata, and subtitles) that can be utilized by the playback device to stream and playback content." *See, e.g., id.* at 6:39-43. The playback server system filters the streams based on playback device capabilities, information associated with the user account, or other rules defined by the content owner. *See, e.g., id.* at 6:50-55. The playback server system then sends the top-level index file to the playback device for use in adaptive bitrate streaming for improved performance.

84. In particular, claim 1 of the '720 patent recites a specific way to generate a top-level index file for adaptive bitrate streaming tailored to a specific playback device. *Id.* at claim 1. The playback server system generates the top-level index file based on capabilities of the device, and sends the index to the playback device, which can use the index "to determine which assets to request for playback on the device"—for more efficient adaptive bitrate streaming specific to the technical capabilities of a particular playback device. Claim 1 recites a novel solution for improving the performance of adaptive bitrate streaming in a manner that was not well-understood, routine, or conventional at the time of the '720 patent.

V. The '515 Patent

85. The '515 patent, entitled "Systems and Methods for Automatically Generating Top Level Index Files," was duly and legally issued on June 12, 2018, from a patent application filed January 28, 2016, with Jason Braness, Evan Wallin, and Ederson Ferreira as the named inventors. The '515 patent claims priority to U.S. Provisional Application No. 61/529,403, filed on August 31, 2011.

86. The inventions recited in the '515 patent enable Hulu to offer adaptive bitrate streaming services that perform smoothly and without stalls when switching among video streams of different resolution during playback on a user's device. Specifically, the '515 patent is directed to a playback server system that

automatically generates a top-level index file tailored to a particular playback device that the playback device uses to request a streaming file, improving adaptive bitrate streaming.

87. The ’515 patent shares a specification with the ’720 patent and thus addresses the corresponding technical problem related to adaptive bitrate streaming for a diverse device ecosystem with many different kinds of devices and corresponding technical capabilities. *See, e.g.*, ’515 patent, 1:30-45; 8:2-9; 9:17-23; 11:65-12:16; 12:40-60; *see also supra* ¶ 80.

88. The ’515 patent claims a solution to the problem with systems and methods for automatically generating a top-level index file for a particular playback device for use in adaptive bitrate streaming, based on the device’s specific attributes, including the type of device. *See, e.g.*, *id.* at 11:40-46; *see also supra* ¶ 96.

89. In particular, claim 1 of the ’515 patent recites a specific way to generate a top-level index file for adaptive bitrate streaming tailored to a specific playback device. *Id.* at claim 1. The playback server system generates the top-level index file based on the type of the device and software version loaded on the device, and sends the index to the playback device—for more efficient adaptive bitrate streaming specific to the technical capabilities of a particular playback device. Claim 1 recites a novel solution for improving the performance of adaptive bitrate streaming in a manner that was not well-understood, routine, or conventional at the time of the ’515 patent.

VI. The ’486 Patent

90. The ’486 patent, entitled “Elementary Bitstream Cryptographic Material Transport Systems and Methods,” was duly and legally issued on February 19, 2019, from a patent application filed June 6, 2017, with Francis Yee-Dug Chan, Kourosh Soroushian, and Andrew Jeffrey Wood as the named inventors. The ’486

patent claims priority to U.S. Provisional Application No. 61/266,982, filed on December 4, 2009.

91. The inventions recited in the '486 patent enable Hulu to improve the security of its video streaming system, allowing it to obtain high-quality content from content providers and to trust in the security of its own, home-grown content. Specifically, the '486 patent is directed to a content security architecture that deciphers frame keys within a secure video decoder, efficiently enhancing content security.

92. The '486 patent addresses a technical problem. It explains that content providers need to make sure that only authorized users can access and play back digital content. *See, e.g.*, '486 patent, 1:31-35. This is a particular problem when the content is transmitted over connections that are not secure and can be intercepted. *See, e.g.*, *id.* at 1:53-59. Accordingly, a need existed to improve the distribution of digital content to enhance security of content that may be transmitted over an unsecured connection, while enabling efficient access to the content for the correct users.

93. The '486 patent claims a solution to this problem with specific ways to transmit "encrypted multimedia content over an unsecured connection" to improve security and enable efficient distribution and playback of multimedia content. *See, e.g.*, *id.* at 1:28-29. The '486 inventions "do not secure the transmission but rather secure the data being transmitted via the unsecured connection." *See, e.g.*, *id.* at 5:29-40. The inventions accomplish this by ciphering decryption key information in the multimedia data, and not deciphering those keys to decrypt the multimedia until the data is at the decoder and no longer being transmitted. *See, e.g.*, *id.*; *see also* 6:53-7:5. As a result, "by allowing the decryption to occur on the decoder the bitstream is protected even if the connection is compromised and an unauthorized component or process intercepts the bitstream." *See, e.g.*, *id.* at 5:37-40.

94. In particular, claim 1 of the '486 patent recites "deciphering a frame key" for a partially encrypted video frame on the playback device, and "decrypting the encrypted portion of each partially encrypted frame based upon the frame key." *Id.* at claim 1. That is, the keys necessary to decrypt the video are protected until they are deciphered on the device. The invention recited in claim 1 solves the problem of enhancing multimedia content security by deciphering frame keys within a secure video decoder in a manner that was not well-understood, routine, or conventional at the time of the '486 patent.

VII. The '588 Patent

95. The '588 patent, entitled "Playback Devices and Methods for Playing Back Alternative Streams of Content Protected Using a Common Set of Cryptographic Keys," was duly and legally issued on March 5, 2019, from a patent application filed September 19, 2018, with Michael George Kiefer, Eric William Grab, and Jason Braness as the named inventors. The '588 patent claims priority to U.S. Provisional Application No. 61/530,305, filed on September 1, 2011.

96. The inventions recited in the '588 patent enable Hulu to offer its users an improved experience for adaptive bitrate streaming while maintaining the content security that it and other content providers require to make video content available over the internet. Specifically, the '588 patent is directed to a DRM architecture that uses common frame encryption keys to encode alternate video streams, reducing playback stalls and improving performance during adaptive bitrate streaming.

97. The '588 patent addresses a technical problem. "In many instances, content is divided into multiple streams," and "some streams can be encoded as alternative streams that are suitable for different network connection bandwidths." *See, e.g.*, '588 patent, 1:45-58. In adaptive bitrate streaming, "the source media is encoded at multiple bitrates and the playback device or client switches between streaming the different encodings depending on available resources." *See, e.g., id.*

at 1:59-67. Prior to the '588 invention, each stream used different cryptographic information for authorizing secure playback. *See, e.g., id.* at 8:37-61; 9:65-10:31. Storing and processing cryptographic information for each stream requires more computing resources and increases the cost and complexity of the playback device, and it can also result in stalls and delays when switching among video streams with different bitrates. *See, e.g., id.* Accordingly, a need existed for a more efficient and high-performance DRM implementation for adaptive bitrate streaming that would reduce the computer memory consumed by cryptographic information and reduce the time and computing resources consumed by playback devices when switching among video streams having different bitrates.

98. The '588 patent claims a solution to this problem with specific ways to reduce the computer memory and other resources consumed by cryptographic information during adaptive bitrate streaming. With the '588 invention, "each of the alternative streams of protected content are encrypted using common cryptographic information." *See, e.g., id.* at Abstract; *see also id.* at 2:66-3:30; 8:37-61; 9:65-10:31. The '588 invention allows an adaptive bitrate streaming system to switch among video streams having different bitrates more efficiently, consuming fewer computing resources and avoiding interruptions in video playback, improving the performance of the computing system.

99. In particular, claim 1 of the '588 patent recites a "top level index file identifying a plurality of alternative streams of protected video," "wherein each of the alternative streams of protected video includes partially encrypted video frames that are encrypted using a set of common keys comprising at least one key." *Id.* at claim 1. Claim 1 solves the problem of inefficient and low-performance video playback caused by the use of different cryptographic information for each video stream in an adaptive bitrate streaming service in a manner that was not well-understood, routine, or conventional at the time of the '588 patent.

HULU'S INTERNAL TESTING

100. Upon information and belief, Hulu tests its software application and video streaming service on CE devices to confirm that the application and service work properly before releasing them to users.

101. Upon information and belief, device testing is important to Hulu's success. Device testing allows Hulu to ensure that its application and service operate seamlessly on Hulu-compatible devices—a large ecosystem. Hulu's testing further ensures that iterative versions, updates, and subsequent releases of the application and service remain compatible and operable with consumer devices.

102. Hulu advertises its Quality Assurance Engineer position to include responsibilities such as "design[ing] test plans and creat[ing] test cases for exciting new features being introduced."[18]

103. Upon information and belief, Hulu directly infringes the DivX Patents during Hulu's internal testing of its application and video streaming service on consumer devices.

104. Upon information and belief, Hulu's internal testing enables Hulu to deliver its application and service in the United States and worldwide.

105. Protecting content has become more important for studios in today's high-resolution world.[19] Upon information and belief, Hulu tests the DRM technologies that it employs to protect the security of the video content that it licenses from third parties, including studios, and that it produces itself. Upon information and belief, Hulu's internal testing of the DRM technologies it employs, therefore, enables Hulu to obtain video content from third parties and to invest in its

[18] https://lensa.com/quality-assurance-engineer-android-jobs/seattle/jd/43262aac704de51d7a888b3fe0e43468.

[19] https://www.streamingmedia.com/Articles/ReadArticle.aspx?ArticleID=127701.

own production of original content, which leads to increased adoption of Hulu's service by paying members in the United States and worldwide.

HULU'S INDIRECT INFRINGEMENT

106. Hulu has indirectly infringed and continues to indirectly infringe at least the '673 patent, the '651 patent, the '792 patent, the '515 patent, the '486 patent, and the '588 patent (collectively, the "Indirectly Infringed DivX Patents") by inducing third parties to directly infringe those patents.

107. Hulu has induced, and continues to induce, direct infringement of the Indirectly Infringed DivX Patents by customers, importers, sellers, resellers, and/or end users of infringing playback devices enabled with the Hulu application and service.

I. Hulu's Knowledge of the DivX Patents

108. At the very latest, Hulu had actual knowledge of the DivX Patents and of its infringement as of the date of this Complaint.

II. Hulu's Knowledge of Third-Party Actions Infringing DivX's Patents

109. Hulu is a known market leader and one of the dominant players in internet digital video streaming.

110. Hulu possesses the technical expertise required to understand the scope of the inventions claimed in the DivX Patents.

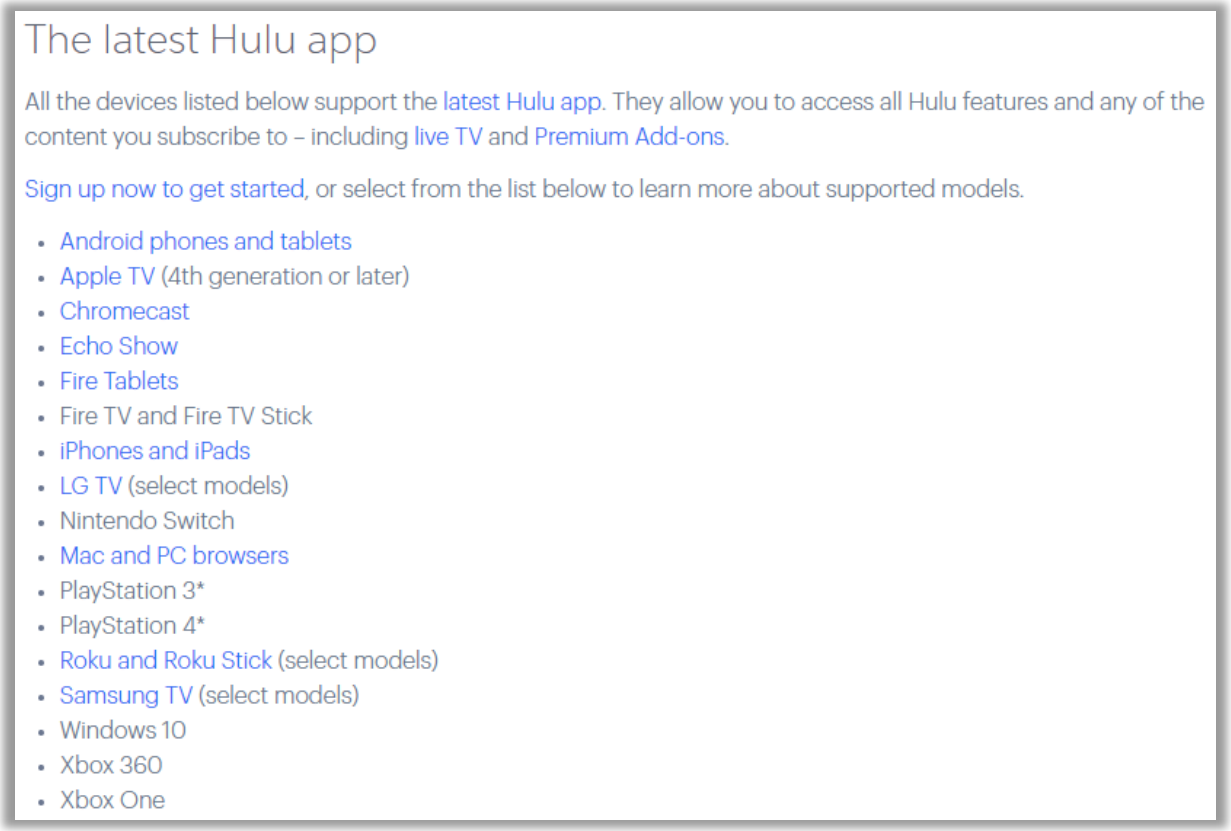
111. Hulu knows that it provides and markets an application, through its website,[20] the Apple App Store,[21] and the Google Play Store,[22] for use on playback devices that causes the playback devices and their users, importers, sellers, resellers, and customers to directly infringe Indirectly Infringed DivX Patents, when used as intended with Hulu's internet video streaming service. Indeed, as

[20] https://www.hulu.com/press/hulu-app-now-available-for-windows-10/.

[21] https://itunes.apple.com/us/app/hulu-watch-tv-shows-movies/id376510438.

[22] https://play.google.com/store/apps/details?id=com.hulu.plus&hl=en_US.

discussed, Hulu broadcasts that its "[a]s a Hulu subscriber, you'll be able to stream your favorite content from the comfort of your very own couch to the confines of public transportation using any one of our supported devices."[23]



The latest Hulu app

All the devices listed below support the latest Hulu app. They allow you to access all Hulu features and any of the content you subscribe to – including live TV and Premium Add-ons.

Sign up now to get started, or select from the list below to learn more about supported models.

- Android phones and tablets
- Apple TV (4th generation or later)
- Chromecast
- Echo Show
- Fire Tablets
- Fire TV and Fire TV Stick
- iPhones and iPads
- LG TV (select models)
- Nintendo Switch
- Mac and PC browsers
- PlayStation 3*
- PlayStation 4*
- Roku and Roku Stick (select models)
- Samsung TV (select models)
- Windows 10
- Xbox 360
- Xbox One

112. Hulu actively encourages the installation and use of its application and service on consumer devices. Hulu has successfully pursued agreements with telecommunication network providers such as Sprint and AT&T to make Hulu's service available through consumer devices.[24] Hulu provides directions to consumers on how to download and install its application and service on different

[23] https://help.hulu.com/en-us/supported-devices.

[24] https://www.sprint.com/en/support/solutions/services/hulu.html; https://about.att.com/story/att_to_offer_hulu_subscription_streaming_service_to_customers.html.

consumer devices.[25]

113. Hulu knows that its application is enabled in infringing playback devices used by over 25 million subscribers.[26]

114. Hulu knows that third parties—including playback device users, importers, sellers, resellers, and customers—make, use, offer to sell, sell, and/or import into the United States playback devices and other products that incorporate and enable the Hulu application. Indeed, Hulu encourages use of its application on "your favorite devices."[27]

115. Hulu knows that a number of devices come with the app "pre-installed."[28] Hulu announces when it rolls out user interfaces for CE devices. For example, it announced when it "roll[ed] out the updated UI [user interface] and access to Hulu with Live TV to even more devices across platforms including LG, Samsung and Roku."[29] And it announced when it rolled out its application for PlayStation3 & PlayStation4.[30]

116. Upon information and belief, Hulu has designed its application such that, when third party CE playback devices incorporate and/or enable the Hulu application and such third party devices with the Hulu application are used as intended, the third-party products with the application directly infringe one or more claims of the Indirectly Infringed DivX Patents when made, used, offered for sale,

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[25] https://help.hulu.com/s/all-devices?language=en_US.

[26] https://www.pcmag.com/article/348989/netflix-vs-hulu-streaming-service-showdown.

[27] https://www.hulu.com/welcome.

[28] https://help.hulu.com/en-us/download-hulu ("The Hulu app may come pre-installed . . . .").

[29] https://www.hulu.com/press/hulu-update/lg-samsung-roku/.

[30] https://www.hulu.com/press/hulu-update/playstation-new-hulu/.

or sold in the United States, or when imported into the United States, as set forth in exemplary detail in the Counts herein.

117. At least as of the date of this Complaint, and based on its knowledge of the scope of the DivX Patents, its application, and products enabling that application, Hulu knows that third party sellers, resellers, importers, customer end-users, and other third parties have directly infringed and continue to directly infringe at least one claim of each of the Indirectly Infringed DivX Patents, as set forth in exemplary detail in the Counts herein.

III. Hulu's Specific Intent to Cause Third-Party Actions Infringing DivX's Patents

118. Upon information and belief, Hulu has designed, marketed, and sold its application and service to third parties with knowledge and the specific intent to cause the third parties to make, use, offer to sell, or sell in the United States, and/or import into the United States products incorporating and enabling the Hulu application and service.

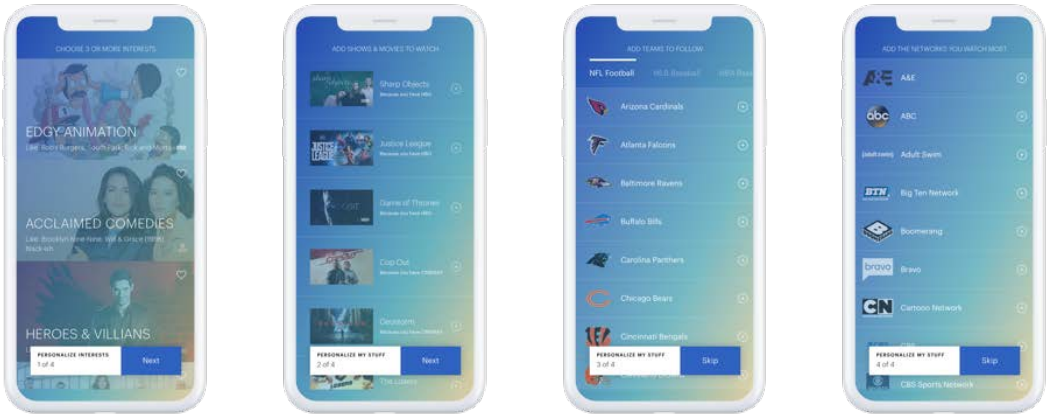
119. Upon information and belief, Hulu actively encourages its customers and end users to directly infringe the Indirectly Infringed DivX Patents by encouraging them to use the Hulu application as intended on various playback devices.

120. Hulu specifically encourages its customers to download its application onto a number of CE devices and provides detailed instructions for its users to download the app to particular CE devices.[31]

121. Hulu offers "mobile onboarding" image instructions, shown here.[32]

[31] https://help.hulu.com/en-us/download-hulu.

[32] https://www.hulu.com/press/products-assets/.



122. Upon information and belief, at least as of the date of this Complaint, Hulu intends and continues to intend to induce patent infringement by these third parties, has actual knowledge that the inducing acts would cause infringement, or is willfully blind to the possibility that its inducing acts would cause infringement.

123. Upon information and belief, Hulu indirectly infringes one or more claims of the Indirectly Infringed DivX Patents by inducing numerous third-parties to make, have made, use, sell, offer to sell, and/or import into the United States playback devices with the Hulu application installed and/or enabled.

COUNT I: INFRINGEMENT OF U.S. PATENT NO. 7,295,673

124. The allegations of paragraphs 1-123 of this Complaint are incorporated by reference as though fully set forth herein.

125. Pursuant to 35 U.S.C. § 282, the ’673 patent is presumed valid.

126. Upon information and belief, Hulu directly infringes the ’673 patent by making, using, offering to sell, selling, and/or importing into the United States its Hulu service, which provides a method and system for securing compressed digital video (collectively, the “Accused ’673 Infringing Products”).

127. Upon information and belief, the Accused ’673 Infringing Products directly infringe at least claim 1 of the ’673 patent at least in the exemplary manner described in paragraphs 128-134 below.

128. Hulu provides a "method for producing a protected stream of compressed video content," namely, Hulu encoding, encrypting, and packaging videos in, for example, the Apple HTTP Live Streaming (HLS) format for streaming.

129. Hulu "receiv[es] an input stream of compressed video content containing a sequence of frames." As shown below, Hulu encodes videos via, for example, at least Apple HLS recommendations, which become an input stream of compressed video content containing a sequence of frames.[33]

> **Functionality**
>
> Our Live TV offering needs to deliver video to a variety of devices, which means the service needs to produce both Dynamic Adaptive Streaming over HTTP (MPEG-DASH) and Apple's HTTP Live Streaming (HLS) media formats. At a high level, our system must ingest contribution streams from vendors, remux and repackage the video segments, and publish them to the CDN origin. In addition to the video workflow, the service needs to be capable of processing ad and program markers from the ingested stream to present live assets as programs (not simply as channels) with accurate start and end times as well as identify sections of the program that are ads.

130. Hulu "generat[es] a frame encryption key and stor[es] the encryption key in a key table" by creating a frame encryption key and storing it in a key table comprising multiple keys during sample encryption of the video in accordance with Apple's HLS and Fairplay DRM specifications.[34]

131. Hulu "creat[es] a set of encrypted frames by encrypting at least selected portions of selected frames of said sequence of frames using the frame

[33] *See* https://medium.com/hulu-tech-blog/the-challenges-of-live-linear-video-ingest-part-one-live-versus-on-demand-system-requirements-89238f3af4f6, Last accessed on Feb 14th, 2019.

[34] https://developer.apple.com/streaming/fps/.

encryption keys in accordance with a frame encryption function" because Hulu's HLS playlists and transport streams (TS) specifies the use of sample encryption in accordance with Apple's HLS specifications.

132. Hulu "generat[es] frame decryption information necessary to decrypt said set of encrypted frames including an encryption key pointer identifying a decryption key to be used in the decryption of each encrypted frame" by generating frame decryption information that includes (1) a pointer to a decryption key, and (2) information about the frames and portions of frames that are encrypted. Apple's HLS and Fairplay DRM specifications teach frame decryption information that includes an encryption key pointer identifying a decryption key to be used in the decryption of each encrypted frame.

133. Hulu "assembl[es] at least said set of encrypted frames, unencrypted frames of said sequence of frames, and said frame decryption information to produce the protected stream of compressed video content" by assembling the requisite information into transport stream (TS) files. The manifest, for example playlists, delivered from Hulu and the files streamed using the manifest indicate that the Hulu encoding and packaging process creates the video file downloaded from Hulu's content delivery network (CDN), which is a protected stream of compressed video.

134. Hulu's "frame decryption information is synchronized with said set of encrypted frames into a synchronized frame decryption stream" when Hulu synchronizes the frame decryption information by interleaving data including the private data indicator descriptor "zavc" throughout the TS file.[35]

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[35] Apple Developer Documentation Archive, "MPEG-2 Stream Encryption Format for HTTP Live Streaming," Section 2.0 Encryption, located at https://developer.apple.com/library/archive/documentation/AudioVideo/Conceptual/HLS_Sample_Encryption/Encryption/Encryption.html#//apple_ref/doc/uid/TP40012862-CH2-SW6; *Id.* at Section 3.0 Transport Stream Signaling, located at https://developer.apple.com/library/archive/documentation/AudioVideo/Conceptual

135. Hulu directly infringes at least claim 1, at least as described, when it tests its service using various playback devices.

136. Upon information and belief, testing Hulu-compatible CE devices is critical to ensuring the success of the Hulu streaming service. Testing allows Hulu to ensure that the largest ecosystem of CE devices possible may seamlessly use the service. It further ensures that iterative versions, updates, and subsequent releases of the application and service remain compatible with CE devices.

137. Hulu has infringed, and continues to infringe, at least claim 1 of the '673 patent in the United States by making, using, offering for sale, selling, and/or importing the Accused '673 Infringing Products, in violation of 35 U.S.C. § 271(a).

138. Hulu has induced, and continues to induce, infringement of at least claim 14 of the '673 patent, at least in the exemplary manner described in paragraphs 139-147 in violation of 35 U.S.C. § 271(b).

139. At least as of the date of this Complaint, Hulu knows that the '673 patent enables Hulu to stream video to a diverse array of consumer devices while protecting the video content with secure encryption and decryption, allowing Hulu to both offer its service on a diverse device ecosystem and provide high-quality video content.

140. Specifically, upon information and belief, Hulu knows that the '673 patent is directed to a partial frame encryption architecture that enables more efficient streaming of encrypted video to any device, providing secure playback by enabling demultiplexing without decryption, and decryption immediately prior to secure decoding.

/HLS_Sample_Encryption/TransportStreamSignaling/TransportStreamSignaling.html#//apple_ref/doc/uid/TP40012862-CH3-SW1.

141. At least as of the date of this Complaint, Hulu knows that it provides and specifically intends to provide an application and service for CE playback devices that, when used as intended, infringes claim 14.

142. At least as of the date of this Complaint, Hulu knows and specifically intends that its end users practice the method recited in claim 14 in the exemplary manner described below, when using its application and service as intended—namely, decrypting a protected stream of compressed video content.

143. Hulu induces "receiving an input stream of compressed video content containing encrypted frames and unencrypted frames" when its application enabled on a CE playback device receives an input stream of compressed video content containing encrypted frames and unencrypted frames when using Apple's HTTP Live Streaming (HLS) format for streaming. The HLS format specifies compressed video content, for example, H.264 (AVC).[36] Apple's HLS specification[37] also requires playlists and transport streams (TS) that use sample encryption. Use of Apple's HLS sample-based encryption results in video streams having encrypted and unencrypted frames.[38]

144. When encrypting the compressed video for example to be streamed to iOS devices, Hulu uses HLS sample encryption where a NAL unit may be partially encrypted or not encrypted.[39]

145. Hulu induces "receiving frame decryption information necessary to decrypt said encrypted frames, said frame decryption information is synchronized

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[36] *See* Encryption at https://developer.apple.com/library/archive/documentation/AudioVideo/Conceptual/HLS_Sample_Encryption/Encryption/Encryption.html#//apple_ref/doc/uid/TP40012862-CH2-SW7.

[37] *Id.*

[38] *Id.*

[39] *Id.*

with said set of encrypted frames into a synchronized frame decryption stream and distinguishes said encrypted frames from said unencrypted frames" when its application enabled on a CE playback device receives frame decryption information containing key information and other information for proper decryption of each and every sample. Such frame decryption information can distinguish encrypted frames from unencrypted frames. Upon information and belief, Hulu provides frame decryption information including an encryption key pointer identifying a decryption key to be used in the decryption of each encrypted frame[40] in accordance with the Apple HLS specification. The frame decryption information is synchronized with the encrypted frames of video using a private data indicator descriptor "zavc" throughout the MPEG2-TS container files that contain portions of the video stream.[41]

146. Hulu induces "obtaining an applicable frame decryption key from the received frame decryption information" when its application enabled on a CE playback device obtains frame decryption information, for example, as specified by the HLS specification.

147. Hulu induces "decrypting selected portions of said encrypted frames using a frame decryption function in accordance with said frame decryption information, which identifies the specific portions of the frames to be decrypted and the applicable frame decryption key from the frame decryption information" when its application enabled on a CE playback device decrypts selected portions of said encrypted frames using a frame decryption function in accordance with said frame decryption information, which identifies the specific portions of the frames to be

[40] *See* https://tools.ietf.org/html/draft-pantos-hls-rfc8216bis-03.

[41] *See* Transport Stream Signaling at https://developer.apple.com/library/archive/documentation/AudioVideo/Conceptual/HLS_Sample_Encryption/TransportStreamSignaling/TransportStreamSignaling.html#//apple_ref/doc/uid/TP40012862-CH3-SW1.

decrypted and the applicable frame decryption key from the frame decryption information. As described, because some encrypted frames are partially encrypted, the information contained within the decryption information will indicate which portion of said encrypted frames needs to be decrypted, and the applicable frame decryption key that is used to decrypt the identified specific portions of the frames. The ISO Common Encryption Standard and the Microsoft PIFF Specification teach frame decryption information that includes an encryption key pointer identifying a decryption key to be used in the decryption of each encrypted frame.

148. Hulu's infringement has caused and continues to cause damage to DivX, and DivX is entitled to recover damages sustained as a result of Hulu's wrongful acts in an amount subject to proof at trial.

COUNT II: INFRINGEMENT OF U.S. PATENT NO. 8,139,651

149. The allegations of paragraphs 1-148 of this Complaint are incorporated by reference as though fully set forth herein.

150. Pursuant to 35 U.S.C. § 282, the '651 patent is presumed valid.

151. Upon information and belief, Hulu directly infringes the '651 patent by making, using, offering to sell, selling, and/or importing into the United States its Hulu service, which provides a video deblocking filter (collectively, the "Accused '651 Infringing Products").

152. Upon information and belief, the Accused '651 Infringing Products directly infringe at least claim 1 of the '651 patent in at least the exemplary manner described in paragraphs 153-160 below.

153. Hulu practices a "method of deblocking a reconstructed video frame." Hulu's encoding platform performs a method of deblocking a reconstructed video frame when encoding titles pursuant to the H.265 (HEVC) Standard. The method is an integral part of the video encoding process. Upon information and belief, Hulu encodes videos in H.265 (HEVC) format.

154. Hulu encodes videos in H.265 (HEVC) format using encoding profiles that *require* a deblocking filter.[42] The encoding profiles that Hulu uses—including at least "Profile Main 10 @ Level 2," "Profile Main 10 @ Level 2.1," and "Profile Main 10 @ Level 3.1" based on observation—are not listed as profiles where a deblocking filter is *optional*.[43] The deblocking filter is used during the encode and decode process within the H.265 (HEVC) Standard. Below, the gray boxes represent components that would be reused in a decoder.[44]

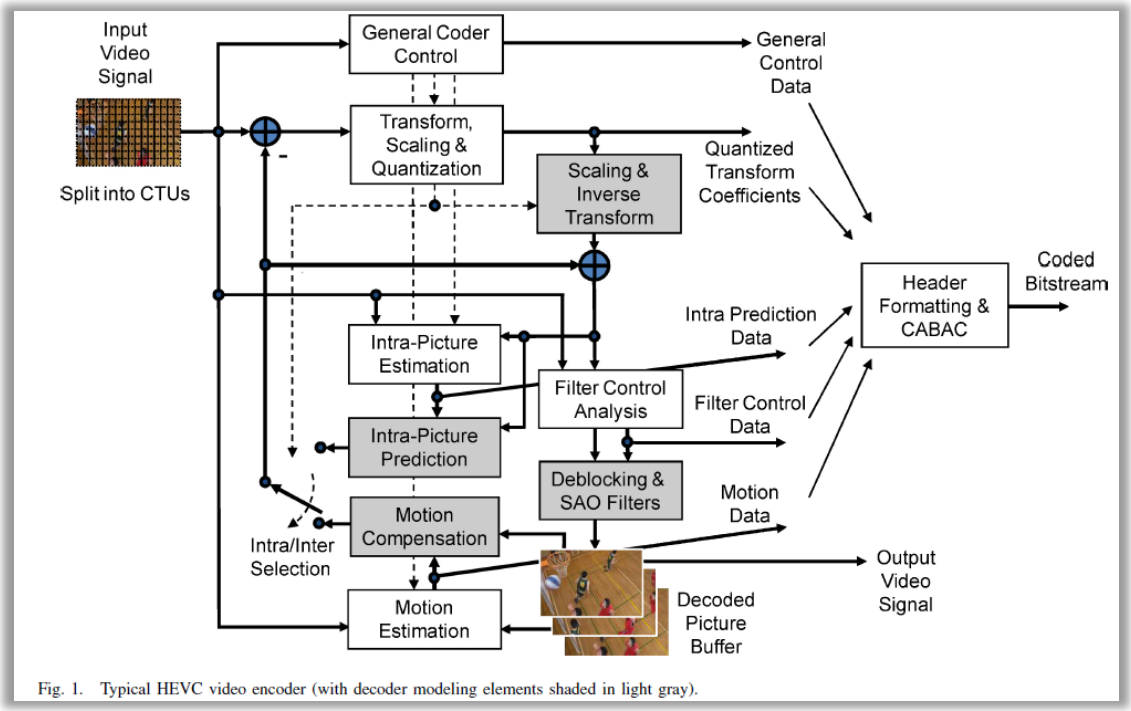

Fig. 1. Typical HEVC video encoder (with decoder modeling elements shaded in light gray).

[42] "High efficiency video coding Recommendation ITU-T H.265 (02/2018)" at 185 ("H.265 (HEVC) Standard"); *see also id.* at 119-20, 282.

[43] *Id.* at 255.

[44] Sullivan, *et al.*, *Overview of the High Efficiency Video Coding (HEVC) Standard*, IEEE TRANSACTIONS ON CIRCUITS AND SYSTEMS FOR VIDEO TECHNOLOGY, VOL. 22, NO. 12, at 1651 (December 2012) ("H.265 (HEVC) Overview"), *available at* http://iphome.hhi.de/wiegand/assets/pdfs/2012_12_IEEE-HEVC-Overview.pdf.

155. The encoding of an H.265 (HEVC) by Hulu practices the method of deblocking a reconstructed video frame.

156. Hulu "identif[ies] a boundary between two blocks of the reconstructed video frame." The H.265 (HEVC) Standard, used by Hulu to encode video in the H.265 (HEVC) format as just discussed, includes a deblocking filter as part of the encoding process.[45]

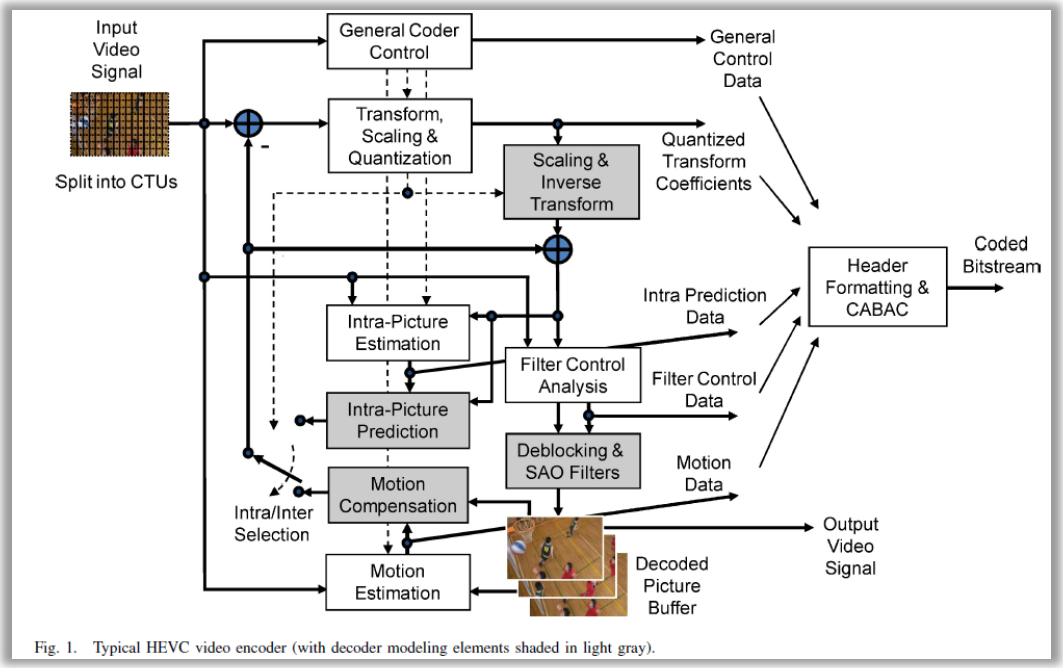

Fig. 1. Typical HEVC video encoder (with decoder modeling elements shaded in light gray).

157. The deblocking filter modifies a reconstructed video frame according to the deblocking filter process, including filtering the boundaries of the video frame.[46] The boundaries between blocks are determined as outlined in steps 4-5 of the deblocking filtering algorithm, as specified in the H.265 (HEVC) Standard.[47]

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[45] *Id.*

[46] H.265 (HEVC) Standard at 185.

[47] *Id.* at 185-86; *see also* Norkin, *et al.*, *HEVC Deblocking Filter*, IEEE TRANSACTIONS ON CIRCUITS AND SYSTEMS FOR VIDEO TECHNOLOGY, VOL. 22, NO. 12, at 1746-54 (December 2012) ("H.265 (HEVC) Deblocking"), *available at* https://ieeexplore.ieee.org/abstract/document/6324414.

Specifically, the H.265 (HEVC) encoder that performs part of the deblocking filter process identifies the boundary between two blocks of the reconstructed video frame.[48]

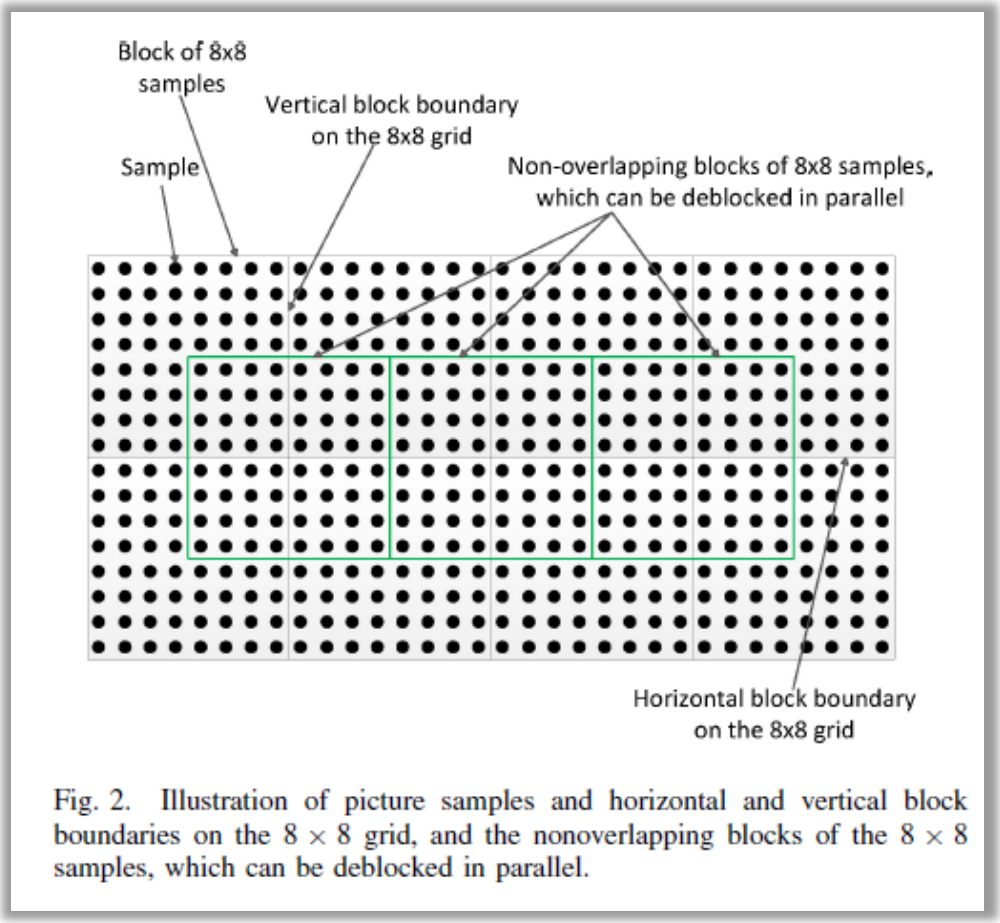


Fig. 2. Illustration of picture samples and horizontal and vertical block boundaries on the 8 × 8 grid, and the nonoverlapping blocks of the 8 × 8 samples, which can be deblocked in parallel.

[48] H.265 (HEVC) Deblocking at 1747; *see also* H.265 (HEVC) Standard at 185 (Section 8.7.2.1).

> Deblocking is, therefore, performed on a four-sample part of a block boundary when all of the following three criteria are true: 1) the block boundary is a prediction unit or transform unit boundary; 2) the boundary strength is greater than zero; and 3) variation of signal on both sides of a block boundary is below a specified threshold (see Fig. 4). When certain additional conditions (Section II-D) hold, a strong filter is applied on the block edge instead of the normal deblocking filter.

158. Hulu "determin[es] the level of detail of the reconstructed video frame across a region in which the block boundary is located, wherein the region includes pixels from multiple rows and multiple columns of the reconstructed video frame that encompass pixels immediately adjacent to at least two sides of the block boundary and includes at least one pixel that is not immediately adjacent to the block boundary." The H.265 (HEVC) Standard requires a deblocking filter determining the level of detail by considering a region that includes pixels from multiple rows and multiple columns of the reconstructed video frame that encompass pixels immediately adjacent to at least two sides of the block boundary and at least one pixel not immediately adjacent to the block boundary. The boundary filtering strength, which contributes to the level of detail, is determined as outlined in step 6 of the deblocking filtering algorithm as specified in the H.265 (HEVC) Standard.[49] The boundary filtering strength calculation first identifies whether to operate on a PU (prediction unit) boundary or TU (transform unit) boundary. Then the boundary filtering strength is determined, to decide whether to apply a strong deblocking filter or normal deblocking filter. If the boundary strength is greater than zero, then four conditions are also computed and checked as part of the level of detail to determine whether to apply a deblocking filter and

[49] H.265 (HEVC) Standard at 185-87.

whether to use the normal or strong version.[50] This is illustrated in the images below. The four conditions are based on calculations from a region that includes pixels from multiple rows and multiple columns of the reconstructed video frame that encompass pixels immediately adjacent to at least two sides of the block boundary and includes at least one pixel that is not immediately adjacent to the block boundary.[51]

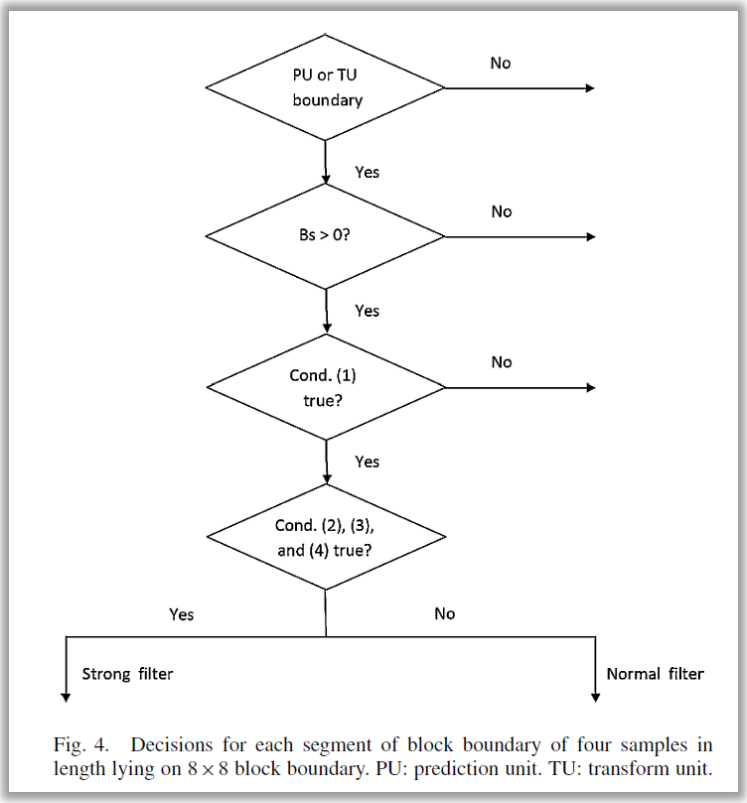


Fig. 4. Decisions for each segment of block boundary of four samples in length lying on 8 × 8 block boundary. PU: prediction unit. TU: transform unit.

[50] H.265 (HEVC) Deblocking at 1748-49.

[51] *Id.* at 1748.

TABLE I

DEFINITION OF BS VALUES FOR THE BOUNDARY BETWEEN TWO NEIGHBORING LUMA BLOCKS

Conditions	*Bs*
At least one of the blocks is Intra	2
At least one of the blocks has non-zero coded residual coefficient and boundary is a transform boundary	1
Absolute differences between corresponding spatial motion vector components of the two blocks are >= 1 in units of integer pixels	1
Motion-compensated prediction for the two blocks refers to different reference pictures or the number of motion vectors is different for the two blocks	1
Otherwise	0

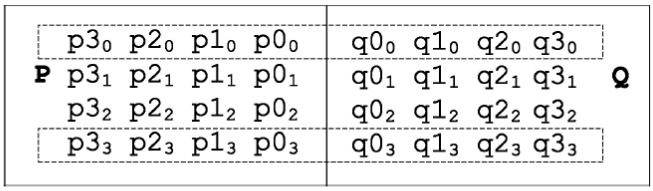


Fig. 3. Four-pixel long vertical block boundary formed by the adjacent blocks P and Q. Deblocking decisions are based on lines marked with the dashed line (lines 0 and 3).

159. An illustration of the multiple rows (row 0 & 3) and multiple columns (cols 0 & 3) involved in such determination is shown below.[52] Column 0 pixels are immediately adjacent to the two sides of the block boundary, and Column 3 pixels are not.

[52] *Id.*

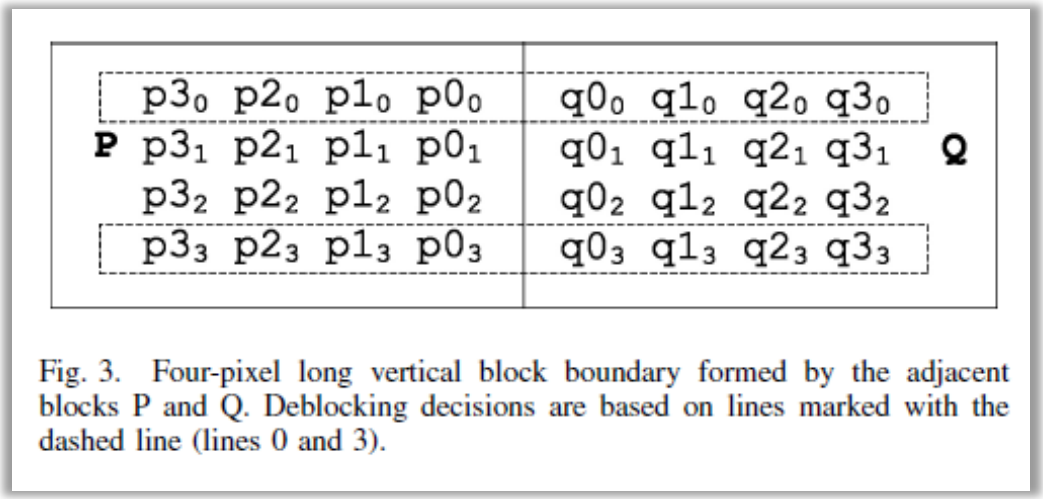


Fig. 3. Four-pixel long vertical block boundary formed by the adjacent blocks P and Q. Deblocking decisions are based on lines marked with the dashed line (lines 0 and 3).

160. Hulu "select[s] a filter to apply to predetermined pixels on either side of the block boundary based upon the determined level of detail" when the H.265 (HEVC) deblocking filter selects between the normal filter and the strong filter to apply to either side of the block boundary based upon the determined level of detail, *for example*, boundary strength and the four conditions.[53]

161. Hulu directly infringes at least claim 1, at least as described, when it tests its service using various playback devices.

162. Upon information and belief, testing Hulu-compatible CE devices is critical to ensuring the success of the Hulu streaming service. Testing allows Hulu to ensure that the largest ecosystem of CE devices possible may seamlessly use the service. It further ensures that iterative versions, updates, and subsequent releases of the application and service remain compatible with CE devices.

163. Hulu has infringed, and continues to infringe, at least claim 1 of the '651 patent in the United States by making, using, offering for sale, selling, and/or importing the Accused '651 Infringing Products, in violation of 35 U.S.C. § 271(a).

[53] *Id.* at 1749.

164. Hulu has induced, and continues to induce, infringement of at least claim 1 of the '651 patent, at least in the exemplary manner described in paragraphs 165-167, in violation of 35 U.S.C. § 271(b).

165. At least as of the date of this Complaint, Hulu knows that the '651 patent allows its users to stream high-resolution content with smooth playback and with greater quality and efficiency. Specifically, at least as of the date of this Complaint, Hulu knows that the '651 patent is directed to a multidimensional adaptive deblocking filter that allows for a higher-quality streaming video experience with more efficient compression and reduced bandwidth requirements.

166. At least as of the date of this Complaint, Hulu knows that it provides and specifically intends to provide an application and service for CE playback devices that, when used as intended, practices the method recited in claim 1.

167. At least as of the date of this Complaint, Hulu knows and specifically intends that its end users practice the method recited in claim 1, when using its application and service as intended—namely, deblocking a reconstructed video frame, as described in paragraphs 153-160.

168. Hulu's infringement has caused and continues to cause damage to DivX, and DivX is entitled to recover damages sustained as a result of Hulu's wrongful acts in an amount subject to proof at trial.

COUNT III: INFRINGEMENT OF U.S. PATENT NO. 8,472,792

169. The allegations of paragraphs 1-168 of this Complaint are incorporated by reference as though fully set forth herein.

170. Pursuant to 35 U.S.C. § 282, the '792 patent is presumed valid.

171. Upon information and belief, Hulu directly infringes the '792 patent by making, using, offering to sell, selling, and/or importing into the United States its Hulu service, which provides a multimedia distribution system (collectively, the "Accused '792 Infringing Products").

172. Upon information and belief, the Accused '792 Infringing Products directly infringe at least claim 9 of the '792 patent at least in the exemplary manner described in paragraphs 173-178 below.

173. Hulu provides an encoder for encoding a multimedia file, as '792 patent claim 9 recites. Hulu uses one or more servers that contain at least an encoder for encoding a multimedia file.

174. Hulu's encoder comprises "a processor." Hulu encodes movies and other titles using computers with processors.

175. Hulu's encoder further comprises "a memory including a file containing at least one sequence of encoded video frames and a full index that includes information indicative of the location within the file and characteristics of each encoded video frame." Hulu produces multimedia files, such as MP4 files, with at least one sequence of encoded video frames stored in media data, or "mdat," boxes. Upon information and belief, Hulu multimedia streams contain mdat boxes. Hulu multimedia files (for example, MP4 files) also include at least one full index that includes information indicative of the location within the file and characteristics of each encoded video frame. A movie fragment box (or "moof") contains a number of track fragment, or "traf," boxes that each contain index information describing a sequence of video frames contained within an mdat box. A traf box contains size information for each track fragment. A traf box also contains a track run ("trun") box, which is a complete index to the location of each frame in the mdat box referenced by the traf box. The ISO/IEC definitions of the moof, traf, and trun boxes are below.[54]

[54] ISO/IEC 14496-12 at 56-58.

8.8.4.1 Definition

Box Type: 'moof'
Container: File
Mandatory: No
Quantity: Zero or more

The movie fragments extend the presentation in time. They provide the information that would previously have been in the Movie Box. The actual samples are in Media Data Boxes, as usual, if they are in the same file. The data reference index is in the sample description, so it is possible to build incremental presentations where the media data is in files other than the file containing the Movie Box.

The Movie Fragment Box is a top-level box, (i.e. a peer to the Movie Box and Media Data boxes). It contains a Movie Fragment Header Box, and then one or more Track Fragment Boxes.

8.8.6.1 Definition

Box Type: 'traf'
Container: Movie Fragment Box ('moof')
Mandatory: No
Quantity: Zero or more

Within the movie fragment there is a set of track fragments, zero or more per track. The track fragments in turn contain zero or more track runs, each of which document a contiguous run of samples for that track. Within these structures, many fields are optional and can be defaulted.

8.8.8.1 Definition

Box Type: 'trun'
Container: Track Fragment Box ('traf')
Mandatory: No
Quantity: Zero or more

Within the Track Fragment Box, there are zero or more Track Run Boxes. If the duration-is-empty flag is set in the tf_flags, there are no track runs. A track run documents a contiguous set of samples for a track.

The moof and mdat boxes are provided to the video assembler, which stores them in memory to process them. Upon information and belief, the Hulu video assembler builds a multimedia file, and it stores the file in memory containing all of the moof and mdat boxes, which collectively contain a sequence of encoded video frames and a full index including information indicative of the location within the file and characteristics of each encoded video frame.

176. Hulu's processor "is configured to generate an abridged index that references a subset of the encoded video frames in the sequence of encoded video frames." Hulu multimedia files (for example, MP4 files) include an abridged index that references a subset of the encoded video frames in the sequence of encoded video frames. The Hulu video contains a segment index box ("sidx"), which can be considered to be an abridged index that references a subset of the encoded video frames in the sequence of encoded video frames. The sidx box is an index pointing to the location of each segment containing a moof box and a following mdat box, as shown below.[55]

8.16.3 Segment Index Box

8.16.3.1 Definition

Box Type: `sidx'
Container: File
Mandatory: No
Quantity: Zero or more

The Segment Index box ('sidx') provides a compact index of one media stream within the media segment to which it applies. It is designed so that it can be used not only with media formats based on this specification (i.e. segments containing sample tables or movie fragments), but also other media formats (for example, MPEG-2 Transport Streams [ISO/IEC 13818-1]). For this reason, the formal description of the box given here is deliberately generic, and then at the end of this Subclause the specific definitions for segments using movie fragments are given.

[55] *Id.* at 105, 228.

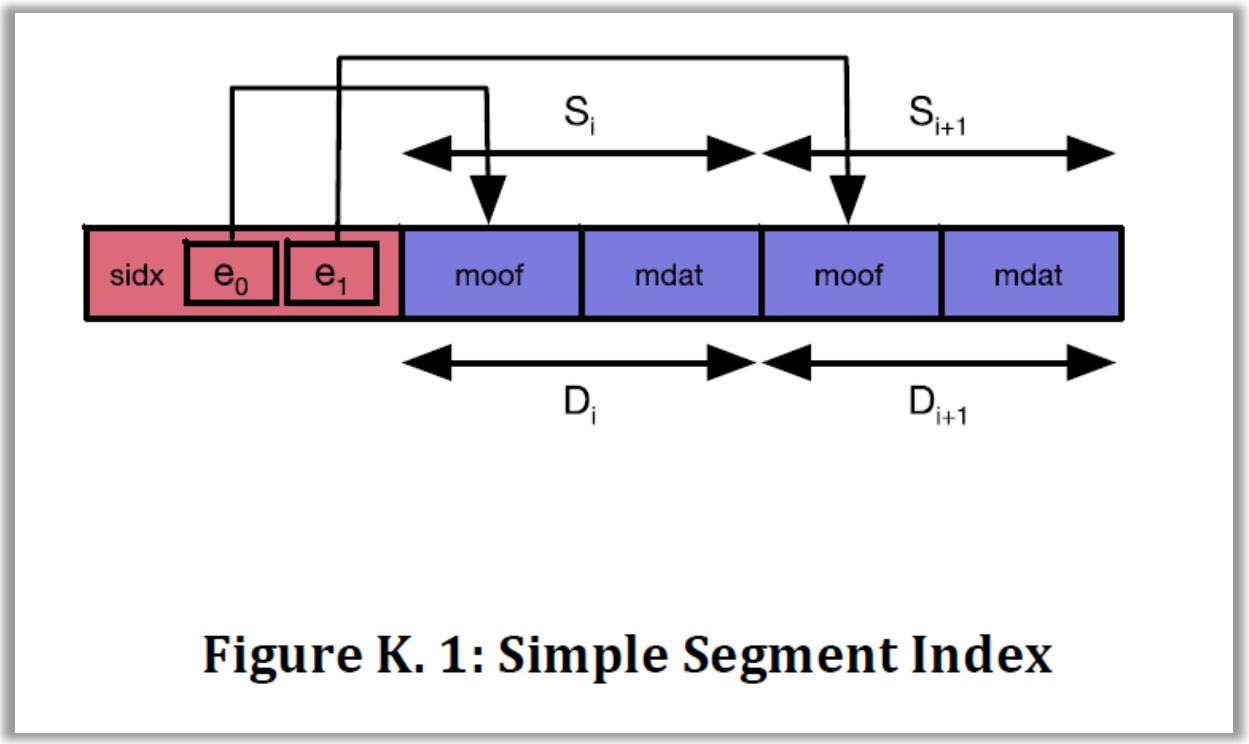


Figure K. 1: Simple Segment Index

The sequence of video frames in the mdat box contained within each of the video segments (namely, moof and following mdat box) pointed to by the abridged index contained within the sidx box is a subset of the encoded video frames contained within the sequence of encoded video frames contained within the file.[56]

177. Hulu's processor is further configured "to encode a multimedia file including the abridged index, the at least one sequence of encoded video frames, and a full index." The video assembler encodes a multimedia file (for example, MP4 file) that contains the abridged index (the sidx box, as described in the previous paragraph), the encoded video segments (moof and mdat boxes), and the full index (trun boxes).

178. Further, "the abridged index is located within the multimedia file prior to the series of encoded video frames, the first and second indexes enabling trick play functionality." Hulu multimedia files (for example, MP4 files) show that the

[56] *Id.* at 56.

abridged index is located within the multimedia file prior to the series of encoded video frames, and the multimedia file contains the first and second indexes that enable trick play functionality (for example, seeking). This is because each element in the trun and sidx boxes enables a playback device to seek to an I-frame corresponding to a specific playback time. An I-frame is a single frame of digital content that an encoder encodes without reference to any other frames within the video sequence. The trun box and the sidx box enable trick play functionality because: (1) the sidx box is used to locate a video segment (that is, moof box and following mdat box) corresponding to a particular playback time that contains an I-frame, and (2) the trun box within the moof box of the located video segment can be used to locate the first I-frame within the mdat box of the located video segment. The trun box can also be used in combination with the sidx box to locate other frames within the mdat box. Upon information and belief, once the location of a frame is identified, individual frames of video from the mdat box can be extracted and provided to a decoder to commence playback at the new playback location.[57]

179. Hulu directly infringes at least claim 9, at least as described, when it tests its service using various playback devices.

180. Upon information and belief, testing Hulu-compatible CE devices is critical to ensuring the success of the Hulu streaming service. Testing allows Hulu to ensure that the largest ecosystem of CE devices possible may seamlessly use the service. It further ensures that iterative versions, updates, and subsequent releases of the application and service remain compatible with CE devices.

181. Hulu has infringed, and continues to infringe, at least claim 9 of the '792 patent in the United States by making, using, offering for sale, selling, and/or importing the Accused '792 Infringing Products, in violation of 35 U.S.C. § 271(a).

[57] *Id.* at 43, 59.

182. Hulu has induced, and continues to induce, infringement of at least claim 15 of the '792 patent, at least in the exemplary manner described in paragraphs 183-190, in violation of 35 U.S.C. § 271(b).

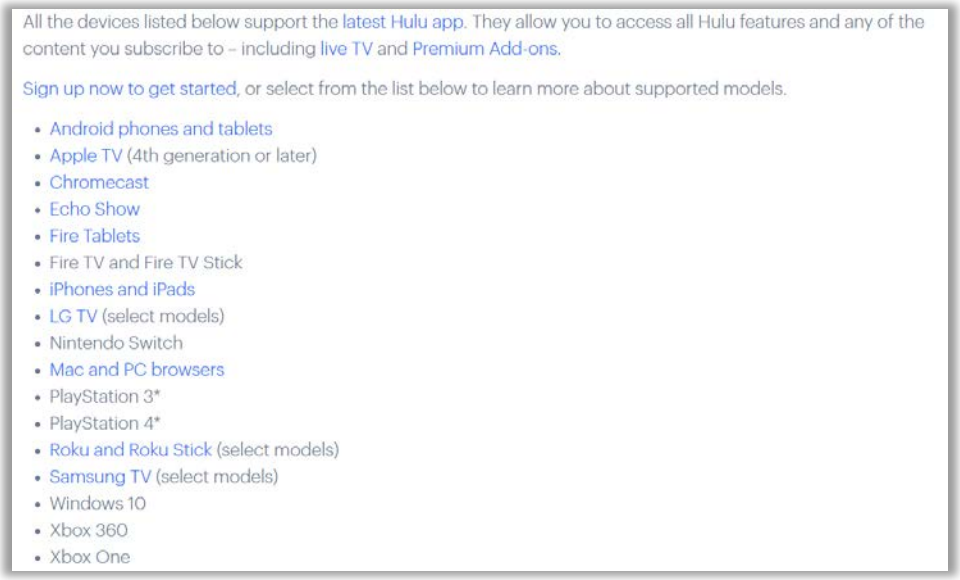
183. At least as of the date of this Complaint, Hulu knows that the '792 patent enables playback features that video streaming users expect, enjoy, and use to navigate digital video easily, and they improve the user experience by reducing delays in loading and playing a video when it is selected by the user. Specifically, at least as of the date of this Complaint, Hulu knows that the '792 patent is directed to providing an abridged video index that improves the user playback experience by enabling chunk-based adaptive bitrate streaming, "trick play," and "fast start" functionality.

184. At least as of the date of this Complaint, Hulu knows that it provides and specifically intends to provide an application and service for CE playback devices that, when used as intended, meets the limitations of claim 15.

185. At least as of the date of this Complaint, Hulu knows and specifically intends that CE playback devices enabling the Hulu application and service infringe claim 15, when enabling the application and service as intended—namely, the CE playback device serves as a decoder for decoding multimedia comprising at least one video track and at least one audio track.

186. The CE playback device enabling the Hulu application comprises "a processor configured to decode multimedia." Hulu's application runs on a device with a processor, and Hulu's application configures the processor to decode multimedia streamed from Hulu's server.[58]

[58] https://help.hulu.com/s/article/supported-devices?language=en_US.



All the devices listed below support the latest Hulu app. They allow you to access all Hulu features and any of the content you subscribe to – including live TV and Premium Add-ons.

Sign up now to get started, or select from the list below to learn more about supported models.

- Android phones and tablets
- Apple TV (4th generation or later)
- Chromecast
- Echo Show
- Fire Tablets
- Fire TV and Fire TV Stick
- iPhones and iPads
- LG TV (select models)
- Nintendo Switch
- Mac and PC browsers
- PlayStation 3*
- PlayStation 4*
- Roku and Roku Stick (select models)
- Samsung TV (select models)
- Windows 10
- Xbox 360
- Xbox One

187. Hulu's application, enabled on a CE playback device, configures the processor to decode multimedia "wherein the multimedia includes a sequence of encoded video frames." The video that Hulu streams contains a sequence of encoded video frames. The video streamed from Hulu and stored at the decoder's memory contains at least a series mdat boxes, which, as discussed, contain encoded video frames within a video fragment.[59] Upon information and belief, Hulu's video streams contain mdat boxes.

188. Hulu's application, enabled on a CE playback device, configures the processor to decode multimedia wherein the multimedia further includes "a complete index referencing each encoded video frame in the sequence of encoded video frames." As explained, video streamed from Hulu contains moof boxes, which contain traf boxes. A traf box contains size information of each traf. The traf box also contains a trun box, which is a complete index to the location of each frame in the mdat box that follows the moof box containing the trun box.[60] Thus, Hulu video streams contain multiple sequences of encoded video frames and a

[59] ISO/IEC 14496-12 at 57.

[60] *Id.* at 56, 58.

complete index referencing each encoded video frame in the sequence of encoded video frames.

189. The Hulu application, enabled on a CE playback device, configures the processor to decode multimedia where the multimedia further includes "an abridged index referencing a subset of the encoded video frames in the sequence of encoded video frames." As explained, the Hulu video contains an sidx box, which is an abridged index that references a subset of the encoded video frames in the sequence of encoded video frames.

190. The Hulu application further configures the CE playback device's processor "to locate a particular encoded video frame within the multimedia using the abridged index and to playback the sequence of encoded video frame starting from the located encoded video frame, the first and second indexes enabling trick play functionality." As described in previous paragraphs, Hulu multimedia files (for example, MP4 files) show that the abridged index is located within the multimedia file before the series of encoded video frames, and the multimedia file contains the first and second indexes that enable trick play functionality (for example, seeking) because each element in trun and sidx enables a playback device to seek to an I-frame corresponding to a specific playback time. The trun box in combination with the sidx box enable trick play functionality, as already described.

191. Hulu's infringement has caused and continues to cause damage to DivX, and DivX is entitled to recover damages sustained as a result of Hulu's wrongful acts in an amount subject to proof at trial.

COUNT IV: INFRINGEMENT OF U.S. PATENT NO. 9,270,720

192. The allegations of paragraphs 1-191 of this Complaint are incorporated by reference as though fully set forth herein.

193. Pursuant to 35 U.S.C. § 282, the '720 patent is presumed valid.

194. Upon information and belief, Hulu directly infringes the '720 patent by making, using, offering to sell, selling, and/or importing into the United States its

Hulu service, which provides a system and method for automatically generating top-level index files (collectively, the "Accused '720 Infringing Products").

195. Upon information and belief, the Accused '720 Infringing Products directly infringe at least claim 1 of the '720 patent at least in the exemplary manner described in paragraphs 196-201 below.

196. Hulu practices a "method of generating a top level index file," that is, a Media Presentation Description (MPD) file when streaming multimedia.

197. Hulu "receiv[es] a request from a playback device at a playback server system, where the request (i) identifies a piece of content and (ii) includes a product identifier" when its streaming infrastructure, that is, its playback server system, receives a request from a CE playback device, where the request (i) identifies a piece of content and (ii) includes a product identifier. Upon information and belief, when using the Hulu application on a CE playback device and requesting a particular piece of content, the Hulu application sends a request for an MPD file to a Hulu server, and the server receives that request. The request identifies a piece of content and includes a product identifier, consisting of at least a version and device number.

198. Hulu "retriev[es], using the playback server system, (i) a list of assets associated with the identified piece of content and (ii) at least one device capability based upon the product identifier, wherein each asset is a different stream associated with the piece of content." The Hulu playback server system has a list of different streams associated with the requested piece of content. For example, the Hulu playback server system contains multiple versions of video encoded using the H.264 (AVC) and H.265 (HEVC) video codecs, at different bitrates and different resolutions and packaged for different streaming frameworks, that is, MPEG-DASH or HTTP Live Streaming (HLS). For example, upon information and belief, this is evidenced by the contents of the MPDs and playlists for various exemplar devices, including the Samsung Galaxy S5 smartphone. Upon information and

belief, Hulu's playback server system retrieves at least one device capability based on the product identifier, such as device type, codecs supported, streaming protocols supported, player language, screen resolution, and/or software version.

199. Hulu "filter[s] the list of assets using the at least one device capability using the playback server system, wherein the playback server system maintains a database of product identifiers and associated device capabilities." For example, and as described in the previous paragraph, there exists multiple versions of *The Handmaid's Tale* encoded using the H.264 (AVC) and H.265 (HEVC) codecs, at different bitrates and different resolutions and packaged for different streaming frameworks, that is, MPEG-DASH or HTTP Live Streaming (HLS), within the Hulu playback server. For example, upon information and belief, this is evidenced by the contents of the MPD for various exemplar devices, including the Samsung Galaxy S5 smartphone. Hulu's playback server system filters the list of streams for each type of device and its capabilities, which include but are not limited to at least one of maximum screen resolution, codec capabilities (for example, H.264 (AVC) or H.265 (HEVC)), streaming protocol capabilities (for example, MPEG-DASH with MP4 files versus HLS with transport stream (MPEG2-TS) files), and other player-specific or device-specific capabilities. Thus, the playback server system accurately delivers the appropriate assets to different devices based on the retrieved product identifier, which demonstrates that the playback server system maintains a database of product identifiers and associated device capabilities.

200. Hulu "generat[es] a top level index file describing each asset in the filtered list of assets using the playback server system," that is, an MPD or playlist. Hulu provides an MPD file or playlist for each media stream, which is a top-level index file describing each asset in the filtered list of assets. As described in the previous paragraph, the list of streams are filtered for each type of device and its capabilities, which include but are not limited to maximum screen resolution, codec capabilities (for example, H.264 (AVC) or H.265 (HEVC)), and player software

format capabilities (for example, MPEG-DASH with MP4 files versus HLS with MPEG2-TS files). Thus, Hulu generates a top-level index file describing each asset in the filtered list of assets—for example, the MPD file—using its playback server system.

201. Hulu "send[s] the top level index file to the playback device using the playback server system, wherein the top level index file is used by the playback device to determine which assets to request for playback on the device." Hulu sends the top-level index file—for example, the manifest, MPD file, or playlist—to the playback device using its playback server system. Hulu's servers receive requests from playback devices for portions of video streams (that is, assets) described in the MPD file or playlist. Hulu's servers use information provided within the MPD files and used by the playback devices to request the assets to authenticate the requests. Thus, the playback device uses the MPD file to determine which assets to request for playback.

202. Hulu directly infringes at least claim 1, at least as described, when it tests its service using various playback devices.

203. Upon information and belief, testing Hulu-compatible CE devices is critical to ensuring the success of the Hulu streaming service. Testing allows Hulu to ensure that the largest ecosystem of CE devices possible may seamlessly use the service. It further ensures that iterative versions, updates, and subsequent releases of the application and service remain compatible with CE devices.

204. Hulu has infringed, and continues to infringe, at least claim 1 of the '720 patent in the United States by making, using, offering for sale, selling, and/or importing the Accused '720 Infringing Products, in violation of 35 U.S.C. § 271(a).

205. Hulu's infringement has caused and continues to cause damage to DivX, and DivX is entitled to recover damages sustained as a result of Hulu's wrongful acts in an amount subject to proof at trial.

COUNT V: INFRINGEMENT OF U.S. PATENT NO. 9,998,515

206. The allegations of paragraphs 1-205 of this Complaint are incorporated by reference as though fully set forth herein.

207. Pursuant to 35 U.S.C. § 282, the ’515 patent is presumed valid.

208. Upon information and belief, Hulu directly infringes the ’515 patent by making, using, offering to sell, selling, and/or importing into the United States its Hulu service, which provides a system and method for automatically generating top-level index files (collectively, the “Accused ’515 Infringing Products”).

209. Upon information and belief, the Accused ’515 Infringing Products directly infringe at least claim 1 of the ’515 patent at least in the exemplary manner described in paragraphs 210-216 below.

210. Hulu practices a “method for authorizing playback of content,” that is, its streaming service.

211. Hulu “receiv[es] a request for content from a playback device at a playback server, where the request includes a product identifier that identifies a device configuration.” For example, upon information and belief, when using the Hulu application on a CE playback device and requesting a particular piece of content, the Hulu application sends a request for an MPD file to a Hulu server, and the server receives that request. The request for content includes a product identifier that identifies a device configuration. For example, upon information and belief, when the Hulu application on a Samsung Galaxy S5 smartphone requests a particular episode of *The Handmaid’s Tale*, there is a product identifier that consists of its version and device numbers.

212. Hulu “identif[es], using the playback server, based on the product identifier, a plurality of device capabilities including a device type and a device software version indicating a version number for an adaptive streaming software component implemented on the playback device.” For example, upon information and belief, an exemplary Samsung Galaxy S5’s device number is 166, which is

associated with Samsung Android device SM-G900V, and a "build number" is included, which is a software version of an adaptive streaming software component—the Hulu application.

213. Hulu "retriev[es], using the playback server, a list of assets associated with the identified piece of content, wherein each asset is a different stream associated with the piece of content." The Hulu playback server retrieves a list of streams (video formats, bitrates, screen size, etc.) associated with the identified piece of content. For example, the Hulu playback server contains multiple versions of video encoded using the H.264 (AVC) and H.265 (HEVC) video codecs at different bitrates and different resolutions and packaged for different streaming frameworks, for example, MPEG-DASH or HTTP Live Streaming (HLS). For example, upon information and belief this is evidenced by the contents of the MPDs and playlists for various exemplar devices, including the Samsung Galaxy S5 smartphone.

214. Hulu "filter[s], using the playback server, the list of assets based on the plurality of device capabilities." For example, and as described in the previous paragraphs, there exist multiple versions of *The Handmaid's Tale* encoded using the H.264 (AVC) and H.265 (HEVC) codecs, at different bitrates and different resolutions and packaged for different streaming frameworks, that is, MPEG-DASH or HTTP Live Streaming (HLS), within the Hulu playback server. For example, upon information and belief, this is evidenced by the contents of the MPD for various exemplar devices, including the Samsung Galaxy S5 smartphone. Hulu's playback server filters the list of streams for each type of device and its capabilities, which include but are not limited to at least one of maximum screen resolution, codec capabilities (for example, H.264 (AVC) or H.265 (HEVC)), streaming protocol capabilities (for example, MPEG-DASH with MP4 files versus HLS with transport stream (ts) files), and other player-specific or device-specific

capabilities. Thus, Hulu filters, using the playback server, the list of assets based on the plurality of device capabilities.

215. Hulu "generat[es], using the playback server, a top level index file describing each asset in the filtered list of assets, wherein the top level index file identifies locations and bitrates of a plurality of alternative streams capable of being used to perform adaptive streamlining of the content," that is, an MPD or playlist. Hulu provides an MPD file or playlist for each media stream, which is a top-level index file describing each asset in the filtered list of assets. As described in the previous paragraph, the list of streams are filtered for each type of device and its capabilities, which include but are not limited to maximum screen resolution, codec capabilities (for example, H.264 (AVC) or H.265 (HEVC)), streaming protocol capabilities (for example, MPEG-DASH with MP4 files versus HLS with MPEG2-TS files), and other player-specific or device-specific capabilities. The Hulu playback server generates either an MPEG-DASH-compliant MPD file or an HLS-compliant set of m3u8 playlist files describing each video stream in the filtered list of video streams, including the location of the video file and its bitrate. Thus, Hulu generates a top level index file describing each asset in the filtered list of assets, wherein the top level index file identifies locations and bitrates of a plurality of alternative streams capable of being used to perform adaptive streaming of the content—for example, the MPD file—using its playback server.

216. Hulu "send[s] the top level index file from the playback server to the playback device." Hulu sends the top-level index file—for example, the MPD file or playlist—to the playback device using its playback server. For example, when the playback device, such as the Samsung Galaxy S5, performs a GET request to the manifest server (part of the playback server at Hulu), the server returns the manifest file to the Galaxy S5 in response to the request.

217. Hulu directly infringes at least claim 1, at least as described, when it tests its service using various playback devices.

218. Upon information and belief, testing Hulu-compatible CE devices is critical to ensuring the success of the Hulu streaming service. Testing allows Hulu to ensure that the largest ecosystem of CE devices possible may seamlessly use the service. It further ensures that iterative versions, updates, and subsequent releases of the application and service remain compatible with CE devices.

219. Hulu has infringed, and continues to infringe, at least claim 1 of the '515 patent in the United States by making, using, offering for sale, selling, and/or importing the Accused '515 Infringing Products, in violation of 35 U.S.C. § 271(a).

220. Hulu has induced, and continues to induce, infringement of at least claim 16 of the '515 patent, at least in the exemplary manner described in paragraphs 221-231, in violation of 35 U.S.C. § 271(b).

221. At least as of the date of this Complaint, Hulu knows that the '515 patent enables it to offer adaptive bitrate streaming services that perform smoothly and without stalls when switching among video streams of different resolution during playback on a user's device.

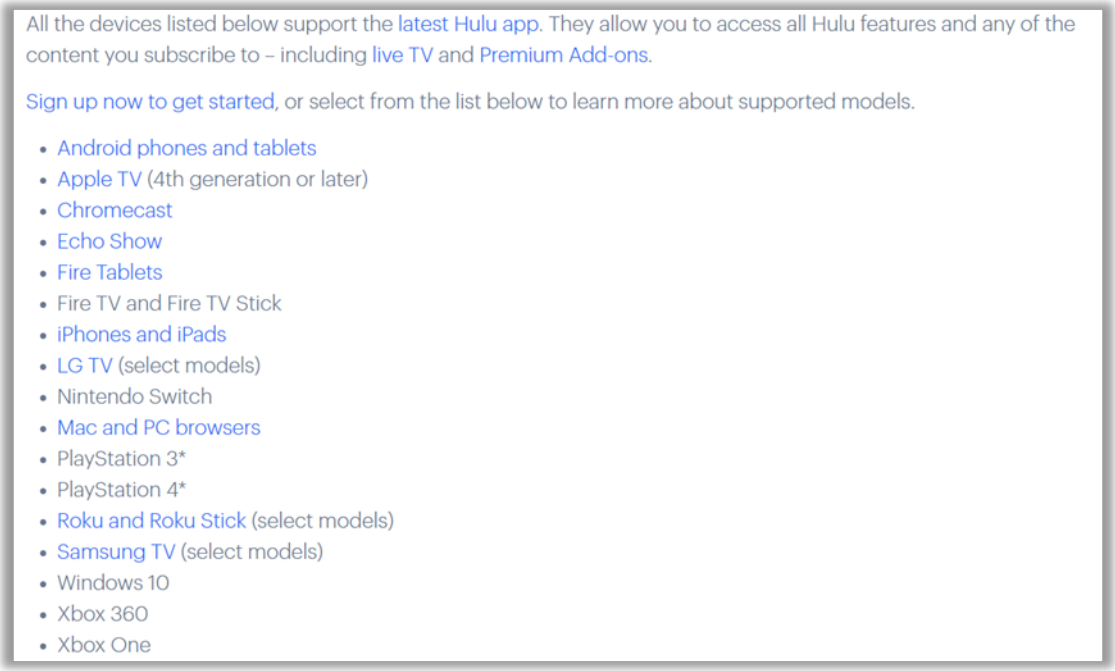
222. Specifically, at least as of the date of this Complaint, Hulu knows that the '515 patent is directed to a playback server system that automatically generates a top-level index file tailored to a particular playback device that the playback device uses to request a streaming file, improving adaptive bitrate streaming.

223. At least as of the date of this Complaint, Hulu knows that it provides and specifically intends to provide an application and service to be used with a CE playback device that, when used as intended, meets the limitations of claim 16.

224. At least as of the date of this Complaint, Hulu knows and specifically intends that end-user CE playback devices be a device that meets all of the limitations of claim 16, when the Hulu application is enabled on the playback device as intended.

225. The CE playback device enabling the Hulu application comprises "memory containing information used to identify capabilities of the playback

device." Devices enabling the Hulu application have memory containing information used to identify the capabilities of the playback device.[61]



All the devices listed below support the latest Hulu app. They allow you to access all Hulu features and any of the content you subscribe to – including live TV and Premium Add-ons.

Sign up now to get started, or select from the list below to learn more about supported models.

- Android phones and tablets
- Apple TV (4th generation or later)
- Chromecast
- Echo Show
- Fire Tablets
- Fire TV and Fire TV Stick
- iPhones and iPads
- LG TV (select models)
- Nintendo Switch
- Mac and PC browsers
- PlayStation 3*
- PlayStation 4*
- Roku and Roku Stick (select models)
- Samsung TV (select models)
- Windows 10
- Xbox 360
- Xbox One

For example, the Samsung Galaxy S5 has memory that stores various information used to identify the capabilities of the playback device. The JSON data POSTed from the device to the Hulu playback servers demonstrates that the memory contains the capabilities of the S5 and the Hulu application.

226. The CE playback device enabling the Hulu application further comprises "a processor configured by a client application," namely, the Hulu application. The Hulu application runs on a device with a processor, and the processor is configured by Hulu's application.[62]

227. Hulu's application "configures the processor to request, using the playback device, a top level index file from a playback server, where the request identifies a piece of content and includes a software version indicating a version

[61] https://help.hulu.com/s/article/supported-devices?language=en_US.

[62] *Id.*

number for an adaptive streaming software component implemented on the device." The processor, configured by the Hulu application, uses the playback device to request a top-level index file—for example, an MPD file or playlist. For example, upon information and belief, when using the Hulu application on a Samsung Galaxy S5 and requesting an episode of *The Handmaid's Tale*, the Hulu application sends a request to a Hulu server for a manifest file. Upon information and belief, the request identifies a piece of content, for example, an episode of *The Handmaid's Tale*, and includes a software version indicating a version number for an adaptive streaming software component implemented on the device, for example, the Hulu application.

228. Hulu's application further configures the processor to "receive, using the playback device, a top level index file from the playback server, where the top level index file identifies locations and bitrates of a plurality of different alternative streams capable of being used to perform adaptive streaming of the identified piece of content and accessible to the playback device." The processor, configured by the Hulu application, uses the playback device to request and receive an MPD file or playlist from the Hulu playback server. For example, when the playback device, such as the Samsung Galaxy S5, issues a GET request to the manifest server (part of the playback server at Hulu), the server returns the manifest file to the Galaxy S5 in response to the request. The manifest includes the locations and bitrates of a plurality of different alternative streams.

229. Hulu's application further configures the processor to "select, using the playback device, an initial stream from the plurality of different alternative streams." The processor, configured by the Hulu application, uses the playback device to select an initial stream out of the plurality of different alternative streams defined in the manifest file.

230. Hulu's application further configures the processor to "retrieve, using the playback device, at least a portion of the initial stream from the locations

identified in the top level index file." The processor, configured by the Hulu application, uses the playback device to request and receive an MPD file or playlist. Then, for example, the Samsung Galaxy S5 with the Hulu application requests portions of a specific stream from a location specified in, for example, the MPD file. Then at least a portion of the initial stream from that location is retrieved.

231. Hulu's application further configures the processor to "play back, using the playback device, the portion of the initial stream." After the processor retrieves the at least portion of the initial stream from one of the locations identified in the top-level index file—for example, the MPD file—the playback device plays the file. For example, *The Handmaid's Tale* is streamed from Hulu and played back on a Samsung Galaxy S5 in the Hulu application.

232. Hulu's infringement has caused and continues to cause damage to DivX, and DivX is entitled to recover damages sustained as a result of Hulu's wrongful acts in an amount subject to proof at trial.

COUNT VI: INFRINGEMENT OF U.S. PATENT NO. 10,212,486

233. The allegations of paragraphs 1-232 of this Complaint are incorporated by reference as though fully set forth herein.

234. Pursuant to 35 U.S.C. § 282, the '486 patent is presumed valid.

235. On information and belief, Hulu directly infringes the '486 patent by making, using, offering to sell, selling, and/or importing into the United States its Hulu service, which provides playback devices and methods for deciphering frame keys within a secure video decoder, efficiently enhancing content security (collectively, the "Accused '486 Infringing Products").

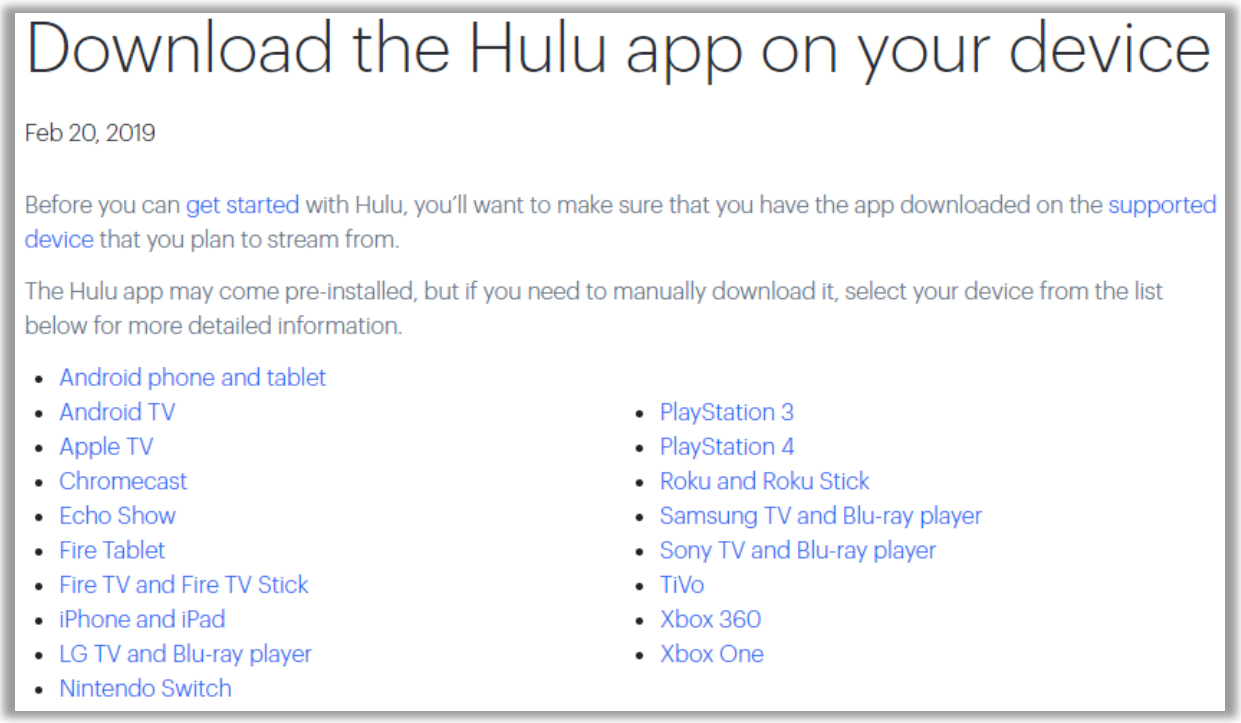
236. On information and belief, the Accused '486 Infringing Products directly infringe at least claim 1 of the '486 patent at least as shown in the exemplary manner described in paragraphs 237-251 below.

237. Hulu provides "[a] playback device for playing back encrypted video" by providing applications that enable playback utilizing the MPEG-DASH Standard on a heterogeneous set of viewing devices.

238. Hulu's playback device comprises "a set of one or more processors" because all playback devices that run the Hulu player application or other client applications that access the Hulu service include a set of one or more processors.

239. Hulu's playback device further comprises "a non-volatile storage containing a playback application" because to play back content, the playback device uses, for example, a Hulu player application that is either pre-installed or downloaded and stored in non-volatile memory. As shown below, Hulu provides details on how to access the Hulu application on numerous devices—including smartphones, tablets, computers, smart TVs, streaming media players, game consoles, set-top boxes, and Blu-ray players—and states that "[t]he Hulu app may come pre-installed."[63]

[63] https://help.hulu.com/en-us/download-hulu/.



Download the Hulu app on your device

Feb 20, 2019

Before you can get started with Hulu, you'll want to make sure that you have the app downloaded on the supported device that you plan to stream from.

The Hulu app may come pre-installed, but if you need to manually download it, select your device from the list below for more detailed information.

- Android phone and tablet
- Android TV
- Apple TV
- Chromecast
- Echo Show
- Fire Tablet
- Fire TV and Fire TV Stick
- iPhone and iPad
- LG TV and Blu-ray player
- Nintendo Switch
- PlayStation 3
- PlayStation 4
- Roku and Roku Stick
- Samsung TV and Blu-ray player
- Sony TV and Blu-ray player
- TiVo
- Xbox 360
- Xbox One

240. Hulu's playback device further comprises "a non-volatile storage containing a playback application for causing the set of one or more processors to perform the step[] of . . . receiving a container file with video data at a parser."

a. Hulu's applications receive data from MP4 container files that contain video streams encrypted in accordance with the ISO Common Encryption Standard and Microsoft PIFF Specification. Hulu's applications include certain code— a parser—responsible for extracting information utilized in the decryption and playback of the video.

b. For example, upon information and belief, the main parser method from the "BaseBox.java" module of the Hulu Android App shows that the Hulu Android App parses data received from a container file by performing HTTP byte range requests for specific portions of the container file.

241. Hulu's playback device further comprises "a non-volatile storage containing a playback application for causing the set of one or more processors to perform the step[] of . . . extracting portions of the container file using the parser." As noted above, the Hulu Android App is capable of streaming video in accordance with the MPEG-DASH Standard and includes a parser used to extract portions of MP4 container files. *See* ¶ 240.

242. Hulu's playback device further comprises "a non-volatile storage containing a playback application for causing the set of one or more processors to perform the step[] of . . . extracting portions of the container file using the parser, wherein the container file comprises: video data with a plurality of partially encrypted frames."

a. As shown below, Hulu uses the ISO Common Encryption Standard[64] and Microsoft PIFF Specification,[65] which specify the use of partially encrypted frames (referred to as sub-sample encryption).

> Encrypted AVC Tracks MUST use the SubSample encryption feature of the SampleEncryptionBox to tell the decryption component exactly what parts of a sample are and are not encrypted. See section 5.3.2 for details on how to represent subsamples in the SampleEncryptionBox.

[64] ISO/IEC CD 23001-7 (3rd Ed.) at 6.
[65] Microsoft PIFF Specification at 16.

5.3.2.1 **Syntax**

```
aligned(8) class SampleEncryptionBox extends FullBox('uuid',
extended_type= 0xA2394F52-5A9B-4f14-A244-6C427C648DF4, version=0,
flags=0)
{
      if (flags & 0x000001)
      {
          unsigned int(24)    AlgorithmID;
          unsigned int(8)     IV_size;
          unsigned int(8)[16] KID;
      }
      unsigned int (32)      sample_count;
      {
          unsigned int(IV_size)  InitializationVector;

          if (flags & 0x000002)
          {
              unsigned int(16) NumberOfEntries;
              {
                  unsigned int(16) BytesOfClearData;
                  unsigned int(32) BytesOfEncryptedData;
              } [ NumberOfEntries]
          }

      }[ sample_count ]
}
```

b. For example, upon information and belief, Hulu Android App streaming data shows that (1) the streams include video data that conforms to the "cenc" scheme specified in the ISO Common Encryption Standard (2) the received video is encoded in accordance with the H.264 (AVC) Standard so that the encrypted portions of the frames are indicated within a PIFF Sample Encryption Box (uuid).

243. Hulu's playback device further comprises "a non-volatile storage containing a playback application for causing the set of one or more processors to perform the step[] of . . . extracting portions of the container file using the parser, wherein each partially encrypted frame contains encrypted portions and

unencrypted portions of data." As noted above, each partially encrypted frame includes encrypted portions and unencrypted portions. *See* ¶ 242.

244. Hulu's playback device further comprises "a non-volatile storage containing a playback application for causing the set of one or more processors to perform the step[] of . . . extracting portions of the container file using the parser, wherein the container file comprises: a set of cryptographic information describing the encrypted portion of each partially encrypted frame." As noted above, the PIFF Sample Encryption Box ("uuid") in the MP4 files received by the Hulu Android App includes cryptographic information for each frame, including information describing the encrypted and unencrypted portion of each frame. *Id.*

245. Hulu's playback device further comprises "a non-volatile storage containing a playback application for causing the set of one or more processors to perform the step[] of . . . extracting portions of the container file using the parser, wherein the container file comprises: a set of cryptographic information describing the encrypted portion of each partially encrypted frame, where cryptographic information for a partially encrypted frame comprises: cryptographic material for the encrypted portion of the partially encrypted frame."

a. The Microsoft PIFF Specification and ISO Common Encryption Standard employed by Hulu relies on the use of an AES-CTR cipher to generate a frame key to decrypt partially encrypted frames.

b. The frame key is generated based on the PIFF Sample Encryption Box ("uuid") in the MP4 files received from Hulu's servers by the Hulu Android App.[66]

c. For example, upon information and belief, the MP4 container file used by the Hulu Android App shows that the cryptographic

[66] ISO/IEC 23001-7:2016(E) at 16 – 17 (§ 9.5.2.3).

material from the downloaded video are contained within a PIFF Sample Encryption Box ("uuid").

246. Hulu's playback device further comprises "a non-volatile storage containing a playback application for causing the set of one or more processors to perform the step[] of . . . extracting portions of the container file using the parser, wherein the container file comprises: a set of cryptographic information describing the encrypted portion of each partially encrypted frame, where cryptographic information for a partially encrypted frame comprises: a block reference that identifies the encrypted portion of the partially encrypted frame." As noted above, upon information and belief, the PIFF Sample Encryption Box ("uuid") in the MP4 files received by, for example, the Hulu Android App includes a block reference in the form of an offset (that is, a number of unencrypted bytes) and a number of encrypted bytes. *See* ¶ 242.

247. Hulu's playback device further comprises "a non-volatile storage containing a playback application for causing the set of one or more processors to perform the step[] of . . . providing each partially encrypted frame, the cryptographic material for each partially encrypted frame, and the block reference for each partially encrypted frame from the parser to a video decoder."

a. To decrypt the partially encrypted streams received from Hulu's servers, the Hulu applications provide partially encrypted frames, the cryptographic material for each partially encrypted frame, and the block reference for each partially encrypted frame from the parser to a video decoder.

b. For example, the Hulu Android App implements an interface to a hardware decoder and/or a software decoder. Upon information and belief, the "HardwareDecoder.java" module can decide to decrypt and decode a frame of video if there is a native hardware decoder. When there is a native hardware decoder, the

code employs "getCryptoInfo,"[67] which can be set to cenc, cbc1, cens, or cbcs. The mode parameter is set in a JavaScript method from the "TrackInfo.java" module, which is the part of the parser. This signaling is in accordance with the ISO Common Encryption Standard.[68]

248. Hulu's playback device further comprises "a non-volatile storage containing a playback application for causing the set of one or more processors to perform the step[] of . . . identifying the encrypted portion of each partially encrypted frame using the block reference for each partially encrypted frame." The encrypted portion of the partially encrypted frame is identified using the block reference contained within the "PIFFSubSampleEncryptionEntries" from the MP4 container files. This identifying data is passed via CryptoInfo.

249. Hulu's playback device further comprises "a non-volatile storage containing a playback for causing the set of one or more processors to perform the step[] of . . . deciphering a frame key for each partially encrypted frame using the cryptographic material for each partially encrypted frame to produce a frame key for each partially encrypted frame."

a. The method of encryption employed by Hulu is specified in a "TrackEncryption Box" in accordance with the ISO Common Encryption Standard.[69] The TrackEncryption Box in Hulu streams includes a value Specification= "cenc," indicating the usage of the AES-CTR cipher.

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[67] https://developer.android.com/reference/android/media/MediaCodec.CryptoInfo.

[68] ISO/IEC 23001-7:2016(E) at 3 (§4.1).

[69] *See* ISO/IEC 23001-7:2016(E) at 19 (§10.1).

b. Frames encrypted by Hulu using the AES-CTR cipher employ a frame encryption key (that is, "key stream" output by the AES-CTR cipher) to encrypt each partially encrypted frame. At least one frame encryption key for a given frame is deciphered according to the following process:[70]

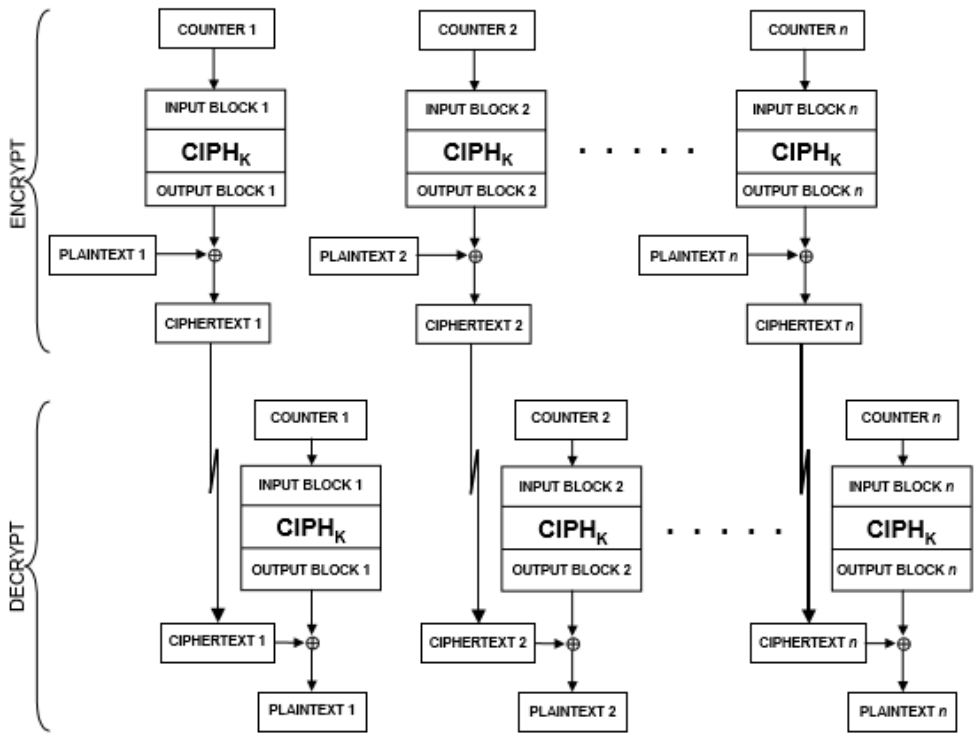


Figure 5: The CTR Mode

The CTR mode is illustrated in Figure 5.

c. The output blocks of an AES cipher in AES-CTR mode are conventionally referred to as a "key stream."[71] The "key stream" (that is, the frame key) for a particular frame is used to decrypt

[70] https://nvlpubs.nist.gov/nistpubs/Legacy/SP/nistspecialpublication800-38a.pdf.

[71] https://www.ietf.org/rfc/rfc3686.txt.pdf.

encrypted blocks within the frame by combining the encrypted block with the "key stream" using an exclusively-OR operation.

d. The Hulu Android App parses data from MP4 files to determine the encryption method utilized. The App deciphers "key streams" using the AES-CTR cipher in a manner compatible with the encryption specification present in the Protection Scheme Info Box (sinf). A key referenced by the KID present in the sinf is used to configure the AES cipher in AES-CTR mode to decipher the at least one frame key. Additionally, the initialization vectors specified in the PIFF Sample Encryption for each frame entry is used to configure the AES cipher in AES-CTR mode to generate the frame key.

250. Hulu's playback device further comprises "a non-volatile storage containing a playback application for causing the set of one or more processors to perform the step[] of . . . decrypting the encrypted portion of each partially encrypted frame based upon the frame key for each partially encrypted frame using the video decoder." As noted above, the Hulu Android App decrypts the encrypted portion of the partially encrypted frame using the frame key deciphered using the AES-CTR cipher. The decryption process involves combining the frame key (that is, the key stream) with the encrypted block of data using an exclusive-OR process. *See* ¶ 241.

251. Hulu's playback device further comprises "a non-volatile storage containing a playback application for causing the set of one or more processors to perform the step[] of . . . decoding each decrypted frame for rendering on a display device using the video decoder." The decrypted frame is decoded for rendering on a display device using the video decoder.

252. Hulu directly infringes at least claim 1, at least as described, when it tests its service using various playback devices.

253. Upon information and belief, testing Hulu-compatible CE devices is critical to ensuring the success of the Hulu streaming service. Testing allows Hulu to ensure that the largest ecosystem of CE devices possible may seamlessly use the service. It further ensures that iterative versions, updates, and subsequent releases of the application and service remain compatible with CE devices.

254. Hulu has infringed, and continues to infringe, at least claim 1 of the '486 patent in the United States by making, using, offering for sale, selling, and/or importing the Accused '486 Infringing Products in violation of 35 U.S.C. § 271(a).

255. Hulu has induced and continues to induce infringement of at least claim 1 of the '486 patent, at least in the exemplary manner described in paragraphs 256-258, in violation of 35 U.S.C. § 271(b).

256. At least as of the date of this Complaint, Hulu knows that the '486 patent is directed to a content security architecture that deciphers frame keys within a secure video decoder, efficiently enhancing content security. Hulu knows that it provides and specifically intends to provide an application and service to be used with a playback device that, when used as intended, meets the limitations of claim 1.

257. At least as of the date of this Complaint, Hulu knows that it provides and specifically intends to provide an application and service for CE playback devices that, when used as intended, meets the limitations of claim 1.

258. At least as of the date of this Complaint, Hulu knows and specifically intends that its end users infringe claim 1, when using its application and service as intended—namely, providing playback devices and methods for deciphering frame keys within a secure video decoder, efficiently enhancing content security, as described in paragraphs 237-251.

259. Hulu's infringement has caused and continues to cause damage to DivX, and DivX is entitled to recover damages sustained as a result of Hulu's wrongful acts in an amount subject to proof at trial.

COUNT VII: INFRINGEMENT OF U.S. PATENT NO. 10,225,588

260. The allegations of paragraphs 1-259 of this Complaint are incorporated by reference as though fully set forth herein.

261. Pursuant to 35 U.S.C. § 282, the ’588 patent is presumed valid.

262. Upon information and belief, Hulu directly infringes the ’588 patent by making, using, offering to sell, selling, and/or importing into the United States its Hulu service, which provides playback devices and methods for playing back alternative streams of content protected using a common set of cryptographic keys (collectively, the “Accused ’588 Infringing Products”).

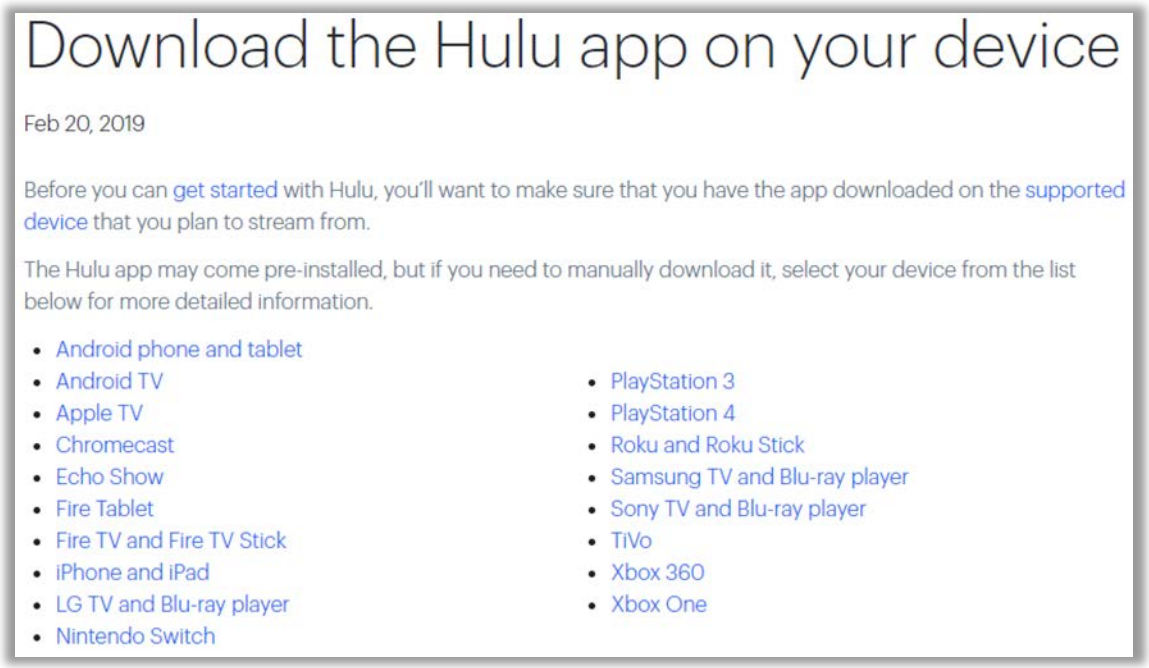
263. Upon information and belief, the Accused ’588 Infringing Products directly infringe at least claim 1 of the ’588 patent at least as shown in the exemplary manner described in paragraphs 264-275 below.

264. Hulu provides a “playback device for playing protected content from a plurality of alternative streams” by providing applications that enable playback utilizing the MPEG-DASH Standard and Microsoft PIFF Specification on a heterogeneous set of viewing devices.

265. Hulu’s playback device comprises “a set of one or more processors” because all playback devices that run the Hulu player application or other client applications that access the Hulu service include a set of one or more processors.

266. Hulu’s playback device further comprises “a non-volatile storage containing an application” because in order to play back content, the playback device uses, for example, a Hulu player application that is either pre-installed or downloaded and stored in non-volatile memory. Hulu provides details on how to access the Hulu application on numerous devices—including smartphones, tablets, computers, smart TVs, streaming media players, game consoles, set-top boxes, and

Blu-ray players—and states that "the Hulu app may come pre-installed" or the user can "manually download it."[72]



Download the Hulu app on your device

Feb 20, 2019

Before you can get started with Hulu, you'll want to make sure that you have the app downloaded on the supported device that you plan to stream from.

The Hulu app may come pre-installed, but if you need to manually download it, select your device from the list below for more detailed information.

- Android phone and tablet
- Android TV
- Apple TV
- Chromecast
- Echo Show
- Fire Tablet
- Fire TV and Fire TV Stick
- iPhone and iPad
- LG TV and Blu-ray player
- Nintendo Switch
- PlayStation 3
- PlayStation 4
- Roku and Roku Stick
- Samsung TV and Blu-ray player
- Sony TV and Blu-ray player
- TiVo
- Xbox 360
- Xbox One

267. Hulu's playback device further comprises "a non-volatile storage containing an application for causing the set of one or more processors to perform the step[] of obtaining a top level index file identifying a plurality of alternative streams of protected video, wherein each of the alternative streams of protected video includes partially encrypted video frames that are encrypted using a set of common keys comprising at least one key, and wherein the partially encrypted video frames contain encrypted portions and unencrypted portions of data."

a. For example, the Hulu application downloads a manifest file, which is a "top-level index identifying a plurality of alternative streams of protected video." Many Hulu players utilize the MPEG-DASH Standard to adaptively stream content by obtaining a top level index file that describes multiple alternative streams of video

[72] https://help.hulu.com/s/article/download-hulu?language=en_US.

encrypted in accordance with the ISO Common Encryption Standard or Microsoft PIFF Specification and then selecting between the protected streams based upon network streaming conditions. The MPEG-DASH Standard includes requirements for a Media Presentation Description or MPD file (that is, top level index file) that includes descriptions of different Representations (that is, alternative streams) in an Adaptation Set:[73] As shown below, the Hulu manifest includes the information contained within an MPD file.

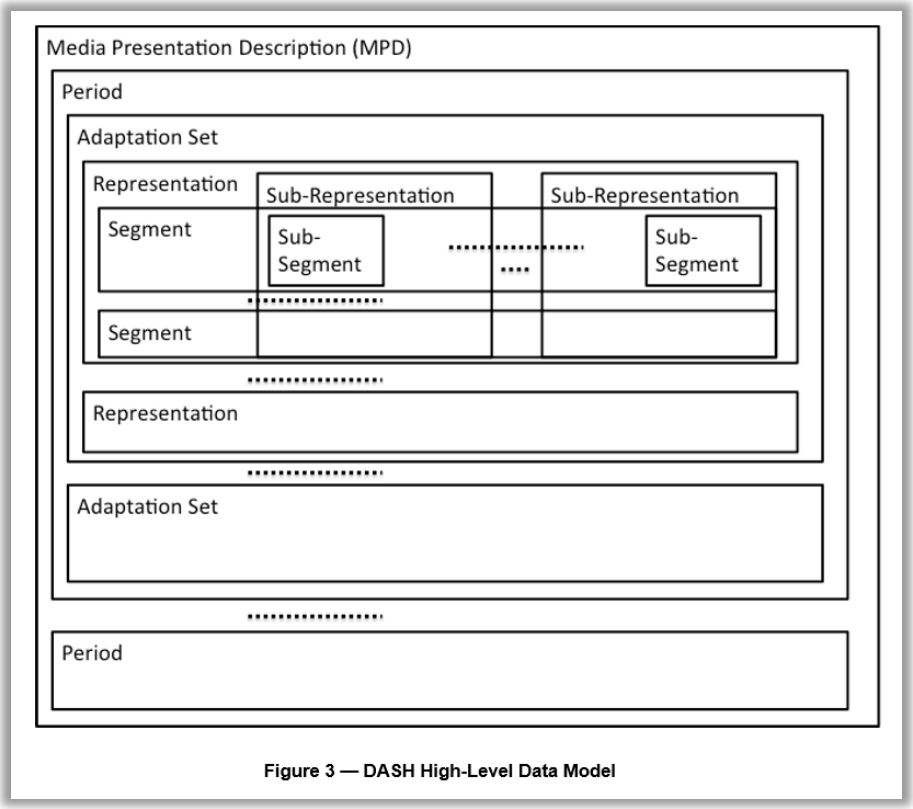
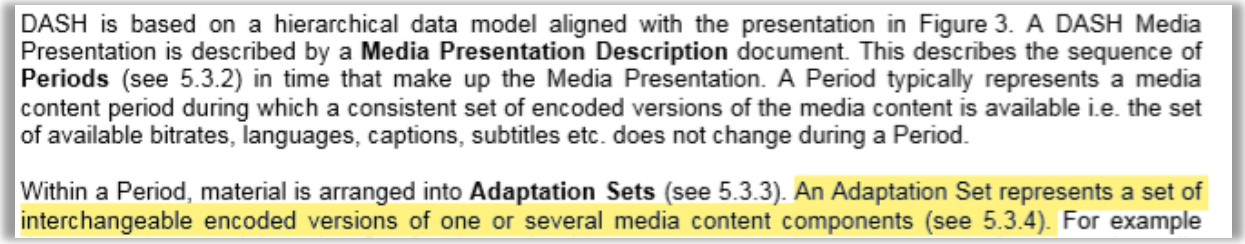


Figure 3 — DASH High-Level Data Model

[73] ISO/IEC/23009-1 (2014) Information technology – Dynamic adaptive streaming over HTTP (DASH) – Part 1: Media presentation description and segment formats at 9-10 (yellow highlighting added).



DASH is based on a hierarchical data model aligned with the presentation in Figure 3. A DASH Media Presentation is described by a **Media Presentation Description** document. This describes the sequence of **Periods** (see 5.3.2) in time that make up the Media Presentation. A Period typically represents a media content period during which a consistent set of encoded versions of the media content is available i.e. the set of available bitrates, languages, captions, subtitles etc. does not change during a Period.

Within a Period, material is arranged into **Adaptation Sets** (see 5.3.3). An Adaptation Set represents a set of interchangeable encoded versions of one or several media content components (see 5.3.4). For example

b. In addition, "each of the alternative streams of protected video includes partially encrypted video frames that are encrypted using a set of common keys comprising at least one key, and wherein the partially encrypted video frames contain encrypted portions and unencrypted portions of data." As noted above, the plurality of streams of video are encrypted in accordance with the ISO Common Encryption Standard and Microsoft PIFF Specification. Specifically, Hulu uses an AES-CTR cipher to partially encrypt video frames using a set of common keys comprising at least one key. Furthermore, Hulu encodes a plurality of alternative streams described in the top level index files so that each of the plurality of alternative streams of protected video includes partially encrypted video frames that are encrypted using a set of common keys comprising at least one key. In some instances, Hulu encodes a plurality of alternative streams that each have the same resolution and encrypts them using the same key. In many instances, Hulu encrypts all streams (irrespective of resolution) using the same key.

268. Hulu's playback device further comprises "a non-volatile storage containing an application for causing the set of one or more processors to perform the step[] of . . . obtaining a copy of the set of common keys." In order to playback streamed content, the Hulu player application obtains the key indicated by the KID

specified, for example, in the PIFF Track Encryption Boxes of the plurality of alternative protected video streams that share a common KID.

269. Hulu's playback device further comprises "a non-volatile storage containing an application for causing the set of one or more processors to perform the step[] of . . . detecting streaming conditions for the playback device" because, for example, the Hulu player application detects streaming conditions and selects a stream from the plurality of alternate streams of protected video. For example, Hulu documentation indicates that the Hulu player application ("client") detects streaming conditions because "[q]uality will automatically adjust based on your available bandwidth, ensuring you always have the best picture quality possible for streaming"[74] and "video qualities . . . will adjust based on your internet speed and the device in-use, to provide you with the best stream possible" during device playback:[75]

Video quality on Hulu

Jan 4, 2019

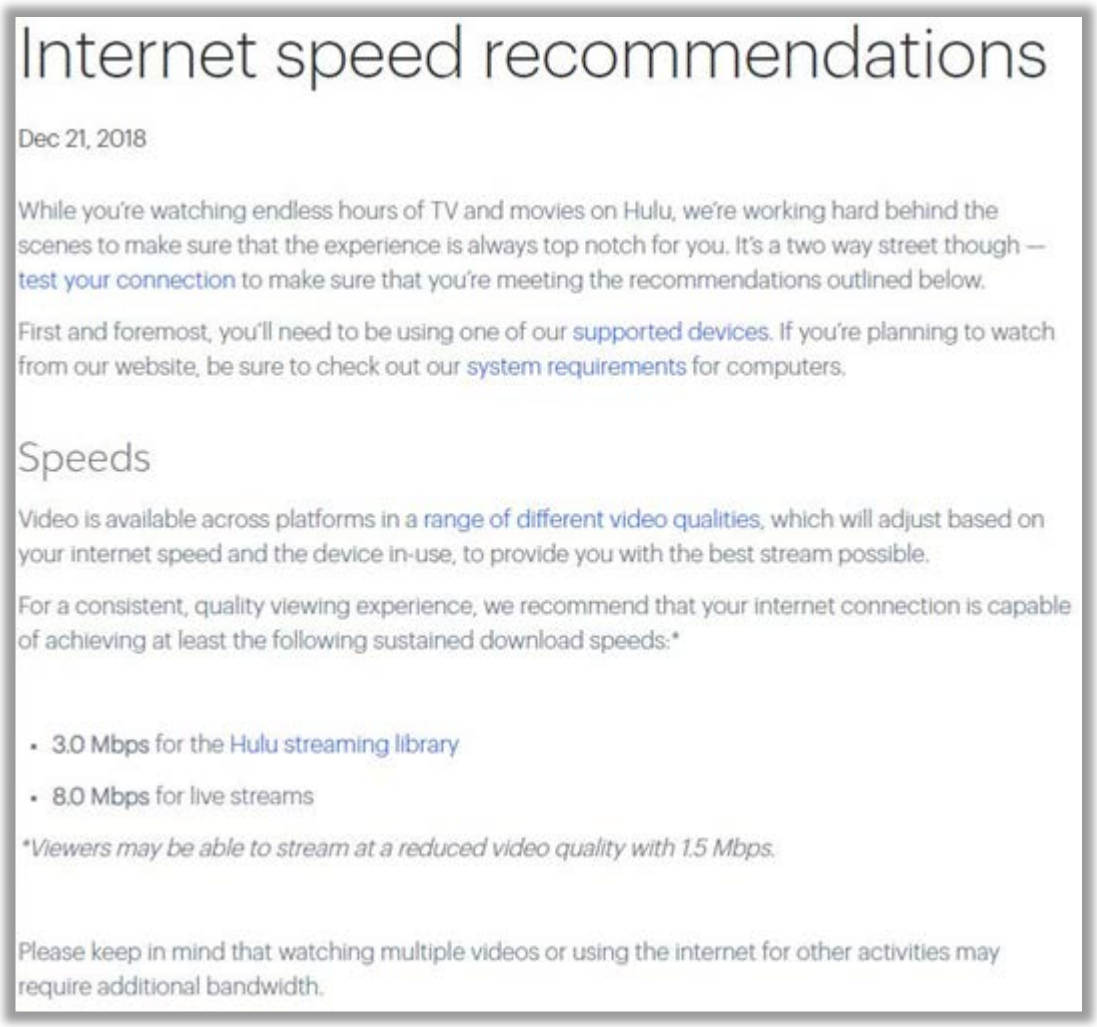
Hulu's streaming library and live TV programming is available to stream in various high definition (HD) video qualities, like 720p, 1080p, and 60fps high definition (HD) video qualities.

Quality will automatically adjust based on your available bandwidth, ensuring you always have the best picture quality possible for streaming

These available options may also vary on the content you're watching and the device you're using to stream.

[74] https://help.hulu.com/en-us/video-quality.

[75] https://help.hulu.com/en-us/network-requirements.



Internet speed recommendations

Dec 21, 2018

While you're watching endless hours of TV and movies on Hulu, we're working hard behind the scenes to make sure that the experience is always top notch for you. It's a two way street though — test your connection to make sure that you're meeting the recommendations outlined below.

First and foremost, you'll need to be using one of our supported devices. If you're planning to watch from our website, be sure to check out our system requirements for computers.

Speeds

Video is available across platforms in a range of different video qualities, which will adjust based on your internet speed and the device in-use, to provide you with the best stream possible.

For a consistent, quality viewing experience, we recommend that your internet connection is capable of achieving at least the following sustained download speeds:*

- 3.0 Mbps for the Hulu streaming library
- 8.0 Mbps for live streams

*Viewers may be able to stream at a reduced video quality with 1.5 Mbps.

Please keep in mind that watching multiple videos or using the internet for other activities may require additional bandwidth.

270. Hulu's playback device further comprises "a non-volatile storage containing an application for causing the set of one or more processors to perform the step[] of . . . selecting a stream from the plurality of alternative streams of protected video based on the detected streaming conditions." *See* ¶ 269.

271. Hulu's playback device further comprises "a non-volatile storage containing an application for causing the set of one or more processors to perform the step[] of . . . receiving a container index that provides byte ranges for portions of the selected stream of protected video within an associated container file" because, for example, MP4 container files encoded by Hulu include container indexes in the form of an sidx box, which provides byte ranges for portions of a

stream of protected video within the container file. For example, the MPEG-DASH Standard requires including an sidx box within the MP4 container file:[76]

> **6.3.4.3 Indexed Media Segment**
>
> A Media Segment conforming to the Indexed Media Segment Format is defined as follows:
>
> — Each Media Segment shall comply with the general type as defined in 6.3.4.2 and in addition in each self-contained movie fragment, the movie fragment ('moof') box is immediately followed by its corresponding media data ('mdat').
>
> — Each Media Segment shall contain one or more 'sidx' boxes. The first 'sidx' box shall be placed before any 'moof' box and shall document Subsegments that span the composition time of the entire Segment.
>
> — Each Media Segment shall carry 'msix' as a compatible brand. The conformance requirements of this brand are defined in this subclause.

272. Hulu's playback device further comprises "a non-volatile storage containing an application for causing the set of one or more processors to perform the step[] of . . . requesting portions of the selected stream of protected video based on the provided byte ranges" because Hulu applications use, for example, the sidx box to make HTTP byte range requests for content.

273. Hulu's playback device further comprises "a non-volatile storage containing an application for causing the set of one or more processors to perform the step[] of . . . locating encryption information that identifies encrypted portions of frames of video within the requested portions of the selected stream of protected video." For example, in order to decrypt the partially encrypted streams received from Hulu, Hulu player applications locate encryption information that identifies encrypted portions of frames of video within the selected stream (for example, the received PIFF Sample and Subsample Encryption Boxes "uuid"). The process utilized is in accordance with the Microsoft PIFF Specification:[77]

[76] ISO/IEC 23009-1:2014 at 87 (§ 6.3.4.3).

[77] Microsoft PIFF Specification at 2.

> The parser uses the Sample Table metadata along with the Movie and Track fragment random access Boxes to figure out which sample to play at any given time in the presentation. Once a sample is located in a fragment, it will use the SampleEncryptionBox for that fragment along with any default values from the TrackEncryptionBox to get the correct key, initialization vector, and sub sample data (if necessary) for the sample. Either the fragment is not encrypted and can be passed directly to the decoder or the content will need to be decrypted using the proper encryption parameters. Normally a decryption transform component handles the work of figuring out if decryption is necessary, figuring out the necessary license for decryption, setting up the decryption context for the key, caching the decryption context for future use, applying sample protection, etc. All the media pipeline needs to do is provide the KID, sample data, subsample data (if necessary) and appropriate initialization vector to the decryption transform component for each sample in the fragment.

274. Hulu's playback device further comprises "a non-volatile storage containing an application for causing the set of one or more processors to perform the step[] of . . . decrypting each encrypted portion of the frames of video identified within the located encryption information using the set of common keys" because Hulu player applications decrypt, or cause the decryption of, the encrypted portion of the partially encrypted frame (for example, the demultiplexed, encoded samples from MediaExtractor) using the common keys (for example, the common key indicated by the KID in the PIFF Track Encryption Box for the plurality of alternative video streams).

275. Hulu's playback device further comprises "a non-volatile storage containing an application for causing the set of one or more processors to perform the step[] of . . . playing back the decrypted frames of video obtained from the requested portions of the selected stream of protected video" because the Hulu application causes, or Hulu client software in conjunction with another application(s) causes, the processor(s) and the hardware elements of the client device under the processor's control to play back decrypted video.

276. Hulu directly infringes at least claim 1, at least as described, when it tests its service using various playback devices.

277. Upon information and belief, testing Hulu-compatible CE devices is critical to ensuring the success of the Hulu streaming service. Testing allows Hulu to ensure that the largest ecosystem of CE devices possible may seamlessly use the service. It further ensures that iterative versions, updates, and subsequent releases of the application and service remain compatible with CE devices.

278. Hulu has infringed, and continues to infringe, at least claim 1 of the '588 patent in the United States by making, using, offering for sale, selling, and/or importing the Accused '588 Infringing Products in violation of 35 U.S.C. § 271(a).

279. Hulu has induced, and continues to induce infringement of at least claim 1 of the '588 patent, at least in the exemplary manner described in paragraphs 280-282, in violation of 35 U.S.C. § 271(b).

280. At least as of the date of this Complaint, Hulu knows that the '588 patent is directed to a DRM architecture that uses common frame encryption keys to encode alternate video streams, reducing playback stalls during adaptive bitrate streaming. Hulu knows that it provides and specifically intends to provide an application and service to be used with a playback device that, when used as intended, meets the requirements recited in claim 1.

281. At least as of the date of this Complaint, Hulu knows that it provides and specifically intends to provide an application and service for CE playback devices that, when used as intended, meets the requirements cited in claim 1.

282. At least as of the date of this Complaint, Hulu knows and specifically intends that its end users infringe claim 1, when using its application and service as intended—namely, playing protected content from a plurality of alternative streams on a playback device, as described in paragraphs 264-275.

283. Hulu's infringement has caused and continues to cause damage to DivX, and DivX is entitled to recover damages sustained as a result of Hulu's wrongful acts in an amount subject to proof at trial.

JURY TRIAL DEMANDED

DivX hereby demands a trial by jury on all claims and issues so triable.

PRAYER FOR RELIEF

WHEREFORE, DivX respectfully requests that the Court:

A. Enter judgment that Hulu has directly infringed one or more claims of one or more of the DivX Patents, either literally or under the doctrine of equivalents, in violation of 35 U.S.C. § 271(a);

B. Enter judgment that Hulu has induced infringement of one or more claims of the DivX Patents in violation of 35 U.S.C. § 271(b);

C. Enter an order, pursuant to 35 U.S.C. § 284, awarding to DivX damages adequate to compensate for Hulu's infringement of the DivX Patents (and, if necessary, related accountings), in an amount to be determined at trial, but not less than a reasonable royalty;

D. Enter an order, pursuant to 35 U.S.C. § 285, deeming this to be an "exceptional case" and thereby awarding to DivX its reasonable attorneys' fees, costs, and expenses;

E. Enter an order that Hulu account for and pay to DivX the damages to which DivX is entitled as a consequence of the infringement;

F. Enter an order for a post-judgment equitable accounting of damages for the period of infringement of the DivX Patents following the period of damages established at trial;

G. Enter an order awarding to DivX pre- and post-judgment interest at the maximum rates allowable under the law; and

H. Enter an order awarding to DivX such other and further relief, whether at law or in equity, that this Court deems just and proper.

DATED: March 5, 2019

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By: */s/ Roman M. Silberfeld*

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