

1 RUSS, AUGUST & KABAT
 2 Marc A. Fenster, SBN 181067
 Email: mfenster@raklaw.com
 3 Reza Mirzaie (CA SBN 246953)
 Email: rmirzaie@raklaw.com
 4 Brian D. Ledahl (CA SBN 186579)
 Email: bledahl@raklaw.com
 5 C. Jay Chung (CA SBN 252794)
 Email: jchung@raklaw.com
 6 Philip X. Wang (CA SBN 262239)
 Email: pwang@raklaw.com
 7 Timothy T. Hsieh (CA SBN 255953)
 8 Email: thsieh@raklaw.com
 12424 Wilshire Boulevard, 12th Floor
 9 Los Angeles, California 90025
 10 Telephone: (310) 826-7474
 Facsimile: (310) 826-6991

11 *Attorneys for Plaintiff*
 12 *REALTIME ADAPTIVE STREAMING LLC*

13 **UNITED STATES DISTRICT COURT**
 14 **CENTRAL DISTRICT OF CALIFORNIA**
 15 **WESTERN DIVISION**

16 REALTIME ADAPTIVE STREAMING LLC,
 17 Plaintiff,
 18 vs.
 19 HULU, LLC,
 20 Defendant.

Case No. 2:17-cv-07611

JURY TRIAL DEMANDED

22 **FIRST AMENDED COMPLAINT FOR PATENT INFRINGEMENT**

23 This is an action for patent infringement arising under the Patent Laws of the United States of
 24 America, 35 U.S.C. § 1 *et seq.* in which Plaintiff Realtime Adaptive Streaming LLC (“Plaintiff” or
 25 “Realtime”) makes the following allegations against Defendant Hulu, LLC (“Defendant” or “Hulu”).

26 **NATURE OF THE CASE**

27 1. This action arises under 35 U.S.C. § 271 for Hulu’s infringement of Realtime’s
 28 United States Patent Nos. 8,934,535 (“the ’535 patent”), 9,769,477 (“the ’477 patent”), 9,762,907

1 (“the ’907 patent”), 7,386,046 (“the ’046 patent”), 8,867,610 (“the ’610 patent”), 8,634,462 (“the
2 ’462 patent”), and 9,578,298 (“the ’298 patent”) (collectively, the “Patents-In-Suit”).

3 **PARTIES**

4 2. Realtime is a Texas limited liability company. Realtime has a place of business at
5 1828 E.S.E. Loop 323, Tyler, Texas 75701. Realtime has researched and developed specific
6 solutions for data compression, including, for example, those that increase the speeds at which data
7 can be stored and accessed. As recognition of its innovations rooted in this technological field,
8 Realtime holds multiple United States patents and pending patent applications.

9 3. Defendant Hulu is a Delaware limited liability company, with its principal place of
10 business at 2500 Broadway, 2nd Floor, Santa Monica, California 90404. Hulu may be served with
11 process by serving its registered agent, C T Corporation System, 818 West Seventh Street, Suite 930,
12 Los Angeles, California 90017.

13 4. Hulu has a regular and established place of business in this District, including, e.g.,
14 distribution facilities, employees, and other business. For example, Hulu’s principal place of
15 business at 2500 Broadway, 2nd Floor, Santa Monica, California 90404 is clearly in this District.

16 **JURISDICTION AND VENUE**

17 5. This action arises under the patent laws of the United States, Title 35 of the United
18 States Code. This Court has original subject matter jurisdiction pursuant to 28 U.S.C. §§ 1331 and
19 1338(a).

20 6. This Court has personal jurisdiction over Hulu in this action because, among other
21 things: Hulu has its principal place of business in this District; Hulu has committed, aided, abetted,
22 contributed to and/or participated in the commission of acts giving rise to this action within the State
23 of California and this District and has established minimum contacts with this forum such that the
24 exercise of jurisdiction over Hulu would not offend traditional notions of fair play and substantial
25 justice; Hulu has placed products and services that practice the claims of the Patents-in-Suit into the
26 stream of commerce with the reasonable expectation and/or knowledge that actual or potential users
27 of such products and/or services were located within this District; and Hulu has sold, advertised,
28 solicited customers, marketed and distributed its services that practice the claims of the Patents-in-

1 Suit in this District.

2 **THE PATENTS-IN-SUIT**

3 7. Realtime incorporates by reference the preceding paragraphs as if fully set forth
4 herein.

5 8. The '535 patent, titled "Systems and methods for video and audio data storage and
6 distribution," was duly and properly issued by the United States Patent and Trademark Office
7 ("USPTO") on January 13, 2015. A copy of the '535 patent is attached hereto as Exhibit A.
8 Realtime is the owner and assignee of the '535 patent and holds the right to sue for and recover all
9 damages for infringement thereof, including past infringement.

10 9. The '477 patent, titled "Video data compression systems," was duly and properly
11 issued by the USPTO on September 19, 2017. A copy of the '477 patent is attached hereto as
12 Exhibit B. Realtime is the owner and assignee of the '477 patent and holds the right to sue for and
13 recover all damages for infringement thereof, including past infringement.

14 10. The '907 patent, titled "System and Methods for Video and Audio Data Distribution,"
15 was duly and properly issued by the USPTO on September 12, 2017. A copy of the '907 patent is
16 attached hereto as Exhibit C. Realtime is the owner and assignee of the '907 patent and holds the
17 right to sue for and recover all damages for infringement thereof, including past infringement.

18 11. The '046 patent, titled "Bandwidth Sensitive Data Compression and Decompression,"
19 was duly and properly issued by the USPTO on June 10, 2008. A copy of the '046 patent is attached
20 hereto as Exhibit D. Realtime is the owner and assignee of the '046 patent and holds the right to sue
21 for and recover all damages for infringement thereof, including past infringement.

22 12. The '610 patent, titled "System and Methods for Video and Audio Data Distribution,"
23 was duly and properly issued by the USPTO on October 21, 2014. A copy of the '610 patent is
24 attached hereto as Exhibit E. Realtime is the owner and assignee of the '610 patent and holds the
25 right to sue for and recover all damages for infringement thereof, including past infringement.

26 13. The '462 patent, titled "Quantization for Hybrid Video Coding," was duly and
27 properly used by the USPTO on January 21, 2014. A copy of the '462 patent is attached hereto as
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1 Exhibit F. Realtime is the owner and assignee of the '462 patent and holds the right to sue for and
2 recover all damages for infringement thereof, including past infringement.

3 14. The '298 patent, titled "Method for Decoding 2D-compatible Stereoscopic Video
4 Flows," was duly and properly issued by the USPTO on February 21, 2017. A copy of the '298
5 patent is attached hereto as Exhibit G. Realtime is the owner and assignee of the '298 patent and
6 holds the right to sue for and recover all damages for infringement thereof, including past
7 infringement.

8 **COUNT I**

9 **INFRINGEMENT OF U.S. PATENT NO. 8,934,535**

10 15. Plaintiff re-alleges and incorporates by reference the foregoing paragraphs, as if fully
11 set forth herein.

12 16. On information and belief, Hulu has made, used, offered for sale, sold and/or
13 imported into the United States Hulu products that infringe the '535 patent, and continues to do so.
14 By way of illustrative example, these infringing products include, without limitation, Hulu's
15 streaming products/services, such as, e.g., Hulu's streaming service, Hulu's video compression
16 media encoders, Hulu's ad products for brands including Hulu's Ad Selector, Hulu's Blockbuster,
17 Hulu's Branded Entertainment Selector, Hulu's Custom Integrated Commercial, Hulu's Interactive
18 Interstitial, Hulu's Interactive Interstitial Template (DR), Hulu's Masthead Brand Placement, Hulu's
19 Page Brand Placement, Hulu's Premium Slate, Hulu's Slate, Hulu's T-Commerce, Hulu's Video
20 Commercial, Hulu VR, Hulu's 4K video services, and all versions and variations thereof since the
21 issuance of the '535 patent ("Accused Instrumentalities").

22 17. For example, the Accused Instrumentalities utilize the H.264 video compression
23 standard, as can be seen by the below screenshot of Hulu's Video Commercial ad product for brands
24 (<https://www.hulu.com/advertising/ad-product/video-commercial/>):
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hulu FOR BRANDS

Video Commercial

The Video Commercial includes placement of your advertiser's video creative into any one of Hulu's standard long-form content commercial breaks.

Hulu manages the encoding, hosting, and streaming of the video ads/associated creative assets.

AVAILABLE ON

TIMELINE

5 business days traffic and testing lead-time from the receipt of the final asset

Specs

DELIVERABLES TO HULU

- Video Commercial – ProRes .MOV
- 3rd Party Tracking Tags (if applicable).
- Video: 1 x 1 trackers and click commands
- Max standard video commercial length is :60s

SIZE

- SD
- 720 x 480
 - 4:3 or 16:9 pixel aspect ratio
 - No black bars
 - 3:2 display aspect ratio is not accepted
 - No letterboxing or pillarboxing
 - Bitrate: Greater than 2mbps.
 - Main Profile @ Main Level (MP@ML)
 - 4:2:2 Color Space
- HD
- 1280 x 720 or 1920 x 1080 (16:9)
 - 1440 x 1080 (4:3)
 - No black bars
 - Constant Bitrate (CBR) 15-30 Mbps
 - Main Profile @ Main Level (MP@ML)
 - 4:2:2 Color Space

FILE FORMATS

- Quicktime movie (.mov)
- MPEG-4 (.mp4) format only

AUDIO

- 2 channels only
- PCM (preferred) or AAC codec
- 192 kbps minimum
- 16 or 24 bit only
- 48 kHz sample rate
- Audio is required

FRAME RATE

- 23.98, 25, or 29.97 based on native frame rate
- Remove any pull-down added for broadcast
- Constant frame rate only
- Please make content progressive using adaptive de-interlace with no frame blending.

CODEC

- Apple ProRes 422 HQ codec preferred
- **H.264** codec
- Interlaced video is not accepted


18. The Accused Instrumentalities also accept the usage of the H.264 video compression standard. For example, on the page for Hulu’s Custom Integrated Commercial ad product (<https://www.hulu.com/advertising/ad-product/custom-integrated-commercial/>), under header “Specs” and sub-header “Codec” is listed the text “H.264 codec is accepted.”:

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hulu FOR BRANDS

Custom Integrated Commercial

The Custom Integrated Commercial (or CIC) is a new advertising solution that strategically integrates and aligns your brand's values and message with Hulu's in a custom developed and produced commercial that feels like content.



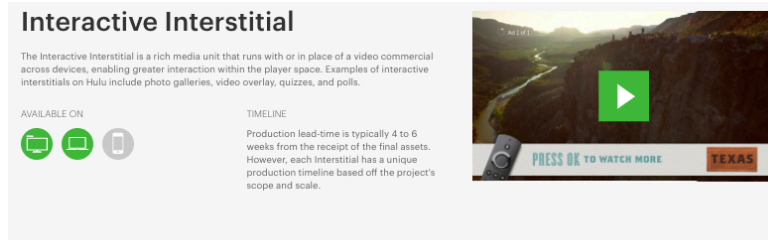
Specs

DELIVERABLES TO HULU	SIZE	FILE FORMATS
<p>While Hulu is able to work with a great variety of assets in the creation of a Custom Integrated Commercial (or "CIC"), the preferred formats, where appropriate and available, include:</p> <ul style="list-style-type: none"> • Apple ProRes 422 (HQ) video files • Accompanying audio, split-track (if available) • Vector brand logos in .eps or .ai format (if available) • Brand style guides • Brand font • For motion graphics assets, AE project files with associated media (if available) 	<ul style="list-style-type: none"> • 1280 x 720 or 1920 x 1080 (16:9) • 1440 x 1080 (4:3) • No black bars • Constant Bitrate (CBR) 15-30 Mbps • Main Profile @ Main Level (MP@ML) • 4:2:2 Color Space 	<ul style="list-style-type: none"> • Quicktime movie (.mov) • MPEG-4 (.mp4) format only
AUDIO	FRAME RATE	CODEC
<ul style="list-style-type: none"> • 2 channels only • Audio (HD/SD): 192 kbps minimum & PCM (preferred) or AAC codec • 16 or 24 bit only • 48 kHz sample rate • Audio is required 	<ul style="list-style-type: none"> • 23.98, 25, or 29.97 based on native frame rate • Remove any pull-down added for broadcast • Constant frame rate only • Please make content progressive using adaptive de-interlace with no frame blending. 	<ul style="list-style-type: none"> • Apple ProRes 422 HQ codec preferred • H.264 codec is accepted • Interlaced video is not accepted

19. Similarly, on the page for Hulu's Interactive Interstitial ad product (<https://www.hulu.com/advertising/ad-product/interactive-interstitial/>) under header "Specs" and sub-header "Video" is listed the text "H.264 codec is accepted, but bitrate must be at least 50 Mbps." Likewise, on the page for Hulu's Interactive Interstitial Template (DR) (<https://www.hulu.com/advertising/ad-product/interactive-interstitial-template-dr/>) , the same text "H.264 codec is accepted, but bitrate must be at least 50 Mbps" is listed under header "Specs" and

1 sub-header “Video.” In addition, on the page for Hulu’s Premium Slate ad product
 2 (<https://www.hulu.com/advertising/ad-product/premium-slate/>) the text “(H.264 codec is accepted,
 3 but bitrate must be at least 50 Mbps)” is listed under header “Specs” and sub-header “Codec.”

4 Representative screenshots are shown below:



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Specs

DELIVERABLES TO HULU

- Product Images (if applicable)
- Audio (background audio must be heard throughout entire unit)
- Brand logo (Vector .AI or .EPS preferred, .PSD accepted)
- Copy & calls-to-action (if applicable)
- Third-party tags
- Click-thru URLs

LEAN-BACK / LEAN-FORWARD

Lean-back experience
 Will time out if the user does not interact with the unit. Will include the standard Hulu ad countdown bar in the top 35 pixels of the player window.
 Click through to another site from within the Interstitial will open a new browser window.

Lean-forward experience
 If interaction options are available within the unit, a “Return to Video” option will appear if a user decides to click somewhere within the unit allowing them to return to the content experience whenever they are ready (this prevents a user from voluntarily becoming engaged and the user getting “kicked out” at the end of the experience).

VIDEO

- If client is providing uncompressed video:
- 23.98 or 29.97
 - Constant frame rate only
 - Apple ProRes 422 HQ codec preferred
 - Audio (HD/SD): PCM (preferred) or AAC codec & 192 kbps minimum
 - **H.264** codec is accepted, but bitrate must be at least 50 Mbps
 - Interlaced video is not accepted
 - Constant Bitrate (CBR) 15-30 Mbps
 - Main Profile @ Main Level (MP@ML)
 - 4:2:0 Color Space
 - Please make content progressive.
 - Video must be submitted without leaders (i.e. slates, countdowns).
 - If assets are delivered with leaders, Hulu will edit them and a Production Fee will be added to the final invoice.

Interactive Interstitial Template (DR)

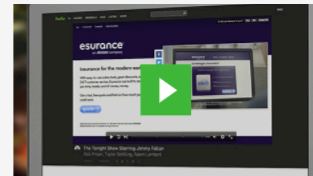
Our Direct Response Interactive Interstitial template is a rich-media unit that runs with a traditional video ad, and delivers greater viewer interaction within the player space. The unit offers several customizable elements including body copy, CTA button text and color, background color, and optional social icons. Because production for this unit is faster than for our classic Interactive Interstitial unit, it’s perfect for last-minute campaigns, specific DR messaging for each region and a great countermeasure against ad fatigue.

AVAILABLE ON



TIMELINE

Production lead-time from the receipt of the final asset is 10 business days.



Specs

DELIVERABLES TO HULU

- Brand logo (Vector .AI or .EPS preferred, .PSD accepted)
- Social media urls (click-trackers accepted)
- Click-thru URL for Video
- Click-thru URL for Logo
- Click-thru URL for CTA Button
- Copy for the body of the unit
- CTA copy for button
- Time when video should start shrinking
- Solid Background: HEX color code for the top portion of the unit, HEX color code for the bottom portion of the unit and HEX color code for the button
- Background Image: Please reference template for specs

SIZE

1184x666

VIDEO

- If client is providing uncompressed video:
- 23.98 or 29.97
 - Constant frame rate only
 - Apple ProRes 422 HQ codec preferred
 - Audio (HD/SD): PCM (preferred) or AAC codec & 192 kbps minimum
 - **H.264** codec is accepted, but bitrate must be at least 50 Mbps
 - Interlaced video is not accepted
 - Constant Bitrate (CBR) 15-30 Mbps
 - Main Profile @ Main Level (MP@ML)
 - 4:2:0 Color Space
 - Please make content progressive.
 - Video must be submitted without leaders (i.e. slates, countdowns).
 - If assets are delivered with leaders, Hulu will edit them and a Production Fee will be added to the final invoice.

Premium Slate

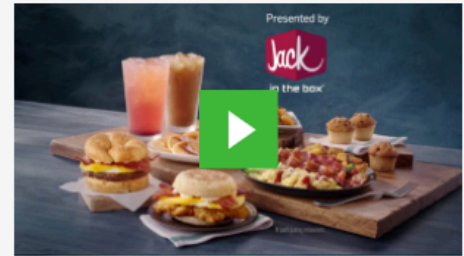
A Premium Slate is a branded :07 video introduction that appears before the advertiser's video commercial at the beginning of the show. Advertisers can create custom videos or leverage existing video creative. The video execution is accompanied by the standard intro text and "presented by" voice over.

AVAILABLE ON



TIMELINE

10 business days production lead-time from the receipt of the final asset



Specs

DELIVERABLES TO HULU

• Required video clip can either be created by Hulu using your :15 or :30 video or the brand can create a custom video clip.

• 3rd Party Tracking Tags (if applicable)

FILE FORMATS

Video Option:

- Quicktime Movie (.mov) or MPEG-4 (.mp4) format only

Static Image Option:

- Any full screen image in PSD format

SIZE

SD

- 720 x 480
- 4:3 or 16:9 pixel aspect ratio
- No black bars
- 3:2 display aspect ratio is not accepted
- No letterboxing or pillarboxing
- Bitrate: Greater than 2mbps.
- Main Profile @ Main Level (MP@ML)
- 4:2:2 Color Space

HD

- 1280 x 720 or 1920 x 1080 (16:9)
- 1440 x 1080 (4:3)
- No black bars
- Constant Bitrate (CBR) 15-30 Mbps
- Main Profile @ Main Level (MP@ML)
- 4:2:2 Color Space

MAX FILE SIZE

10 GB

CODEC

- Apple ProRes 422 HQ codec preferred
- H.264 codec is accepted, but bitrate must be at least 50 Mbps)
- Interlaced video is not accepted

LENGTH

:07 seconds exactly

20. The Accused Instrumentalities also use H.264 video compression to select and compress based on parameters such as bitrate, as explained by the website "How Stuff Works" (<http://computer.howstuffworks.com/internet/basics/hulu4.htm>):

"Hulu.com uses Cascading Style Sheets (CSS) and JavaScript to lay out its web pages, and it powers the video and controls through the Flash player and browser on your computer. When you request a video, Hulu sends it to you it as a Flash format streaming video file (FLV) along with the video player and the sponsors' advertisements.

Hulu encodes the video file for one of two types of video encoding devices (known as codecs) that translates streaming data into the moving images on your screen and the sound in your speakers. Hulu sends the file to you at one of **five speeds, or bitrates, measured as the amount of data sent per second**. When you play a video, the codec Hulu uses depends on the bitrate at which it's sending the video to you.

The site uses the On2 Flash VP6 codec for video streams that run at bitrates of 480 kilobits per second (Kbps) and 700 Kbps. This codec is supported by Flash versions 8.0 and higher, which is installed in more than 98 percent of

1 computers in the U.S. Hulu's higher bitrate streams of 1,000 Kbps and 2,500
2 Kbps use a codec that requires a bit more from your Internet connection. This
3 more intensive codec **follows the H.264 video coding standard**, which
4 requires Flash 9.0.124.0 or higher [source: Hulu].

5 How does all of this come together? While you're viewing most videos on
6 Hulu, **you control the bitrate** when you switch between two progressive scan
7 rates: 360p (standard resolution) or 480p (high resolution).

8 21. The Accused Instrumentalities determine a parameter of at least a portion of a video
9 data block. As shown below, examples of such parameters include bitrate (or max video bitrate) and
10 resolution parameters. Different parameters correspond with different end applications. H.264
11 provides for multiple different ranges of such parameters, each included in the “profiles” and
12 “levels” as defined by the H.264 standard, from the below shown paragraphs from a white paper and
13 Wikipedia. See http://www.axis.com/files/whitepaper/wp_h264_31669_en_0803_lo.pdf at 5:

14 **4. H.264 profiles and levels**

15 The joint group involved in defining H.264 focused on creating a simple and clean solution, limiting
16 options and features to a minimum. An important aspect of the standard, as with other video standards,
17 is providing the capabilities in profiles (sets of algorithmic features) and levels (performance classes)
18 that optimally support popular productions and common formats.

19 H.264 has seven profiles, each targeting a specific class of applications. Each profile defines what
20 feature set the encoder may use and limits the decoder implementation complexity.

21 Network cameras and video encoders will most likely use a profile called the baseline profile, which is
22 intended primarily for applications with limited computing resources. The baseline profile is the most
23 suitable given the available performance in a real-time encoder that is embedded in a network video
24 product. The profile also enables low latency, which is an important requirement of surveillance video and
25 also particularly important in enabling real-time, pan/tilt/zoom (PTZ) control in PTZ network cameras.

26 H.264 has 11 levels or degree of capability to limit performance, bandwidth and memory requirements.
27 Each level defines the bit rate and the encoding rate in macroblock per second for resolutions ranging
28 from QCIF to HDTV and beyond. The higher the resolution, the higher the level required.

See https://en.wikipedia.org/wiki/H.264/MPEG-4_AVC:

Levels with maximum property values

Level	Max decoding speed		Max frame size		Max video bit rate for video coding layer (VCL) kbit/s			Examples for high resolution @ highest frame rate (max stored frames) Toggle additional details
	Luma samples/s	Macroblocks/s	Luma samples	Macroblocks	Baseline, Extended and Main Profiles	High Profile	High 10 Profile	
1	380,160	1,485	25,344	99	64	80	192	176x144@15.0 (4)
1b	380,160	1,485	25,344	99	128	160	384	176x144@15.0 (4)
1.1	768,000	3,000	101,376	396	192	240	576	352x288@7.5 (2)
1.2	1,536,000	6,000	101,376	396	384	480	1,152	352x288@15.2 (6)
1.3	3,041,280	11,880	101,376	396	768	960	2,304	352x288@30.0 (6)
2	3,041,280	11,880	101,376	396	2,000	2,500	6,000	352x288@30.0 (6)
2.1	5,068,800	19,800	202,752	792	4,000	5,000	12,000	352x576@25.0 (6)
2.2	5,184,000	20,250	414,720	1,620	4,000	5,000	12,000	720x576@12.5 (5)
3	10,368,000	40,500	414,720	1,620	10,000	12,500	30,000	720x576@25.0 (5)
3.1	27,648,000	108,000	921,600	3,600	14,000	17,500	42,000	1,280x720@30.0 (5)
3.2	55,296,000	216,000	1,310,720	5,120	20,000	25,000	60,000	1,280x1,024@42.2 (4)
4	62,914,560	245,760	2,097,152	8,192	20,000	25,000	60,000	2,048x1,024@30.0 (4)
4.1	62,914,560	245,760	2,097,152	8,192	50,000	62,500	150,000	2,048x1,024@30.0 (4)
4.2	133,693,440	522,240	2,228,224	8,704	50,000	62,500	150,000	2,048x1,080@60.0 (4)
5	150,994,944	589,824	5,652,480	22,080	135,000	168,750	405,000	3,672x1,536@26.7 (5)
5.1	251,658,240	983,040	9,437,184	36,864	240,000	300,000	720,000	4,096x2,304@26.7 (5)
5.2	530,841,600	2,073,600	9,437,184	36,864	240,000	300,000	720,000	4,096x2,304@56.3 (5)

22. A video data block is organized by the group of pictures (GOP) structure, which is a “collection of successive pictures within a coded video stream.” See Wikipedia Article on Group of Pictures, https://en.wikipedia.org/wiki/Group_of_pictures. A GOP structure can contain intra coded pictures (I picture or I frame), predictive coded pictures (P picture or P frame), bipredictive coded pictures (B picture or B frame) and direct coded pictures (D picture or D frames, or DC direct coded pictures which are used only in MPEG-1 video). See Wikipedia Articles on Video Compression Types and MPEG-1, https://en.wikipedia.org/wiki/Video_compression_picture_types (for descriptions of I frames, P frames and B frames); <https://en.wikipedia.org/wiki/MPEG-1#D-frames> (for descriptions of D frames). Thus, at least a portion of a video data block would also make up a GOP structure and could also contain I frames, P frames, B frames and/or D frames. The GOP structure also reflects the size of a video data block, and the GOP structure can be controlled and used to fine-tune other parameters (e.g. bitrate, max video bitrate and resolution parameters) or even be considered as a parameter by itself.

23. Based on the bitrate and/or resolution parameter identified (e.g. bitrate, max video bitrate, resolution, GOP structure or frame type within a GOP structure), any H.264-compliant

1 system such as the Accused Instrumentalities would determine which profile (e.g., “baseline,”
 2 “extended,” “main”, or “high”) corresponds with that parameter, then select between at least two
 3 asymmetric compressors. If baseline or extended is the corresponding profile, then the system will
 4 select a Context-Adaptive Variable Length Coding (“CAVLC”) entropy encoder. If main or high is
 5 the corresponding profile, then the system will select a Context-Adaptive Binary Arithmetic Coding
 6 (“CABAC”) entropy encoder. Both encoders are asymmetric compressors because it takes a longer
 7 period of time for them to compress data than to decompress data. *See*

8 <https://sonnati.wordpress.com/2007/10/29/how-h-264-works-part-ii/>:

	Baseline	Extended	Main	High	High 10
I and P Slices	Yes	Yes	Yes	Yes	Yes
B Slices	No	Yes	Yes	Yes	Yes
SI and SP Slices	No	Yes	No	No	No
Multiple Reference Frames	Yes	Yes	Yes	Yes	Yes
In-Loop Deblocking Filter	Yes	Yes	Yes	Yes	Yes
CAVLC Entropy Coding	Yes	Yes	Yes	Yes	Yes
CABAC Entropy Coding	No	No	Yes	Yes	Yes
Flexible Macroblock Ordering (FMO)	Yes	Yes	No	No	No
Arbitrary Slice Ordering (ASO)	Yes	Yes	No	No	No
Redundant Slices (RS)	Yes	Yes	No	No	No
Data Partitioning	No	Yes	No	No	No
Interlaced Coding (PicAFF, MBAFF)	No	Yes	Yes	Yes	Yes
4:2:0 Chroma Format	Yes	Yes	Yes	Yes	Yes
Monochrome Video Format (4:0:0)	No	No	No	Yes	Yes
4:2:2 Chroma Format	No	No	No	No	No
4:4:4 Chroma Format	No	No	No	No	No
8 Bit Sample Depth	Yes	Yes	Yes	Yes	Yes
9 and 10 Bit Sample Depth	No	No	No	No	Yes
11 to 14 Bit Sample Depth	No	No	No	No	No
8x8 vs. 4x4 Transform Adaptivity	No	No	No	Yes	Yes
Quantization Scaling Matrices	No	No	No	Yes	Yes
Separate Cb and Cr QP control	No	No	No	Yes	Yes
Separate Color Plane Coding	No	No	No	No	No
Predictive Lossless Coding	No	No	No	No	No

1 See http://web.cs.ucla.edu/classes/fall03/cs218/paper/H.264_MPEG4_Tutorial.pdf at 7:

2 The following table summarizes the two major types of entropy coding: Variable Length
3 Coding (VLC) and Context Adaptive Binary Arithmetic Coding (CABAC). CABAC offers
4 superior coding efficiency over VLC by adapting to the changing probability distribution
5 of symbols, by exploiting correlation between symbols, and by adaptively exploiting bit
6 correlations using arithmetic coding. H.264 also supports Context Adaptive Variable Length
7 Coding (CAVLC) which offers superior entropy coding over VLC without the full cost of
8 CABAC.

9 H.264 Entropy Coding – Comparison of Approaches

10 Characteristics	11 Variable Length Coding (VLC)	12 Context Adaptive Binary Arithmetic Coding (CABAC)
13 • Where it is used	MPEG-2, MPEG-4 ASP	H.264/MPEG-4 AVC (high efficiency option)
14 • Probability distribution	Static - Probabilities never change	Adaptive - Adjusts probabilities based on actual data
15 • Leverages correlation between symbols	No - Conditional probabilities ignored	Yes - Exploits symbol correlations by using "contexts"
16 • Non-integer code words	No - Low coding efficiency for high probability symbols	Yes - Exploits "arithmetic coding" which generates non-integer code words for higher efficiency

17 Moreover, the H.264 Standard requires a bit-flag descriptor, which is set to determine the
18 correct decoder for the corresponding encoder. As shown below, if the flag = 0, then CAVLC must
19 have been selected as the encoder; if the flag = 1, then CABAC must have been selected as the
20 encoder. See https://www.itu.int/rec/dologin_pub.asp?lang=e&id=T-REC-H.264-201304-S!!PDF-E&type=items (Rec. ITU-T H.264 (04/2013)) at 80:

21 **entropy_coding_mode_flag** selects the entropy decoding method to be applied for the syntax elements for which two
22 descriptors appear in the syntax tables as follows:

- 23 – If **entropy_coding_mode_flag** is equal to 0, the method specified by the left descriptor in the syntax table is applied (Exp-Golomb coded, see clause 9.1 or CAVLC, see clause 9.2).
- 24 – Otherwise (**entropy_coding_mode_flag** is equal to 1), the method specified by the right descriptor in the syntax table is applied (CABAC, see clause 9.3).

25 24. The Accused Instrumentalities compress the at least the portion of the data block with
26 the selected one or more asymmetric compressors to provide one or more compressed data blocks,
27 which can be organized in a GOP structure (see above). After its selection, the asymmetric
28 compressor (CAVLC or CABAC) will compress the video data to provide various compressed data
blocks, which can also be organized in a GOP structure, as discussed previously above. See
<https://sonnati.wordpress.com/2007/10/29/how-h-264-works-part-ii/>:

Entropy Coding

For entropy coding, H.264 may use an enhanced VLC, a more complex context-adaptive variable-length coding (CAVLC) or an ever more complex Context-adaptive binary-arithmetic coding (CABAC) which are complex techniques to losslessly compress syntax elements in the video stream knowing the probabilities of syntax elements in a given context. The use of CABAC can improve the compression of around 5-7%. CABAC may requires a 30-40% of total processing power to be accomplished.

See <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.602.1581&rep=rep1&type=pdf> at 13:

Typical compression ratios to maintain excellent quality are:

- 10:1 for general images using JPEG
- 30:1 for general video using H.263 and MPEG-2
- 60:1 for general video using H.264 and WMV9

See http://www.ijera.com/papers/Vol3_issue4/BM34399403.pdf at 2:

Most visual communication systems today use Baseline Profile. Baseline is the simplest H.264 profile and defines, for example, zigzag scanning of the picture and using 4:2:0 (YUV video formats) chrominance sampling. In Baseline Profile, the picture is split in blocks consisting of 4x4 pixels, and each block is processed separately. Another important element of the Baseline Profile is the use of Universal Variable Length Coding (UVLC) and Context Adaptive Variable Length Coding (CAVLC) entropy coding techniques.

The Extended and Main Profiles includes the functionality of the Baseline Profile and add improvements to the predictions algorithms. Since transmitting every single frame (think 30 frames per second for good quality video) is not feasible if you are trying to reduce the bit rate 1000-2000 times, temporal and motion prediction are heavily used in H.264, and allow transmitting only the difference between one frame and the previous frames. The result is spectacular efficiency gain, especially for scenes with little change and motion.

The High Profile is the most powerful profile in H.264, and it allows most efficient coding of video. For example, large coding gain achieved through the use of Context Adaptive Binary Arithmetic Coding (CABAC) encoding which is more efficient than the UVLC/CAVLC used in Baseline Profile.

The High Profile also uses adaptive transform that decides on the fly if 4x4 or 8x8-pixel blocks should be used. For example, 4x4 blocks are used for the parts of the picture that are dense with detail, while parts that have little detail are transformed using 8x8 blocks.

1 25. Therefore, on information and belief, Hulu has directly infringed and continues to
2 infringe the '535 patent, for example, through its own use and testing of the Accused
3 Instrumentalities, which when used, practices the method claimed by Claim 15 of the '535 patent,
4 namely, a method, comprising: determining a parameter of at least a portion of a data block;
5 selecting one or more asymmetric compressors from among a plurality of compressors based upon
6 the determined parameter or attribute; compressing the at least the portion of the data block with the
7 selected one or more asymmetric compressors to provide one or more compressed data blocks; and
8 storing at least a portion of the one or more compressed data blocks. Upon information and belief,
9 Hulu uses the Accused Instrumentalities to practice infringing methods for its own internal non-
10 testing business purposes, while testing the Accused Instrumentalities, and while providing technical
11 support and repair services for the Accused Instrumentalities to Hulu's customers.

12 26. On information and belief, the Accused Instrumentalities store at least a portion of the
13 one or more compressed data blocks in buffers, hard disk, or other forms of memory/storage.

14 27. On information and belief, Hulu also directly infringes and continues to infringe other
15 claims of the '535 patent, for similar reasons as explained above with respect to Claim 15 of the '535
16 patent.

17 28. On information and belief, all of the Accused Instrumentalities perform the claimed
18 methods in substantially the same way, e.g., in the manner specified in the H.264 standard.

19 29. On information and belief, use of the Accused Instrumentalities in their ordinary and
20 customary fashion results in infringement of the methods claimed by the '535 patent.

21 30. On information and belief, Hulu has had knowledge of the '535 patent since at least
22 the filing of this Complaint or shortly thereafter, and on information and belief, Hulu knew of
23 the '535 patent and knew of its infringement, including by way of this lawsuit. By the time of trial,
24 Hulu will have known and intended (since receiving such notice) that its continued actions would
25 actively induce and contribute to the infringement of the claims of the '535 patent.

26 31. Upon information and belief, Hulu's affirmative acts of making, using, and selling the
27 Accused Instrumentalities, and providing implementation services and technical support to users of
28 the Accused Instrumentalities, including, e.g., through training, demonstrations, brochures,

1 installation and user guides, have induced (at least since filing of this action) and continue to induce
2 users of the Accused Instrumentalities to use them in their normal and customary way to infringe
3 the '535 patent by practicing a method, comprising: determining a parameter of at least a portion of a
4 data block; selecting one or more asymmetric compressors from among a plurality of compressors
5 based upon the determined parameter or attribute; compressing the at least the portion of the data
6 block with the selected one or more asymmetric compressors to provide one or more compressed
7 data blocks; and storing at least a portion of the one or more compressed data blocks. For example,
8 Hulu adopted H.264 as its video codec in its streaming products/services, such as, e.g., Hulu's
9 streaming service, Hulu's video compression media encoders, and Hulu's ad products for brands.
10 For similar reasons, Hulu also induces its customers to use the Accused Instrumentalities to infringe
11 other claims of the '535 patent. Hulu specifically intended and was aware that these normal and
12 customary activities would infringe the '535 patent. Hulu performed the acts that constitute induced
13 infringement, and would induce actual infringement, with the knowledge of the '535 patent and with
14 the knowledge, or willful blindness to the probability, that the induced acts would constitute
15 infringement. On information and belief, Hulu engaged in such inducement to promote the sales of
16 the Accused Instrumentalities. Accordingly, Hulu has induced (at least since filing of this action)
17 and continues to induce users of the Accused Instrumentalities to use the Accused Instrumentalities
18 in their ordinary and customary way to infringe the '535 patent, knowing that such use constitutes
19 infringement of the '535 patent. Accordingly, Hulu has been (at least since filing of this action), and
20 currently is, inducing infringement of the '535 patent, in violation of 35 U.S.C. § 271(b).

21 32. Hulu has also infringed, and continues to infringe, claims of the '535 patent by
22 offering to commercially distribute, commercially distributing, making, and/or importing the
23 Accused Instrumentalities, which are used in practicing the process, or using the systems, of the '535
24 patent, and constitute a material part of the invention. Hulu knows the components in the Accused
25 Instrumentalities to be especially made or especially adapted for use in infringement of the '535
26 patent, not a staple article, and not a commodity of commerce suitable for substantial noninfringing
27 use. Accordingly, Hulu has been (at least since filing of this action), and currently is, contributorily
28 infringing the '535 patent, in violation of 35 U.S.C. § 271(c).

1 33. By making, using, offering for sale, selling and/or importing into the United States
2 the Accused Instrumentalities, and touting the benefits of using the Accused Instrumentalities’
3 compression features, Hulu has injured Realtime and is liable to Realtime for infringement of
4 the ’535 patent pursuant to 35 U.S.C. § 271.

5 34. As a result of Hulu’s infringement of the ’535 patent, Plaintiff Realtime is entitled to
6 monetary damages in an amount adequate to compensate for Hulu’s infringement, but in no event
7 less than a reasonable royalty for the use made of the invention by Hulu, together with interest and
8 costs as fixed by the Court.

9 **COUNT II**

10 **INFRINGEMENT OF U.S. PATENT NO. 9,769,477**

11 35. Plaintiff re-alleges and incorporates by reference the foregoing paragraphs, as if fully
12 set forth herein.

13 36. On information and belief, Hulu has made, used, offered for sale, sold and/or
14 imported into the United States Hulu products that infringe the ’477 patent, and continues to do so.
15 By way of illustrative example, these infringing products include, without limitation, Hulu’s
16 streaming products/services, such as, e.g., Hulu’s streaming service, Hulu’s video compression
17 media encoders, Hulu’s ad products for brands including Hulu’s Ad Selector, Hulu’s Blockbuster,
18 Hulu’s Branded Entertainment Selector, Hulu’s Custom Integrated Commercial, Hulu’s Interactive
19 Interstitial, Hulu’s Interactive Interstitial Template (DR), Hulu’s Masthead Brand Placement, Hulu’s
20 Page Brand Placement, Hulu’s Premium Slate, Hulu’s Slate, Hulu’s T-Commerce, Hulu’s Video
21 Commercial, Hulu VR, Hulu’s 4K video services, and all versions and variations thereof since the
22 issuance of the ’477 patent (“Accused Instrumentalities”).

23 37. For example, the Accused Instrumentalities utilize the H.264 video compression
24 standard, as can be seen by the below screenshot of Hulu’s Video Commercial ad product for brands
25 (<https://www.hulu.com/advertising/ad-product/video-commercial/>):
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hulu FOR BRANDS

Video Commercial

The Video Commercial includes placement of your advertiser's video creative into any one of Hulu's standard long-form content commercial breaks.

Hulu manages the encoding, hosting, and streaming of the video ads/associated creative assets.

AVAILABLE ON

TIMELINE

5 business days traffic and testing lead-time from the receipt of the final asset

Specs

DELIVERABLES TO HULU

- Video Commercial – ProRes .MOV
- 3rd Party Tracking Tags (if applicable).
- Video: 1 x 1 trackers and click commands
- Max standard video commercial length is :60s

SIZE

- SD
- 720 x 480
 - 4:3 or 16:9 pixel aspect ratio
 - No black bars
 - 3:2 display aspect ratio is not accepted
 - No letterboxing or pillarboxing
 - Bitrate: Greater than 2mbps.
 - Main Profile @ Main Level (MP@ML)
 - 4:2:2 Color Space
- HD
- 1280 x 720 or 1920 x 1080 (16:9)
 - 1440 x 1080 (4:3)
 - No black bars
 - Constant Bitrate (CBR) 15-30 Mbps
 - Main Profile @ Main Level (MP@ML)
 - 4:2:2 Color Space

FILE FORMATS

- Quicktime movie (.mov)
- MPEG-4 (.mp4) format only

AUDIO

- 2 channels only
- PCM (preferred) or AAC codec
- 192 kbps minimum
- 16 or 24 bit only
- 48 kHz sample rate
- Audio is required

FRAME RATE

- 23.98, 25, or 29.97 based on native frame rate
- Remove any pull-down added for broadcast
- Constant frame rate only
- Please make content progressive using adaptive de-interlace with no frame blending.

CODEC

- Apple ProRes 422 HQ codec preferred
- H.264** codec
- Interlaced video is not accepted

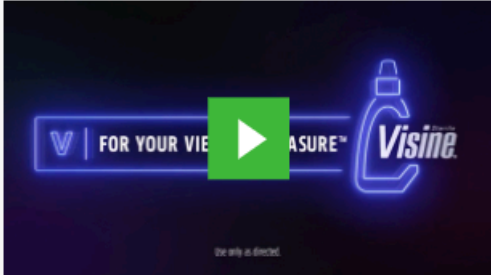
38. The Accused Instrumentalities also accept the usage of the H.264 video compression standard. For example, on the page for Hulu’s Custom Integrated Commercial ad product (<https://www.hulu.com/advertising/ad-product/custom-integrated-commercial/>), under header “Specs” and sub-header “Codec” is listed the text “H.264 codec is accepted.”:

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hulu FOR BRANDS

Custom Integrated Commercial

The Custom Integrated Commercial (or CIC) is a new advertising solution that strategically integrates and aligns your brand's values and message with Hulu's in a custom developed and produced commercial that feels like content.



Specs

DELIVERABLES TO HULU

While Hulu is able to work with a great variety of assets in the creation of a Custom Integrated Commercial (or "CIC"), the preferred formats, where appropriate and available, include:

- Apple ProRes 422 (HQ) video files
- Accompanying audio, split-track (if available)
- Vector brand logos in .eps or .ai format (if available)
- Brand style guides
- Brand font
- For motion graphics assets, AE project files with associated media (if available)

SIZE

- 1280 x 720 or 1920 x 1080 (16:9)
- 1440 x 1080 (4:3)
- No black bars
- Constant Bitrate (CBR) 15-30 Mbps
- Main Profile @ Main Level (MP@ML)
- 4:2:2 Color Space

FILE FORMATS

- Quicktime movie (.mov)
- MPEG-4 (.mp4) format only

AUDIO

- 2 channels only
- Audio (HD/SD): 192 kbps minimum & PCM (preferred) or AAC codec
- 16 or 24 bit only
- 48 kHz sample rate
- Audio is required

FRAME RATE

- 23.98, 25, or 29.97 based on native frame rate
- Remove any pull-down added for broadcast
- Constant frame rate only
- Please make content progressive using adaptive de-interlace with no frame blending.

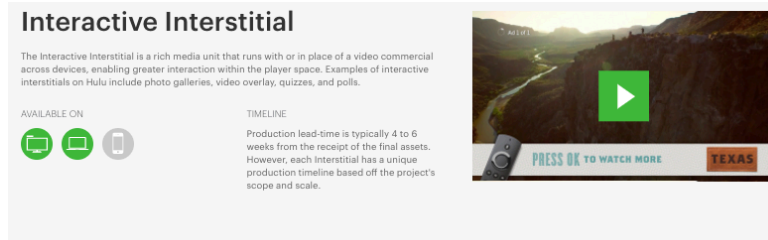
CODEC

- Apple ProRes 422 HQ codec preferred
- H.264 codec is accepted
- Interlaced video is not accepted

39. Similarly, on the page for Hulu's Interactive Interstitial ad product (<https://www.hulu.com/advertising/ad-product/interactive-interstitial/>) under header "Specs" and sub-header "Video" is listed the text "H.264 codec is accepted, but bitrate must be at least 50 Mbps." Likewise, on the page for Hulu's Interactive Interstitial Template (DR) (<https://www.hulu.com/advertising/ad-product/interactive-interstitial-template-dr/>), the same text "H.264 codec is accepted, but bitrate must be at least 50 Mbps" is listed under header "Specs" and

1 sub-header “Video.” In addition, on the page for Hulu’s Premium Slate ad product
 2 (<https://www.hulu.com/advertising/ad-product/premium-slate/>) the text “(H.264 codec is accepted,
 3 but bitrate must be at least 50 Mbps)” is listed under header “Specs” and sub-header “Codec.”

4 Representative screenshots are shown below:



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Specs

DELIVERABLES TO HULU

- Product Images (if applicable)
- Audio (background audio must be heard throughout entire unit)
- Brand logo (Vector .AI or .EPS preferred, .PSD accepted)
- Copy & calls-to-action (if applicable)
- Third-party tags
- Click-thru URLs

LEAN-BACK / LEAN-FORWARD

Lean-back experience
 Will time out if the user does not interact with the unit. Will include the standard Hulu ad countdown bar in the top 35 pixels of the player window.
 Click through to another site from within the Interstitial will open a new browser window.

Lean-forward experience
 If interaction options are available within the unit, a “Return to Video” option will appear if a user decides to click somewhere within the unit allowing them to return to the content experience whenever they are ready (this prevents a user from voluntarily becoming engaged and the user getting “kicked out” at the end of the experience).

VIDEO

- If client is providing uncompressed video:
- 23.98 or 29.97
 - Constant frame rate only
 - Apple ProRes 422 HQ codec preferred
 - Audio (HD/SD): PCM (preferred) or AAC codec & 192 kbps minimum
 - **H.264** codec is accepted, but bitrate must be at least 50 Mbps
 - Interlaced video is not accepted
 - Constant Bitrate (CBR) 15-30 Mbps
 - Main Profile @ Main Level (MP@ML)
 - 4:2:0 Color Space
 - Please make content progressive.
 - Video must be submitted without leaders (i.e. slates, countdowns).
 - If assets are delivered with leaders, Hulu will edit them and a Production Fee will be added to the final invoice.

Interactive Interstitial Template (DR)

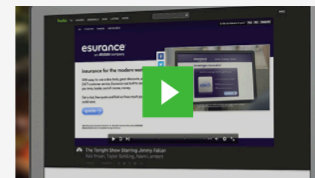
Our Direct Response Interactive Interstitial template is a rich-media unit that runs with a traditional video ad, and delivers greater viewer interaction within the player space. The unit offers several customizable elements including body copy, CTA button text and color, background color, and optional social icons. Because production for this unit is faster than for our classic Interactive Interstitial unit, it’s perfect for last-minute campaigns, specific DR messaging for each region and a great countermeasure against ad fatigue.

AVAILABLE ON



TIMELINE

Production lead-time from the receipt of the final asset is 10 business days.



Specs

DELIVERABLES TO HULU

- Brand logo (Vector .AI or .EPS preferred, .PSD accepted)
- Social media urls (click-trackers accepted)
- Click-thru URL for Video
- Click-thru URL for Logo
- Click-thru URL for CTA Button
- Copy for the body of the unit
- CTA copy for button
- Time when video should start shrinking
- Solid Background: HEX color code for the top portion of the unit, HEX color code for the bottom portion of the unit and HEX color code for the button
- Background Image: Please reference template for specs

SIZE

1184x666

VIDEO

- If client is providing uncompressed video:
- 23.98 or 29.97
 - Constant frame rate only
 - Apple ProRes 422 HQ codec preferred
 - Audio (HD/SD): PCM (preferred) or AAC codec & 192 kbps minimum
 - **H.264** codec is accepted, but bitrate must be at least 50 Mbps
 - Interlaced video is not accepted
 - Constant Bitrate (CBR) 15-30 Mbps
 - Main Profile @ Main Level (MP@ML)
 - 4:2:0 Color Space
 - Please make content progressive.
 - Video must be submitted without leaders (i.e. slates, countdowns).
 - If assets are delivered with leaders, Hulu will edit them and a Production Fee will be added to the final invoice.

Premium Slate

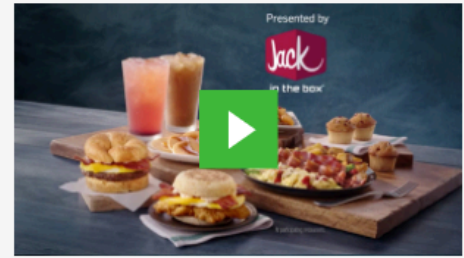
A Premium Slate is a branded :07 video introduction that appears before the advertiser's video commercial at the beginning of the show. Advertisers can create custom videos or leverage existing video creative. The video execution is accompanied by the standard intro text and "presented by" voice over.

AVAILABLE ON



TIMELINE

10 business days production lead-time from the receipt of the final asset



Specs

DELIVERABLES TO HULU

• Required video clip can either be created by Hulu using your :15 or :30 video or the brand can create a custom video clip.

• 3rd Party Tracking Tags (if applicable)

FILE FORMATS

Video Option:

- Quicktime Movie (.mov) or MPEG-4 (.mp4) format only

Static Image Option:

- Any full screen image in PSD format

SIZE

SD

- 720 x 480
- 4:3 or 16:9 pixel aspect ratio
- No black bars
- 3:2 display aspect ratio is not accepted
- No letterboxing or pillarboxing
- Bitrate: Greater than 2mbps.
- Main Profile @ Main Level (MP@ML)
- 4:2:2 Color Space

HD

- 1280 x 720 or 1920 x 1080 (16:9)
- 1440 x 1080 (4:3)
- No black bars
- Constant Bitrate (CBR) 15-30 Mbps
- Main Profile @ Main Level (MP@ML)
- 4:2:2 Color Space

MAX FILE SIZE

10 GB

CODEC

- Apple ProRes 422 HQ codec preferred
- H.264 codec is accepted, but bitrate must be at least 50 Mbps)
- Interlaced video is not accepted

LENGTH

:07 seconds exactly

40. The Accused Instrumentalities also use H.264 video compression to select and compress based on parameters such as bitrate, as explained by the website "How Stuff Works" (<http://computer.howstuffworks.com/internet/basics/hulu4.htm>):

"Hulu.com uses Cascading Style Sheets (CSS) and JavaScript to lay out its web pages, and it powers the video and controls through the Flash player and browser on your computer. When you request a video, Hulu sends it to you it as a Flash format streaming video file (FLV) along with the video player and the sponsors' advertisements.

Hulu encodes the video file for one of two types of video encoding devices (known as codecs) that translates streaming data into the moving images on your screen and the sound in your speakers. Hulu sends the file to you at one of **five speeds, or bitrates, measured as the amount of data sent per second**. When you play a video, the codec Hulu uses depends on the bitrate at which it's sending the video to you.

The site uses the On2 Flash VP6 codec for video streams that run at bitrates of 480 kilobits per second (Kbps) and 700 Kbps. This codec is supported by Flash versions 8.0 and higher, which is installed in more than 98 percent of

1 computers in the U.S. Hulu's higher bitrate streams of 1,000 Kbps and 2,500
 2 Kbps use a codec that requires a bit more from your Internet connection. This
 more intensive codec **follows the H.264 video coding standard**, which
 requires Flash 9.0.124.0 or higher [source: Hulu].

3 How does all of this come together? While you're viewing most videos on
 4 Hulu, **you control the bitrate** when you switch between two progressive scan
 rates: 360p (standard resolution) or 480p (high resolution).

5 41. The Accused Instrumentalities determine a parameter of at least a portion of a video
 6 data block. As shown below, examples of such parameters include bitrate (or max video bitrate) and
 7 resolution parameters. Different parameters correspond with different end applications. H.264
 8 provides for multiple different ranges of such parameters, each included in the “profiles” and
 9 “levels” as defined by the H.264 standard, from the below shown paragraphs from a white paper and
 10 Wikipedia. See http://www.axis.com/files/whitepaper/wp_h264_31669_en_0803_lo.pdf at 5:

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12 **4. H.264 profiles and levels**

13 The joint group involved in defining H.264 focused on creating a simple and clean solution, limiting
 14 options and features to a minimum. An important aspect of the standard, as with other video standards,
 is providing the capabilities in profiles (sets of algorithmic features) and levels (performance classes)
 that optimally support popular productions and common formats.

15 H.264 has seven profiles, each targeting a specific class of applications. Each profile defines what
 16 feature set the encoder may use and limits the decoder implementation complexity.

17 Network cameras and video encoders will most likely use a profile called the baseline profile, which is
 18 intended primarily for applications with limited computing resources. The baseline profile is the most
 suitable given the available performance in a real-time encoder that is embedded in a network video
 19 product. The profile also enables low latency, which is an important requirement of surveillance video and
 also particularly important in enabling real-time, pan/tilt/zoom (PTZ) control in PTZ network cameras.

20 H.264 has 11 levels or degree of capability to limit performance, bandwidth and memory requirements.
 21 Each level defines the bit rate and the encoding rate in macroblock per second for resolutions ranging
 from QCIF to HDTV and beyond. The higher the resolution, the higher the level required.

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 23 See https://en.wikipedia.org/wiki/H.264/MPEG-4_AVC:
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Levels with maximum property values

Level	Max decoding speed		Max frame size		Max video bit rate for video coding layer (VCL) kbit/s			Examples for high resolution @ highest frame rate (max stored frames) Toggle additional details
	Luma samples/s	Macroblocks/s	Luma samples	Macroblocks	Baseline, Extended and Main Profiles	High Profile	High 10 Profile	
1	380,160	1,485	25,344	99	64	80	192	176x144@15.0 (4)
1b	380,160	1,485	25,344	99	128	160	384	176x144@15.0 (4)
1.1	768,000	3,000	101,376	396	192	240	576	352x288@7.5 (2)
1.2	1,536,000	6,000	101,376	396	384	480	1,152	352x288@15.2 (6)
1.3	3,041,280	11,880	101,376	396	768	960	2,304	352x288@30.0 (6)
2	3,041,280	11,880	101,376	396	2,000	2,500	6,000	352x288@30.0 (6)
2.1	5,068,800	19,800	202,752	792	4,000	5,000	12,000	352x576@25.0 (6)
2.2	5,184,000	20,250	414,720	1,620	4,000	5,000	12,000	720x576@12.5 (5)
3	10,368,000	40,500	414,720	1,620	10,000	12,500	30,000	720x576@25.0 (5)
3.1	27,648,000	108,000	921,600	3,600	14,000	17,500	42,000	1,280x720@30.0 (5)
3.2	55,296,000	216,000	1,310,720	5,120	20,000	25,000	60,000	1,280x1,024@42.2 (4)
4	62,914,560	245,760	2,097,152	8,192	20,000	25,000	60,000	2,048x1,024@30.0 (4)
4.1	62,914,560	245,760	2,097,152	8,192	50,000	62,500	150,000	2,048x1,024@30.0 (4)
4.2	133,693,440	522,240	2,228,224	8,704	50,000	62,500	150,000	2,048x1,080@60.0 (4)
5	150,994,944	589,824	5,652,480	22,080	135,000	168,750	405,000	3,672x1,536@26.7 (5)
5.1	251,658,240	983,040	9,437,184	36,864	240,000	300,000	720,000	4,096x2,304@26.7 (5)
5.2	530,841,600	2,073,600	9,437,184	36,864	240,000	300,000	720,000	4,096x2,304@56.3 (5)

42. A video data block is organized by the group of pictures (GOP) structure, which is a “collection of successive pictures within a coded video stream.” See Wikipedia Article on Group of Pictures, https://en.wikipedia.org/wiki/Group_of_pictures. A GOP structure can contain intra coded pictures (I picture or I frame), predictive coded pictures (P picture or P frame), bipredictive coded pictures (B picture or B frame) and direct coded pictures (D picture or D frames, or DC direct coded pictures which are used only in MPEG-1 video). See Wikipedia Articles on Video Compression Types and MPEG-1, https://en.wikipedia.org/wiki/Video_compression_picture_types (for descriptions of I frames, P frames and B frames); <https://en.wikipedia.org/wiki/MPEG-1#D-frames> (for descriptions of D frames). Thus, at least a portion of a video data block would also make up a GOP structure and could also contain I frames, P frames, B frames and/or D frames. The GOP structure also reflects the size of a video data block, and the GOP structure can be controlled and used to fine-tune other parameters (e.g. bitrate, max video bitrate and resolution parameters) or even be considered as a parameter by itself.

43. Based on the bitrate and/or resolution parameter identified (e.g. bitrate, max video bitrate, resolution, GOP structure or frame type within a GOP structure), any H.264-compliant

1 system such as the Accused Instrumentalities would determine which profile (e.g., “baseline,”
 2 “extended,” “main”, or “high”) corresponds with that parameter, then select between at least two
 3 asymmetric compressors. If baseline or extended is the corresponding profile, then the system will
 4 select a Context-Adaptive Variable Length Coding (“CAVLC”) entropy encoder. If main or high is
 5 the corresponding profile, then the system will select a Context-Adaptive Binary Arithmetic Coding
 6 (“CABAC”) entropy encoder. Both encoders are asymmetric compressors because it takes a longer
 7 period of time for them to compress data than to decompress data. *See*

8 <https://sonnati.wordpress.com/2007/10/29/how-h-264-works-part-ii/>:

	Baseline	Extended	Main	High	High 10
I and P Slices	Yes	Yes	Yes	Yes	Yes
B Slices	No	Yes	Yes	Yes	Yes
SI and SP Slices	No	Yes	No	No	No
Multiple Reference Frames	Yes	Yes	Yes	Yes	Yes
In-Loop Deblocking Filter	Yes	Yes	Yes	Yes	Yes
CAVLC Entropy Coding	Yes	Yes	Yes	Yes	Yes
CABAC Entropy Coding	No	No	Yes	Yes	Yes
Flexible Macroblock Ordering (FMO)	Yes	Yes	No	No	No
Arbitrary Slice Ordering (ASO)	Yes	Yes	No	No	No
Redundant Slices (RS)	Yes	Yes	No	No	No
Data Partitioning	No	Yes	No	No	No
Interlaced Coding (PicAFF, MBAFF)	No	Yes	Yes	Yes	Yes
4:2:0 Chroma Format	Yes	Yes	Yes	Yes	Yes
Monochrome Video Format (4:0:0)	No	No	No	Yes	Yes
4:2:2 Chroma Format	No	No	No	No	No
4:4:4 Chroma Format	No	No	No	No	No
8 Bit Sample Depth	Yes	Yes	Yes	Yes	Yes
9 and 10 Bit Sample Depth	No	No	No	No	Yes
11 to 14 Bit Sample Depth	No	No	No	No	No
8x8 vs. 4x4 Transform Adaptivity	No	No	No	Yes	Yes
Quantization Scaling Matrices	No	No	No	Yes	Yes
Separate Cb and Cr QP control	No	No	No	Yes	Yes
Separate Color Plane Coding	No	No	No	No	No
Predictive Lossless Coding	No	No	No	No	No

1 See http://web.cs.ucla.edu/classes/fall03/cs218/paper/H.264_MPEG4_Tutorial.pdf at 7:

2 The following table summarizes the two major types of entropy coding: Variable Length
3 Coding (VLC) and Context Adaptive Binary Arithmetic Coding (CABAC). CABAC offers
4 superior coding efficiency over VLC by adapting to the changing probability distribution
5 of symbols, by exploiting correlation between symbols, and by adaptively exploiting bit
6 correlations using arithmetic coding. H.264 also supports Context Adaptive Variable Length
7 Coding (CAVLC) which offers superior entropy coding over VLC without the full cost of
8 CABAC.

9 H.264 Entropy Coding – Comparison of Approaches

10 Characteristics	11 Variable Length Coding (VLC)	12 Context Adaptive Binary Arithmetic Coding (CABAC)
13 • Where it is used	MPEG-2, MPEG-4 ASP	H.264/MPEG-4 AVC (high efficiency option)
14 • Probability distribution	Static - Probabilities never change	Adaptive - Adjusts probabilities based on actual data
15 • Leverages correlation between symbols	No - Conditional probabilities ignored	Yes - Exploits symbol correlations by using "contexts"
16 • Non-integer code words	No - Low coding efficiency for high probability symbols	Yes - Exploits "arithmetic coding" which generates non-integer code words for higher efficiency

17 Moreover, the H.264 Standard requires a bit-flag descriptor, which is set to determine the
18 correct decoder for the corresponding encoder. As shown below, if the flag = 0, then CAVLC must
19 have been selected as the encoder; if the flag = 1, then CABAC must have been selected as the
20 encoder. See https://www.itu.int/rec/dologin_pub.asp?lang=e&id=T-REC-H.264-201304-S!!PDF-E&type=items (Rec. ITU-T H.264 (04/2013)) at 80:

21 **entropy_coding_mode_flag** selects the entropy decoding method to be applied for the syntax elements for which two
22 descriptors appear in the syntax tables as follows:

- 23 – If **entropy_coding_mode_flag** is equal to 0, the method specified by the left descriptor in the syntax table is applied (Exp-Golomb coded, see clause 9.1 or CAVLC, see clause 9.2).
- 24 – Otherwise (**entropy_coding_mode_flag** is equal to 1), the method specified by the right descriptor in the syntax table is applied (CABAC, see clause 9.3).

25 44. The Accused Instrumentalities compress the at least the portion of the data block with
26 the selected one or more asymmetric compressors to provide one or more compressed data blocks,
27 which can be organized in a GOP structure (see above). After its selection, the asymmetric
28 compressor (CAVLC or CABAC) will compress the video data to provide various compressed data
blocks, which can also be organized in a GOP structure, as discussed previously above. See
<https://sonnati.wordpress.com/2007/10/29/how-h-264-works-part-ii/>:

Entropy Coding

For entropy coding, H.264 may use an enhanced VLC, a more complex context-adaptive variable-length coding (CAVLC) or an ever more complex Context-adaptive binary-arithmetic coding (CABAC) which are complex techniques to losslessly compress syntax elements in the video stream knowing the probabilities of syntax elements in a given context. The use of CABAC can improve the compression of around 5-7%. CABAC may requires a 30-40% of total processing power to be accomplished.

See <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.602.1581&rep=rep1&type=pdf> at 13:

Typical compression ratios to maintain excellent quality are:

- 10:1 for general images using JPEG
- 30:1 for general video using H.263 and MPEG-2
- 60:1 for general video using H.264 and WMV9

See http://www.ijera.com/papers/Vol3_issue4/BM34399403.pdf at 2:

Most visual communication systems today use Baseline Profile. Baseline is the simplest H.264 profile and defines, for example, zigzag scanning of the picture and using 4:2:0 (YUV video formats) chrominance sampling. In Baseline Profile, the picture is split in blocks consisting of 4x4 pixels, and each block is processed separately. Another important element of the Baseline Profile is the use of Universal Variable Length Coding (UVLC) and Context Adaptive Variable Length Coding (CAVLC) entropy coding techniques.

The Extended and Main Profiles includes the functionality of the Baseline Profile and add improvements to the predictions algorithms. Since transmitting every single frame (think 30 frames per second for good quality video) is not feasible if you are trying to reduce the bit rate 1000-2000 times, temporal and motion prediction are heavily used in H.264, and allow transmitting only the difference between one frame and the previous frames. The result is spectacular efficiency gain, especially for scenes with little change and motion.

The High Profile is the most powerful profile in H.264, and it allows most efficient coding of video. For example, large coding gain achieved through the use of Context Adaptive Binary Arithmetic Coding (CABAC) encoding which is more efficient than the UVLC/CAVLC used in Baseline Profile.

The High Profile also uses adaptive transform that decides on the fly if 4x4 or 8x8-pixel blocks should be used. For example, 4x4 blocks are used for the parts of the picture that are dense with detail, while parts that have little detail are transformed using 8x8 blocks.

1 45. Therefore, on information and belief, Hulu has directly infringed and continues to
2 infringe the '477 patent, for example, through its sale, offer for sale, importation, use and testing of
3 the Accused Instrumentalities that practice Claim 1 of the '477 patent, namely, a system,
4 comprising: a plurality of different asymmetric data compression encoders, wherein each
5 asymmetric data compression encoder of the plurality of different asymmetric data compression
6 encoders is configured to utilize one or more data compression algorithms, and wherein a first
7 asymmetric data compression encoder of the plurality of different asymmetric data compression
8 encoders is configured to compress data blocks containing video or image data at a higher data
9 compression rate than a second asymmetric data compression encoder of the plurality of different
10 asymmetric data compression encoders; and one or more processors configured to: determine one or
11 more data parameters, at least one of the determined one or more data parameters relating to a
12 throughput of a communications channel measured in bits per second; and select one or more
13 asymmetric data compression encoders from among the plurality of different asymmetric data
14 compression encoders based upon, at least in part, the determined one or more data parameters.

15 46. On information and belief, the Accused Instrumentalities store at least a portion of the
16 one or more compressed data blocks in buffers, hard disk, or other forms of memory/storage.

17 47. On information and belief, Hulu also directly infringes and continues to infringe other
18 claims of the '477 patent, for similar reasons as explained above with respect to Claim 1 of the '477
19 patent.

20 48. On information and belief, all of the Accused Instrumentalities perform the claimed
21 methods in substantially the same way, e.g., in the manner specified in the H.264 standard.

22 49. On information and belief, use of the Accused Instrumentalities in their ordinary and
23 customary fashion results in infringement of the methods claimed by the '477 patent.

24 50. On information and belief, Hulu has had knowledge of the '477 patent since at least
25 the filing of this Complaint or shortly thereafter, and on information and belief, Hulu knew of
26 the '477 patent and knew of its infringement, including by way of this lawsuit. By the time of trial,
27 Hulu will have known and intended (since receiving such notice) that its continued actions would
28 actively induce and contribute to the infringement of the claims of the '477 patent.

1 51. Upon information and belief, Hulu’s affirmative acts of making, using, and selling the
2 Accused Instrumentalities, and providing implementation services and technical support to users of
3 the Accused Instrumentalities, including, e.g., through training, demonstrations, brochures,
4 installation and user guides, have induced (at least since filing of this action) and continue to induce
5 users of the Accused Instrumentalities to use them in their normal and customary way to infringe
6 the ’477 patent by practicing a system, comprising: a plurality of different asymmetric data
7 compression encoders, wherein each asymmetric data compression encoder of the plurality of
8 different asymmetric data compression encoders is configured to utilize one or more data
9 compression algorithms, and wherein a first asymmetric data compression encoder of the plurality of
10 different asymmetric data compression encoders is configured to compress data blocks containing
11 video or image data at a higher data compression rate than a second asymmetric data compression
12 encoder of the plurality of different asymmetric data compression encoders; and one or more
13 processors configured to: determine one or more data parameters, at least one of the determined one
14 or more data parameters relating to a throughput of a communications channel measured in bits per
15 second; and select one or more asymmetric data compression encoders from among the plurality of
16 different asymmetric data compression encoders based upon, at least in part, the determined one or
17 more data parameters. For example, Hulu adopted H.264 as its video codec in its streaming
18 products/services, such as, e.g., Hulu’s streaming service, Hulu’s video compression media
19 encoders, and Hulu’s ad products for brands. For similar reasons, Hulu also induces its customers to
20 use the Accused Instrumentalities to infringe other claims of the ’477 patent. Hulu specifically
21 intended and was aware that these normal and customary activities would infringe the ’477 patent.
22 Hulu performed the acts that constitute induced infringement, and would induce actual infringement,
23 with the knowledge of the ’477 patent and with the knowledge, or willful blindness to the
24 probability, that the induced acts would constitute infringement. On information and belief, Hulu
25 engaged in such inducement to promote the sales of the Accused Instrumentalities. Accordingly,
26 Hulu has induced (at least since filing of this action) and continues to induce users of the Accused
27 Instrumentalities to use the Accused Instrumentalities in their ordinary and customary way to
28 infringe the ’477 patent, knowing that such use constitutes infringement of the ’477 patent.

1 Accordingly, Hulu has been (at least since filing of this action), and currently is, inducing
2 infringement of the '477 patent, in violation of 35 U.S.C. § 271(b).

3 52. Hulu has also infringed, and continues to infringe, claims of the '477 patent by
4 offering to commercially distribute, commercially distributing, making, and/or importing the
5 Accused Instrumentalities, which are used in practicing the process, or using the systems, of the '477
6 patent, and constitute a material part of the invention. Hulu knows the components in the Accused
7 Instrumentalities to be especially made or especially adapted for use in infringement of the '477
8 patent, not a staple article, and not a commodity of commerce suitable for substantial noninfringing
9 use. Accordingly, Hulu has been (at least since filing of this action), and currently is, contributorily
10 infringing the '477 patent, in violation of 35 U.S.C. § 271(c).

11 53. By making, using, offering for sale, selling and/or importing into the United States
12 the Accused Instrumentalities, and touting the benefits of using the Accused Instrumentalities'
13 compression features, Hulu has injured Realtime and is liable to Realtime for infringement of
14 the '477 patent pursuant to 35 U.S.C. § 271.

15 54. As a result of Hulu's infringement of the '477 patent, Plaintiff Realtime is entitled to
16 monetary damages in an amount adequate to compensate for Hulu's infringement, but in no event
17 less than a reasonable royalty for the use made of the invention by Hulu, together with interest and
18 costs as fixed by the Court.

19 COUNT III

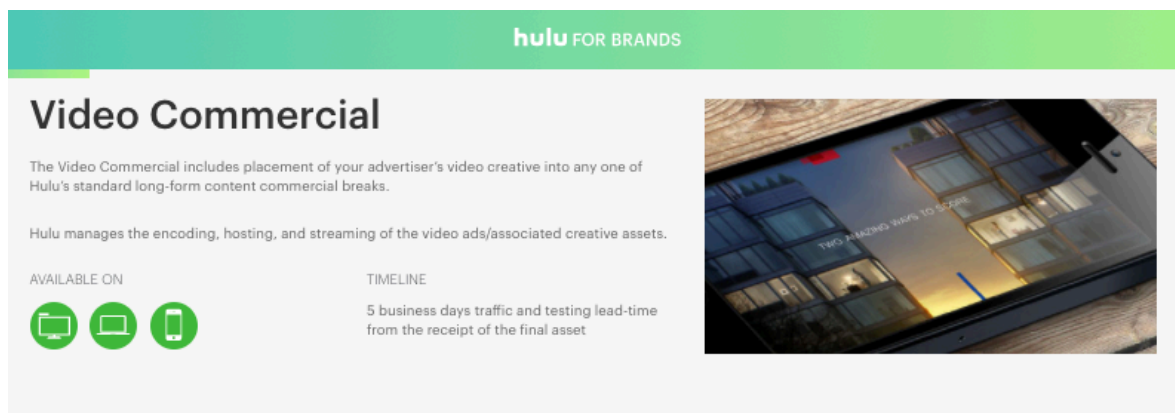
20 INFRINGEMENT OF U.S. PATENT NO. 9,762,907

21 55. Plaintiff re-alleges and incorporates by reference the foregoing paragraphs, as if fully
22 set forth herein.

23 56. On information and belief, Hulu has made, used, offered for sale, sold and/or
24 imported into the United States Hulu products that infringe the '907 patent, and continues to do so.
25 By way of illustrative example, these infringing products include, without limitation, Hulu's
26 streaming products/services, such as, e.g., Hulu's streaming service, Hulu's video compression
27 media encoders, Hulu's ad products for brands including Hulu's Ad Selector, Hulu's Blockbuster,
28 Hulu's Branded Entertainment Selector, Hulu's Custom Integrated Commercial, Hulu's Interactive

1 Interstitial, Hulu’s Interactive Interstitial Template (DR), Hulu’s Masthead Brand Placement, Hulu’s
 2 Page Brand Placement, Hulu’s Premium Slate, Hulu’s Slate, Hulu’s T-Commerce, Hulu’s Video
 3 Commercial, Hulu VR, Hulu’s 4K video services, and all versions and variations thereof since the
 4 issuance of the ’907 patent (“Accused Instrumentalities”)

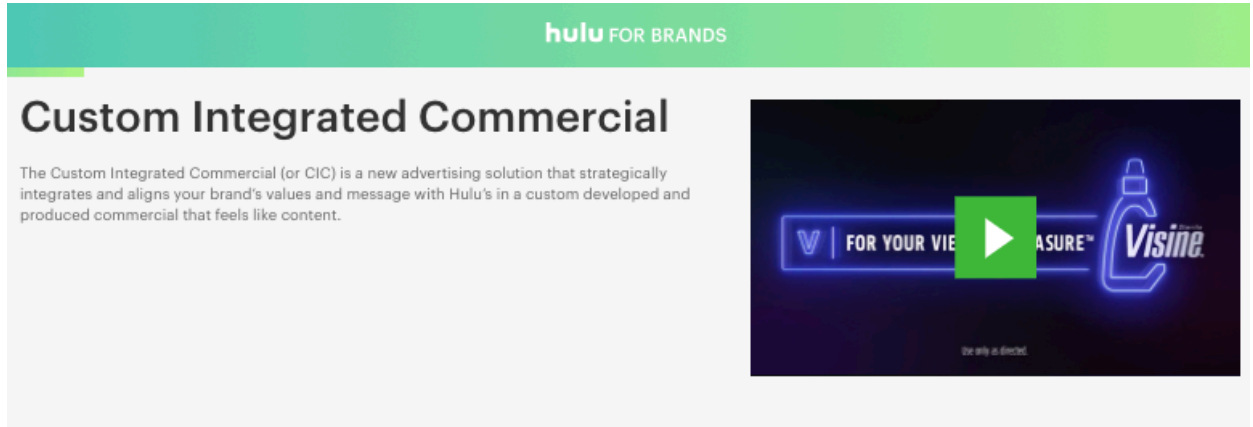
5 57. For example, the Accused Instrumentalities utilize the H.264 video compression
 6 standard, as can be seen by the below screenshot of Hulu’s Video Commercial ad product for brands
 7 (<https://www.hulu.com/advertising/ad-product/video-commercial/>):



16 **Specs**

DELIVERABLES TO HULU	SIZE	FILE FORMATS
<ul style="list-style-type: none"> • Video Commercial – ProRes .MOV • 3rd Party Tracking Tags (if applicable). • Video: 1 x 1 trackers and click commands • Max standard video commercial length is :60s 	<p>SD</p> <ul style="list-style-type: none"> • 720 x 480 • 4:3 or 16:9 pixel aspect ratio • No black bars • 3:2 display aspect ratio is not accepted • No letterboxing or pillarboxing • Bitrate: Greater than 2mbps. • Main Profile @ Main Level (MP@ML) • 4:2:2 Color Space <p>HD</p> <ul style="list-style-type: none"> • 1280 x 720 or 1920 x 1080 (16:9) • 1440 x 1080 (4:3) • No black bars • Constant Bitrate (CBR) 15-30 Mbps • Main Profile @ Main Level (MP@ML) • 4:2:2 Color Space 	<ul style="list-style-type: none"> • Quicktime movie (.mov) • MPEG-4 (.mp4) format only
AUDIO	FRAME RATE	CODEC
<ul style="list-style-type: none"> • 2 channels only • PCM (preferred) or AAC codec • 192 kbps minimum • 16 or 24 bit only • 48 kHz sample rate • Audio is required 	<ul style="list-style-type: none"> • 23.98, 25, or 29.97 based on native frame rate • Remove any pull-down added for broadcast • Constant frame rate only • Please make content progressive using adaptive de-interlace with no frame blending. 	<ul style="list-style-type: none"> • Apple ProRes 422 HQ codec preferred • H.264 codec • Interlaced video is not accepted

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 2 58. The Accused Instrumentalities also accept the usage of the H.264 video compression
 3 standard. For example, on the page for Hulu’s Custom Integrated Commercial ad product
 4 (<https://www.hulu.com/advertising/ad-product/custom-integrated-commercial/>), under header
 5 “Specs” and sub-header “Codec” is listed the text “H.264 codec is accepted.”:



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 15 **Specs**

16 **DELIVERABLES TO HULU**

17 While Hulu is able to work with a great variety of assets in the creation of a Custom Integrated Commercial (or “CIC”), the preferred formats, where appropriate and available, include:

- 18 • Apple ProRes 422 (HQ) video files
- 19 • Accompanying audio, split-track (if available)
- 20 • Vector brand logos in .eps or .ai format (if available)
- 21 • Brand style guides
- 22 • Brand font
- 23 • For motion graphics assets, AE project files with associated media (if available)

24 **SIZE**

- 25 • 1280 x 720 or 1920 x 1080 (16:9)
- 26 • 1440 x 1080 (4:3)
- 27 • No black bars
- 28 • Constant Bitrate (CBR) 15-30 Mbps
- Main Profile @ Main Level (MP@ML)
- 4:2:2 Color Space

FILE FORMATS

- Quicktime movie (.mov)
- MPEG-4 (.mp4) format only

AUDIO

- 2 channels only
- Audio (HD/SD): 192 kbps minimum & PCM (preferred) or AAC codec
- 16 or 24 bit only
- 48 kHz sample rate
- Audio is required

FRAME RATE

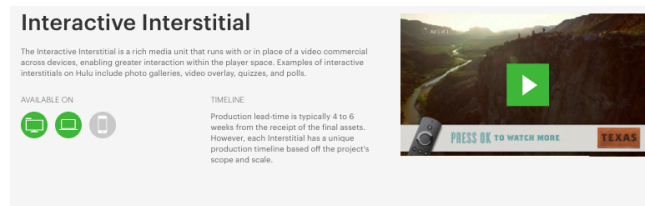
- 23.98, 25, or 29.97 based on native frame rate
- Remove any pull-down added for broadcast
- Constant frame rate only
- Please make content progressive using adaptive de-interlace with no frame blending.

CODEC

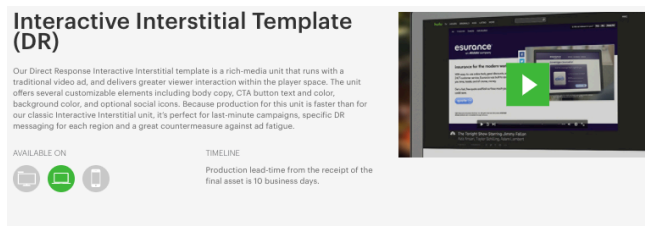
- Apple ProRes 422 HQ codec preferred
- **H.264** codec is accepted
- Interlaced video is not accepted

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59. Similarly, on the page for Hulu’s Interactive Interstitial ad product (<https://www.hulu.com/advertising/ad-product/interactive-interstitial/>) under header “Specs” and sub-header “Video” is listed the text “H.264 codec is accepted, but bitrate must be at least 50 Mbps.” Likewise, on the page for Hulu’s Interactive Interstitial Template (DR) (<https://www.hulu.com/advertising/ad-product/interactive-interstitial-template-dr/>) , the same text “H.264 codec is accepted, but bitrate must be at least 50 Mbps” is listed under header “Specs” and sub-header “Video.” In addition, on the page for Hulu’s Premium Slate ad product (<https://www.hulu.com/advertising/ad-product/premium-slate/>) the text “(H.264 codec is accepted, but bitrate must be at least 50 Mbps)” is listed under header “Specs” and sub-header “Codec.” Representative screenshots are shown below:



Specs		
DELIVERABLES TO HULU <ul style="list-style-type: none"> Product Images (if applicable) Audio (background audio must be heard throughout entire unit) Brand logo (Vector .AI or .EPS preferred, .PSD accepted) Copy & calls-to-action (if applicable) Third-party tags Click-thru URLs 	LEAN-BACK / LEAN-FORWARD <p>Lean-back experience Will time out if the user does not interact with the unit. Will include the standard Hulu ad countdown bar in the top 35 pixels of the player window. Click through to another site from within the interstitial will open a new browser window.</p> <p>Lean-forward experience If interaction options are available within the unit, a "Return to Video" option will appear if a user decides to click somewhere within the unit allowing them to return to the content experience whenever they are ready (this prevents a user from voluntarily becoming engaged and the user getting "kicked out" at the end of the experience).</p>	VIDEO <p>If client is providing uncompressed video:</p> <ul style="list-style-type: none"> 23.98 or 29.97 Constant frame rate only Apple ProRes 422 HQ codec preferred Audio (HD/SD): PCM (preferred) or AAC codec & 192 kbps minimum H.264 codec is accepted, but bitrate must be at least 50 Mbps Interlaced video is not accepted Constant Bitrate (CBR) 15-30 Mbps Main Profile @ Main Level (MP@ML) 4:2:0 Color Space Please make content progressive. Video must be submitted without leaders (i.e. slates, countdowns). If assets are delivered with leaders, Hulu will edit them and a Production Fee will be added to the final invoice.



Specs		
DELIVERABLES TO HULU <ul style="list-style-type: none"> Brand logo (Vector .AI or .EPS preferred, .PSD accepted) Social media urls (click-trackers accepted) Click-thru URL for Video Click-thru URL for Logo Click-thru URL for CTA Button Copy for the body of the unit CTA copy for button Time when video should start shrinking Solid Background: HEX color code for the top portion of the unit, HEX color code for the bottom portion of the unit and HEX color code for the button Background Image: Please reference template for specs 	SIZE 1184x666	VIDEO <p>If client is providing uncompressed video:</p> <ul style="list-style-type: none"> 23.98 or 29.97 Constant frame rate only Apple ProRes 422 HQ codec preferred Audio (HD/SD): PCM (preferred) or AAC codec & 192 kbps minimum H.264 codec is accepted, but bitrate must be at least 50 Mbps Interlaced video is not accepted Constant Bitrate (CBR) 15-30 Mbps Main Profile @ Main Level (MP@ML) 4:2:0 Color Space Please make content progressive. Video must be submitted without leaders (i.e. slates, countdowns). If assets are delivered with leaders, Hulu will edit them and a Production Fee will be added to the final invoice.

Premium Slate

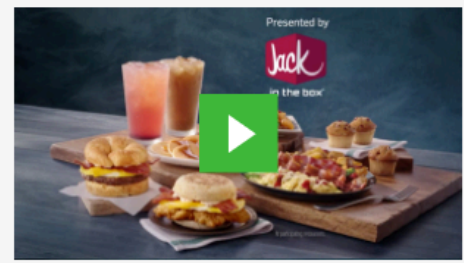
A Premium Slate is a branded :07 video introduction that appears before the advertiser's video commercial at the beginning of the show. Advertisers can create custom videos or leverage existing video creative. The video execution is accompanied by the standard intro text and "presented by" voice over.

AVAILABLE ON



TIMELINE

10 business days production lead-time from the receipt of the final asset



Specs

DELIVERABLES TO HULU

- Required video clip can either be created by Hulu using your :15 or :30 video or the brand can create a custom video clip.
- 3rd Party Tracking Tags (if applicable)

FILE FORMATS

- Video Option:
- Quicktime Movie (.mov) or MPEG-4 (.mp4) format only
- Static Image Option:
- Any full screen image in PSD format

SIZE

- SD
- 720 x 480
 - 4:3 or 16:9 pixel aspect ratio
 - No black bars
 - 3:2 display aspect ratio is not accepted
 - No letterboxing or pillarboxing
 - Bitrate: Greater than 2mbps.
 - Main Profile @ Main Level (MP@ML)
 - 4:2:2 Color Space
- HD
- 1280 x 720 or 1920 x 1080 (16:9)
 - 1440 x 1080 (4:3)
 - No black bars
 - Constant Bitrate (CBR) 15-30 Mbps
 - Main Profile @ Main Level (MP@ML)
 - 4:2:2 Color Space

MAX FILE SIZE

10 GB

CODEC

- Apple ProRes 422 HQ codec preferred
- H.264 codec is accepted, but bitrate must be at least 50 Mbps
- Interlaced video is not accepted

LENGTH

:07 seconds exactly

60. The Accused Instrumentalities also use H.264 video compression to select and compress based on parameters such as bitrate, as explained by the website "How Stuff Works" (<http://computer.howstuffworks.com/internet/basics/hulu4.htm>):

"Hulu.com uses Cascading Style Sheets (CSS) and JavaScript to lay out its web pages, and it powers the video and controls through the Flash player and browser on your computer. When you request a video, Hulu sends it to you it as a Flash format streaming video file (FLV) along with the video player and the sponsors' advertisements.

Hulu encodes the video file for one of two types of video encoding devices (known as codecs) that translates streaming data into the moving images on your screen and the sound in your speakers. Hulu sends the file to you at one of **five speeds, or bitrates, measured as the amount of data sent per second**. When you play a video, the codec Hulu uses depends on the bitrate at which it's sending the video to you.

1 The site uses the On2 Flash VP6 codec for video streams that run at bitrates of
 2 480 kilobits per second (Kbps) and 700 Kbps. This codec is supported by
 3 Flash versions 8.0 and higher, which is installed in more than 98 percent of
 4 computers in the U.S. Hulu's higher bitrate streams of 1,000 Kbps and 2,500
 Kbps use a codec that requires a bit more from your Internet connection. This
 more intensive codec **follows the H.264 video coding standard**, which
 requires Flash 9.0.124.0 or higher [source: Hulu].

5 How does all of this come together? While you're viewing most videos on
 6 Hulu, **you control the bitrate** when you switch between two progressive scan
 rates: 360p (standard resolution) or 480p (high resolution).

7 61. The Accused Instrumentalities determine a parameter of at least a portion of a video
 8 data block. As shown below, examples of such parameters include bitrate (or max video bitrate) and
 9 resolution parameters. Different parameters correspond with different end applications. H.264
 10 provides for multiple different ranges of such parameters, each included in the “profiles” and
 11 “levels” as defined by the H.264 standard, from the below shown paragraphs from a white paper and
 12 Wikipedia. See http://www.axis.com/files/whitepaper/wp_h264_31669_en_0803_lo.pdf at 5:

13 **4. H.264 profiles and levels**

14 The joint group involved in defining H.264 focused on creating a simple and clean solution, limiting
 15 options and features to a minimum. An important aspect of the standard, as with other video standards,
 16 is providing the capabilities in profiles (sets of algorithmic features) and levels (performance classes)
 that optimally support popular productions and common formats.

17 H.264 has seven profiles, each targeting a specific class of applications. Each profile defines what
 18 feature set the encoder may use and limits the decoder implementation complexity.

19 Network cameras and video encoders will most likely use a profile called the baseline profile, which is
 20 intended primarily for applications with limited computing resources. The baseline profile is the most
 21 suitable given the available performance in a real-time encoder that is embedded in a network video
 product. The profile also enables low latency, which is an important requirement of surveillance video and
 also particularly important in enabling real-time, pan/tilt/zoom (PTZ) control in PTZ network cameras.

22 H.264 has 11 levels or degree of capability to limit performance, bandwidth and memory requirements.
 23 Each level defines the bit rate and the encoding rate in macroblock per second for resolutions ranging
 from QCIF to HDTV and beyond. The higher the resolution, the higher the level required.

24
 25 See https://en.wikipedia.org/wiki/H.264/MPEG-4_AVC:
 26
 27
 28

Levels with maximum property values

Level	Max decoding speed		Max frame size		Max video bit rate for video coding layer (VCL) kbit/s			Examples for high resolution @ highest frame rate (max stored frames) Toggle additional details
	Luma samples/s	Macroblocks/s	Luma samples	Macroblocks	Baseline, Extended and Main Profiles	High Profile	High 10 Profile	
1	380,160	1,485	25,344	99	64	80	192	176x144@15.0 (4)
1b	380,160	1,485	25,344	99	128	160	384	176x144@15.0 (4)
1.1	768,000	3,000	101,376	396	192	240	576	352x288@7.5 (2)
1.2	1,536,000	6,000	101,376	396	384	480	1,152	352x288@15.2 (6)
1.3	3,041,280	11,880	101,376	396	768	960	2,304	352x288@30.0 (6)
2	3,041,280	11,880	101,376	396	2,000	2,500	6,000	352x288@30.0 (6)
2.1	5,068,800	19,800	202,752	792	4,000	5,000	12,000	352x576@25.0 (6)
2.2	5,184,000	20,250	414,720	1,620	4,000	5,000	12,000	720x576@12.5 (5)
3	10,368,000	40,500	414,720	1,620	10,000	12,500	30,000	720x576@25.0 (5)
3.1	27,648,000	108,000	921,600	3,600	14,000	17,500	42,000	1,280x720@30.0 (5)
3.2	55,296,000	216,000	1,310,720	5,120	20,000	25,000	60,000	1,280x1,024@42.2 (4)
4	62,914,560	245,760	2,097,152	8,192	20,000	25,000	60,000	2,048x1,024@30.0 (4)
4.1	62,914,560	245,760	2,097,152	8,192	50,000	62,500	150,000	2,048x1,024@30.0 (4)
4.2	133,693,440	522,240	2,228,224	8,704	50,000	62,500	150,000	2,048x1,080@60.0 (4)
5	150,994,944	589,824	5,652,480	22,080	135,000	168,750	405,000	3,672x1,536@26.7 (5)
5.1	251,658,240	983,040	9,437,184	36,864	240,000	300,000	720,000	4,096x2,304@26.7 (5)
5.2	530,841,600	2,073,600	9,437,184	36,864	240,000	300,000	720,000	4,096x2,304@56.3 (5)

62. A video data block is organized by the group of pictures (GOP) structure, which is a “collection of successive pictures within a coded video stream.” See Wikipedia Article on Group of Pictures, https://en.wikipedia.org/wiki/Group_of_pictures. A GOP structure can contain intra coded pictures (I picture or I frame), predictive coded pictures (P picture or P frame), bipredictive coded pictures (B picture or B frame) and direct coded pictures (D picture or D frames, or DC direct coded pictures which are used only in MPEG-1 video). See Wikipedia Articles on Video Compression Types and MPEG-1, https://en.wikipedia.org/wiki/Video_compression_picture_types (for descriptions of I frames, P frames and B frames); <https://en.wikipedia.org/wiki/MPEG-1#D-frames> (for descriptions of D frames). Thus, at least a portion of a video data block would also make up a GOP structure and could also contain I frames, P frames, B frames and/or D frames. The GOP structure also reflects the size of a video data block, and the GOP structure can be controlled and used to fine-tune other parameters (e.g. bitrate, max video bitrate and resolution parameters) or even be considered as a parameter by itself.

63. Based on the bitrate and/or resolution parameter identified (e.g. bitrate, max video bitrate, resolution, GOP structure or frame type within a GOP structure), any H.264-compliant

1 system such as the Accused Instrumentalities would determine which profile (e.g., “baseline,”
 2 “extended,” “main”, or “high”) corresponds with that parameter, then select between at least two
 3 asymmetric compressors. If baseline or extended is the corresponding profile, then the system will
 4 select a Context-Adaptive Variable Length Coding (“CAVLC”) entropy encoder. If main or high is
 5 the corresponding profile, then the system will select a Context-Adaptive Binary Arithmetic Coding
 6 (“CABAC”) entropy encoder. Both encoders are asymmetric compressors because it takes a longer
 7 period of time for them to compress data than to decompress data. *See*

8 <https://sonnati.wordpress.com/2007/10/29/how-h-264-works-part-ii/>:

	Baseline	Extended	Main	High	High 10
I and P Slices	Yes	Yes	Yes	Yes	Yes
B Slices	No	Yes	Yes	Yes	Yes
SI and SP Slices	No	Yes	No	No	No
Multiple Reference Frames	Yes	Yes	Yes	Yes	Yes
In-Loop Deblocking Filter	Yes	Yes	Yes	Yes	Yes
CAVLC Entropy Coding	Yes	Yes	Yes	Yes	Yes
CABAC Entropy Coding	No	No	Yes	Yes	Yes
Flexible Macroblock Ordering (FMO)	Yes	Yes	No	No	No
Arbitrary Slice Ordering (ASO)	Yes	Yes	No	No	No
Redundant Slices (RS)	Yes	Yes	No	No	No
Data Partitioning	No	Yes	No	No	No
Interlaced Coding (PicAFF, MBAFF)	No	Yes	Yes	Yes	Yes
4:2:0 Chroma Format	Yes	Yes	Yes	Yes	Yes
Monochrome Video Format (4:0:0)	No	No	No	Yes	Yes
4:2:2 Chroma Format	No	No	No	No	No
4:4:4 Chroma Format	No	No	No	No	No
8 Bit Sample Depth	Yes	Yes	Yes	Yes	Yes
9 and 10 Bit Sample Depth	No	No	No	No	Yes
11 to 14 Bit Sample Depth	No	No	No	No	No
8x8 vs. 4x4 Transform Adaptivity	No	No	No	Yes	Yes
Quantization Scaling Matrices	No	No	No	Yes	Yes
Separate Cb and Cr QP control	No	No	No	Yes	Yes
Separate Color Plane Coding	No	No	No	No	No
Predictive Lossless Coding	No	No	No	No	No

1 See http://web.cs.ucla.edu/classes/fall03/cs218/paper/H.264_MPEG4_Tutorial.pdf at 7:

2 The following table summarizes the two major types of entropy coding: Variable Length
3 Coding (VLC) and Context Adaptive Binary Arithmetic Coding (CABAC). CABAC offers
4 superior coding efficiency over VLC by adapting to the changing probability distribution
5 of symbols, by exploiting correlation between symbols, and by adaptively exploiting bit
6 correlations using arithmetic coding. H.264 also supports Context Adaptive Variable Length
7 Coding (CAVLC) which offers superior entropy coding over VLC without the full cost of
8 CABAC.

9 H.264 Entropy Coding – Comparison of Approaches

10 Characteristics	11 Variable Length Coding (VLC)	12 Context Adaptive Binary Arithmetic Coding (CABAC)
13 • Where it is used	MPEG-2, MPEG-4 ASP	H.264/MPEG-4 AVC (high efficiency option)
14 • Probability distribution	Static - Probabilities never change	Adaptive - Adjusts probabilities based on actual data
15 • Leverages correlation between symbols	No - Conditional probabilities ignored	Yes - Exploits symbol correlations by using "contexts"
16 • Non-integer code words	No - Low coding efficiency for high probability symbols	Yes - Exploits "arithmetic coding" which generates non-integer code words for higher efficiency

17 Moreover, the H.264 Standard requires a bit-flag descriptor, which is set to determine the
18 correct decoder for the corresponding encoder. As shown below, if the flag = 0, then CAVLC must
19 have been selected as the encoder; if the flag = 1, then CABAC must have been selected as the
20 encoder. See https://www.itu.int/rec/dologin_pub.asp?lang=e&id=T-REC-H.264-201304-S!!PDF-E&type=items (Rec. ITU-T H.264 (04/2013)) at 80:

21 **entropy_coding_mode_flag** selects the entropy decoding method to be applied for the syntax elements for which two
22 descriptors appear in the syntax tables as follows:

- 23 – If **entropy_coding_mode_flag** is equal to 0, the method specified by the left descriptor in the syntax table is applied (Exp-Golomb coded, see clause 9.1 or CAVLC, see clause 9.2).
- 24 – Otherwise (**entropy_coding_mode_flag** is equal to 1), the method specified by the right descriptor in the syntax table is applied (CABAC, see clause 9.3).

25 64. The Accused Instrumentalities compress the at least the portion of the data block with
26 the selected one or more asymmetric compressors to provide one or more compressed data blocks,
27 which can be organized in a GOP structure (see above). After its selection, the asymmetric
28 compressor (CAVLC or CABAC) will compress the video data to provide various compressed data
blocks, which can also be organized in a GOP structure, as discussed previously above. See
<https://sonnati.wordpress.com/2007/10/29/how-h-264-works-part-ii/>:

Entropy Coding

For entropy coding, H.264 may use an enhanced VLC, a more complex context-adaptive variable-length coding (CAVLC) or an ever more complex Context-adaptive binary-arithmetic coding (CABAC) which are complex techniques to losslessly compress syntax elements in the video stream knowing the probabilities of syntax elements in a given context. The use of CABAC can improve the compression of around 5-7%. CABAC may requires a 30-40% of total processing power to be accomplished.

See <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.602.1581&rep=rep1&type=pdf> at 13:

Typical compression ratios to maintain excellent quality are:

- 10:1 for general images using JPEG
- 30:1 for general video using H.263 and MPEG-2
- 60:1 for general video using H.264 and WMV9

See http://www.ijera.com/papers/Vol3_issue4/BM34399403.pdf at 2:

Most visual communication systems today use Baseline Profile. Baseline is the simplest H.264 profile and defines, for example, zigzag scanning of the picture and using 4:2:0 (YUV video formats) chrominance sampling. In Baseline Profile, the picture is split in blocks consisting of 4x4 pixels, and each block is processed separately. Another important element of the Baseline Profile is the use of Universal Variable Length Coding (UVLC) and Context Adaptive Variable Length Coding (CAVLC) entropy coding techniques.

The Extended and Main Profiles includes the functionality of the Baseline Profile and add improvements to the predictions algorithms. Since transmitting every single frame (think 30 frames per second for good quality video) is not feasible if you are trying to reduce the bit rate 1000-2000 times, temporal and motion prediction are heavily used in H.264, and allow transmitting only the difference between one frame and the previous frames. The result is spectacular efficiency gain, especially for scenes with little change and motion.

The High Profile is the most powerful profile in H.264, and it allows most efficient coding of video. For example, large coding gain achieved through the use of Context Adaptive Binary Arithmetic Coding (CABAC) encoding which is more efficient than the UVLC/CAVLC used in Baseline Profile.

The High Profile also uses adaptive transform that decides on the fly if 4x4 or 8x8-pixel blocks should be used. For example, 4x4 blocks are used for the parts of the picture that are dense with detail, while parts that have little detail are transformed using 8x8 blocks.

1 65. Therefore, on information and belief, Hulu has directly infringed and continues to
2 infringe the '907 patent, for example, through its sale, offer for sale, importation, use and testing of
3 the Accused Instrumentalities, which practices the system claimed by Claim 1 of the '907 patent,
4 namely, a system comprising: one or more different asymmetric data compression algorithms,
5 wherein each algorithm of the one or more different asymmetric data compression algorithms
6 utilizes one or more asymmetric data compression routines of a plurality of different asymmetric
7 data compression routines, wherein a first asymmetric data compression routine of the plurality of
8 different asymmetric data compression routines is configured to produce compressed data with a
9 higher data rate for a given data throughput than a second asymmetric data compression routine of
10 the plurality of different asymmetric data compression routines; and a processor configured: to
11 analyze one or more data parameters from one or more data blocks containing video data, wherein at
12 least one data parameter relates to an expected or anticipated throughput of a communications
13 channel; and to select two or more different data compression routines from among a plurality of
14 different data compression routines based upon, at least in part, the one or more data parameters
15 relating to the expected or anticipated throughput of the communications channel.

16 66. On information and belief, the Accused Instrumentalities store at least a portion of the
17 one or more compressed data blocks in buffers, hard disk, or other forms of memory/storage.

18 67. On information and belief, Hulu also directly infringes and continues to infringe other
19 claims of the '907 patent, for similar reasons as explained above with respect to Claim 8 of the '907
20 patent.

21 68. On information and belief, all of the Accused Instrumentalities perform the claimed
22 methods in substantially the same way, e.g., in the manner specified in the H.264 standard.

23 69. On information and belief, use of the Accused Instrumentalities in their ordinary and
24 customary fashion results in infringement of the methods claimed by the '907 patent.

25 70. On information and belief, Hulu has had knowledge of the '907 patent since at least
26 the filing of this Complaint or shortly thereafter, and on information and belief, Hulu knew of
27 the '907 patent and knew of its infringement, including by way of this lawsuit. By the time of trial,
28 Hulu will have known and intended (since receiving such notice) that its continued actions would

1 actively induce and contribute to the infringement of the claims of the '907 patent.

2 71. Upon information and belief, Hulu's affirmative acts of making, using, and selling the
3 Accused Instrumentalities, and providing implementation services and technical support to users of
4 the Accused Instrumentalities, including, e.g., through training, demonstrations, brochures,
5 installation and user guides, have induced (at least since filing of this action) and continue to induce
6 users of the Accused Instrumentalities to use them in their normal and customary way to infringe
7 the '907 patent by practicing a system comprising: one or more different asymmetric data
8 compression algorithms, wherein each algorithm of the one or more different asymmetric data
9 compression algorithms utilizes one or more asymmetric data compression routines of a plurality of
10 different asymmetric data compression routines, wherein a first asymmetric data compression
11 routine of the plurality of different asymmetric data compression routines is configured to produce
12 compressed data with a higher data rate for a given data throughput than a second asymmetric data
13 compression routine of the plurality of different asymmetric data compression routines; and a
14 processor configured: to analyze one or more data parameters from one or more data blocks
15 containing video data, wherein at least one data parameter relates to an expected or anticipated
16 throughput of a communications channel; and to select two or more different data compression
17 routines from among a plurality of different data compression routines based upon, at least in part,
18 the one or more data parameters relating to the expected or anticipated throughput of the
19 communications channel. For example, Hulu adopted H.264 as its video codec in its streaming
20 products/services, such as, e.g., Hulu's streaming service, Hulu's video compression media
21 encoders, and Hulu's ad products for brands. For similar reasons, Hulu also induces its customers to
22 use the Accused Instrumentalities to infringe other claims of the '907 patent. Hulu specifically
23 intended and was aware that these normal and customary activities would infringe the '907 patent.
24 Hulu performed the acts that constitute induced infringement, and would induce actual infringement,
25 with the knowledge of the '907 patent and with the knowledge, or willful blindness to the
26 probability, that the induced acts would constitute infringement. On information and belief, Hulu
27 engaged in such inducement to promote the sales of the Accused Instrumentalities. Accordingly,
28 Hulu has induced (at least since filing of this action) and continues to induce users of the Accused

1 Instrumentalities to use the Accused Instrumentalities in their ordinary and customary way to
2 infringe the '907 patent, knowing that such use constitutes infringement of the '907 patent.
3 Accordingly, Hulu has been (at least since filing of this action), and currently is, inducing
4 infringement of the '907 patent, in violation of 35 U.S.C. § 271(b).

5 72. Hulu has also infringed, and continues to infringe, claims of the '907 patent by
6 offering to commercially distribute, commercially distributing, making, and/or importing the
7 Accused Instrumentalities, which are used in practicing the process, or using the systems, of the '907
8 patent, and constitute a material part of the invention. Hulu knows the components in the Accused
9 Instrumentalities to be especially made or especially adapted for use in infringement of the '907
10 patent, not a staple article, and not a commodity of commerce suitable for substantial noninfringing
11 use. Accordingly, Hulu has been, and currently is, contributorily infringing the '907 patent, in
12 violation of 35 U.S.C. § 271(c).

13 73. By making, using, offering for sale, selling and/or importing into the United States
14 the Accused Instrumentalities, and touting the benefits of using the Accused Instrumentalities'
15 compression features, Hulu has injured Realtime and is liable to Realtime for infringement of
16 the '907 patent pursuant to 35 U.S.C. § 271.

17 74. As a result of Hulu's infringement of the '907 patent, Plaintiff Realtime is entitled to
18 monetary damages in an amount adequate to compensate for Hulu's infringement, but in no event
19 less than a reasonable royalty for the use made of the invention by Hulu, together with interest and
20 costs as fixed by the Court.

21 COUNT IV

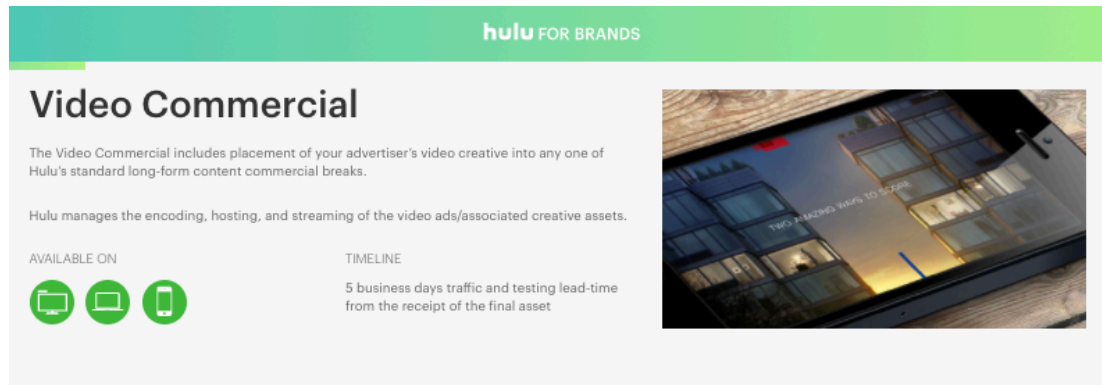
22 INFRINGEMENT OF U.S. PATENT NO. 7,386,046

23 75. Plaintiff re-alleges and incorporates by reference the foregoing paragraphs, as if fully
24 set forth herein.

25 76. On information and belief, Hulu has made, used, offered for sale, sold and/or
26 imported into the United States Hulu products that infringe the '046 patent, and continues to do so.
27 By way of illustrative example, these infringing products include, without limitation, Hulu's
28 streaming products/services, such as, e.g., Hulu's streaming service, Hulu's video compression

1 media encoders, Hulu’s ad products for brands including Hulu’s Ad Selector, Hulu’s Blockbuster,
 2 Hulu’s Branded Entertainment Selector, Hulu’s Custom Integrated Commercial, Hulu’s Interactive
 3 Interstitial, Hulu’s Interactive Interstitial Template (DR), Hulu’s Masthead Brand Placement, Hulu’s
 4 Page Brand Placement, Hulu’s Premium Slate, Hulu’s Slate, Hulu’s T-Commerce, Hulu’s Video
 5 Commercial, Hulu VR, Hulu’s 4K video services, and all versions and variations thereof since the
 6 issuance of the ’046 patent (“Accused Instrumentalities”)

7 77. For example, the Accused Instrumentalities utilize the H.264 video compression
 8 standard, as can be seen by the below screenshot of Hulu’s Video Commercial ad product for brands
 9 (<https://www.hulu.com/advertising/ad-product/video-commercial/>):



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18 **Specs**

19 **DELIVERABLES TO HULU**

- Video Commercial – ProRes .MOV
- 3rd Party Tracking Tags (if applicable).
- Video: 1 x 1 trackers and click commands
- Max standard video commercial length is :60s

20 **SIZE**

- SD
- 720 x 480
- 4:3 or 16:9 pixel aspect ratio
- No black bars
- 3:2 display aspect ratio is not accepted
- No letterboxing or pillarboxing
- Bitrate: Greater than 2mbps.
- Main Profile @ Main Level (MP@ML)
- 4:2:2 Color Space

21 **HD**

- 1280 x 720 or 1920 x 1080 (16:9)
- 1440 x 1080 (4:3)
- No black bars
- Constant Bitrate (CBR) 15-30 Mbps
- Main Profile @ Main Level (MP@ML)
- 4:2:2 Color Space

22 **FILE FORMATS**

- Quicktime movie (.mov)
- MPEG-4 (.mp4) format only

23 **AUDIO**

- 2 channels only
- PCM (preferred) or AAC codec
- 192 kbps minimum
- 16 or 24 bit only
- 48 kHz sample rate
- Audio is required

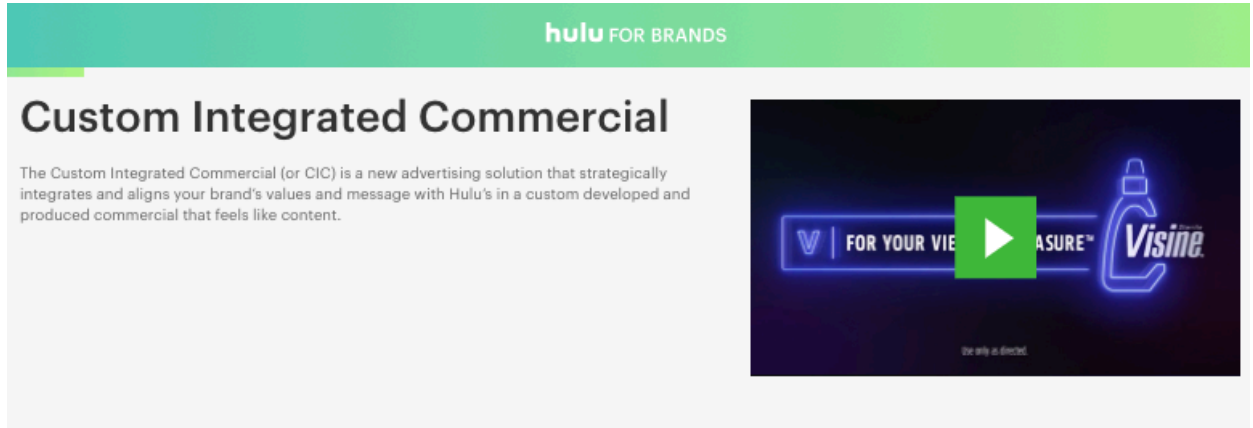
24 **FRAME RATE**

- 23.98, 25, or 29.97 based on native frame rate
- Remove any pull-down added for broadcast
- Constant frame rate only
- Please make content progressive using adaptive de-interlace with no frame blending.

25 **CODEC**

- Apple ProRes 422 HQ codec preferred
- **H.264** codec
- Interlaced video is not accepted

1 78. The Accused Instrumentalities also accept the usage of the H.264 video compression
 2 standard. For example, on the page for Hulu’s Custom Integrated Commercial ad product
 3 (<https://www.hulu.com/advertising/ad-product/custom-integrated-commercial/>), under header
 4 “Specs” and sub-header “Codec” is listed the text “H.264 codec is accepted.”:



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14 **Specs**

15 **DELIVERABLES TO HULU**

While Hulu is able to work with a great variety of assets in the creation of a Custom Integrated Commercial (or “CIC”), the preferred formats, where appropriate and available, include:

- Apple ProRes 422 (HQ) video files
- Accompanying audio, split-track (if available)
- Vector brand logos in .eps or .ai format (if available)
- Brand style guides
- Brand font
- For motion graphics assets, AE project files with associated media (if available)

16 **SIZE**

- 1280 x 720 or 1920 x 1080 (16:9)
- 1440 x 1080 (4:3)
- No black bars
- Constant Bitrate (CBR) 15-30 Mbps
- Main Profile @ Main Level (MP@ML)
- 4:2:2 Color Space

17 **FILE FORMATS**

- Quicktime movie (.mov)
- MPEG-4 (.mp4) format only

18 **AUDIO**

- 2 channels only
- Audio (HD/SD): 192 kbps minimum & PCM (preferred) or AAC codec
- 16 or 24 bit only
- 48 kHz sample rate
- Audio is required

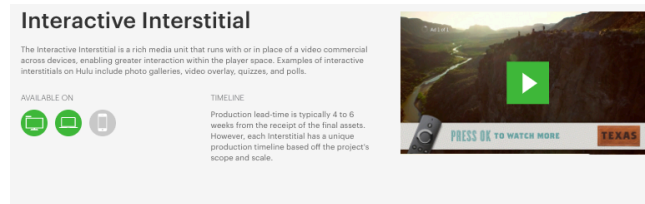
19 **FRAME RATE**

- 23.98, 25, or 29.97 based on native frame rate
- Remove any pull-down added for broadcast
- Constant frame rate only
- Please make content progressive using adaptive de-interlace with no frame blending.

20 **CODEC**

- Apple ProRes 422 HQ codec preferred
- **H.264** codec is accepted
- Interlaced video is not accepted

1 79. Similarly, on the page for Hulu’s Interactive Interstitial ad product
 2 (<https://www.hulu.com/advertising/ad-product/interactive-interstitial/>) under header “Specs” and
 3 sub-header “Video” is listed the text “H.264 codec is accepted, but bitrate must be at least 50 Mbps.”
 4 Likewise, on the page for Hulu’s Interactive Interstitial Template (DR)
 5 (<https://www.hulu.com/advertising/ad-product/interactive-interstitial-template-dr/>) , the same text
 6 “H.264 codec is accepted, but bitrate must be at least 50 Mbps” is listed under header “Specs” and
 7 sub-header “Video.” In addition, on the page for Hulu’s Premium Slate ad product
 8 (<https://www.hulu.com/advertising/ad-product/premium-slate/>) the text “(H.264 codec is accepted,
 9 but bitrate must be at least 50 Mbps)” is listed under header “Specs” and sub-header “Codec.”
 10 Representative screenshots are shown below:



Specs

DELIVERABLES TO HULU

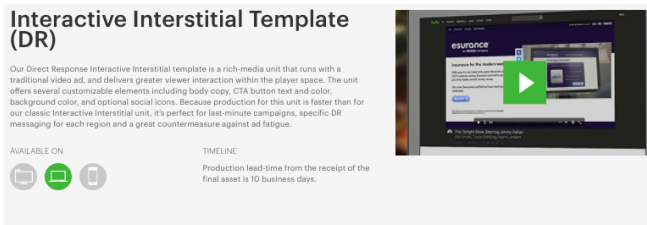
- Product Images (if applicable)
- Audio (background audio must be heard throughout entire unit)
- Brand logo (Vector .AI or .EPS preferred, .PSD accepted)
- Copy & calls-to-action (if applicable)
- Third-party tags
- Click-thru URLs

LEAN-BACK / LEAN-FORWARD

- Lean-back experience**
 Will time out if the user does not interact with the unit. Will include the standard Hulu ad countdown bar in the top 35 pixels of the player window.
 Click-through to another site from within the interstitial will open a new browser window.
- Lean-forward experience**
 If interaction options are available within the unit, a "Return to Video" option will appear if a user decides to click somewhere within the unit allowing them to return to the content experience whenever they are ready (this prevents a user from voluntarily becoming engaged and the user getting "kicked out" at the end of the experience).

VIDEO

- If client is providing uncompressed video:
- 23.98 or 29.97
 - Constant frame rate only
 - Apple ProRes 422 HQ codec preferred
 - Audio (HD/SD): PCM (preferred) or AAC codec & 192 kbps minimum
 - **H.264** codec is accepted, but bitrate must be at least 50 Mbps
 - Interlaced video is not accepted
 - Constant Bitrate (CBR) 15-30 Mbps
 - Main Profile @ Main Level (MP@ML)
 - 4:2:0 Color Space
 - Please make content progressive.
 - Video must be submitted without leaders (i.e. slates, countdowns).
 - If assets are delivered with leaders, Hulu will edit them and a Production Fee will be added to the final invoice.



Specs

DELIVERABLES TO HULU

- Brand logo (Vector .AI or .EPS preferred, .PSD accepted)
- Social media urls (click-trackers accepted)
- Click-thru URL for Video
- Click-thru URL for Logo
- Click-thru URL for CTA Button
- Copy for the body of the unit
- CTA copy for button
- Time when video should start shrinking
- Solid Background: HEX color code for the top portion of the unit, HEX color code for the bottom portion of the unit and HEX color code for the button
- Background Image: Please reference template for specs

SIZE

1184x666

VIDEO

- If client is providing uncompressed video:
- 23.98 or 29.97
 - Constant frame rate only
 - Apple ProRes 422 HQ codec preferred
 - Audio (HD/SD): PCM (preferred) or AAC codec & 192 kbps minimum
 - **H.264** codec is accepted, but bitrate must be at least 50 Mbps
 - Interlaced video is not accepted
 - Constant Bitrate (CBR) 15-30 Mbps
 - Main Profile @ Main Level (MP@ML)
 - 4:2:0 Color Space
 - Please make content progressive.
 - Video must be submitted without leaders (i.e. slates, countdowns).
 - If assets are delivered with leaders, Hulu will edit them and a Production Fee will be added to the final invoice.

Premium Slate

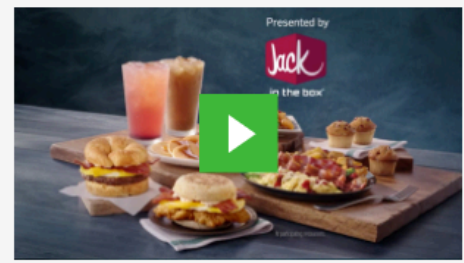
A Premium Slate is a branded :07 video introduction that appears before the advertiser's video commercial at the beginning of the show. Advertisers can create custom videos or leverage existing video creative. The video execution is accompanied by the standard intro text and "presented by" voice over.

AVAILABLE ON



TIMELINE

10 business days production lead-time from the receipt of the final asset



Specs

DELIVERABLES TO HULU

- Required video clip can either be created by Hulu using your :15 or :30 video or the brand can create a custom video clip.
- 3rd Party Tracking Tags (if applicable)

FILE FORMATS

- Video Option:
- Quicktime Movie (.mov) or MPEG-4 (.mp4) format only
- Static Image Option:
- Any full screen image in PSD format

SIZE

- SD
- 720 x 480
 - 4:3 or 16:9 pixel aspect ratio
 - No black bars
 - 3:2 display aspect ratio is not accepted
 - No letterboxing or pillarboxing
 - Bitrate: Greater than 2mbps.
 - Main Profile @ Main Level (MP@ML)
 - 4:2:2 Color Space
- HD
- 1280 x 720 or 1920 x 1080 (16:9)
 - 1440 x 1080 (4:3)
 - No black bars
 - Constant Bitrate (CBR) 15-30 Mbps
 - Main Profile @ Main Level (MP@ML)
 - 4:2:2 Color Space

MAX FILE SIZE

10 GB

CODEC

- Apple ProRes 422 HQ codec preferred
- H.264 codec is accepted, but bitrate must be at least 50 Mbps
- Interlaced video is not accepted

LENGTH

:07 seconds exactly

80. The Accused Instrumentalities also use H.264 video compression to select and compress based on parameters such as bitrate, as explained by the website "How Stuff Works" (<http://computer.howstuffworks.com/internet/basics/hulu4.htm>):

"Hulu.com uses Cascading Style Sheets (CSS) and JavaScript to lay out its web pages, and it powers the video and controls through the Flash player and browser on your computer. When you request a video, Hulu sends it to you it as a Flash format streaming video file (FLV) along with the video player and the sponsors' advertisements.

Hulu encodes the video file for one of two types of video encoding devices (known as codecs) that translates streaming data into the moving images on your screen and the sound in your speakers. Hulu sends the file to you at one of **five speeds, or bitrates, measured as the amount of data sent per second**. When you play a video, the codec Hulu uses depends on the bitrate at which it's sending the video to you.

1 The site uses the On2 Flash VP6 codec for video streams that run at bitrates of
2 480 kilobits per second (Kbps) and 700 Kbps. This codec is supported by
3 Flash versions 8.0 and higher, which is installed in more than 98 percent of
4 computers in the U.S. Hulu's higher bitrate streams of 1,000 Kbps and 2,500
Kbps use a codec that requires a bit more from your Internet connection. This
more intensive codec **follows the H.264 video coding standard**, which
requires Flash 9.0.124.0 or higher [source: Hulu].

5 How does all of this come together? While you're viewing most videos on
6 Hulu, **you control the bitrate** when you switch between two progressive scan
rates: 360p (standard resolution) or 480p (high resolution).

7 81. The Accused Instrumentalities determine a parameter of at least a portion of a video
8 data block. As shown below, examples of such parameters include bitrate (or max video bitrate) and
9 resolution parameters. Different parameters correspond with different end applications. H.264
10 provides for multiple different ranges of such parameters, each included in the “profiles” and
11 “levels” as defined by the H.264 standard, from the below shown paragraphs from a white paper and
12 Wikipedia. See http://www.axis.com/files/whitepaper/wp_h264_31669_en_0803_lo.pdf at 5:

13 **4. H.264 profiles and levels**

14 The joint group involved in defining H.264 focused on creating a simple and clean solution, limiting
15 options and features to a minimum. An important aspect of the standard, as with other video standards,
16 is providing the capabilities in profiles (sets of algorithmic features) and levels (performance classes)
that optimally support popular productions and common formats.

17 H.264 has seven profiles, each targeting a specific class of applications. Each profile defines what
18 feature set the encoder may use and limits the decoder implementation complexity.

19 Network cameras and video encoders will most likely use a profile called the baseline profile, which is
20 intended primarily for applications with limited computing resources. The baseline profile is the most
21 suitable given the available performance in a real-time encoder that is embedded in a network video
product. The profile also enables low latency, which is an important requirement of surveillance video and
also particularly important in enabling real-time, pan/tilt/zoom (PTZ) control in PTZ network cameras.

22 H.264 has 11 levels or degree of capability to limit performance, bandwidth and memory requirements.
23 Each level defines the bit rate and the encoding rate in macroblock per second for resolutions ranging
from QCIF to HDTV and beyond. The higher the resolution, the higher the level required.

24
25 See https://en.wikipedia.org/wiki/H.264/MPEG-4_AVC:
26
27
28

Levels with maximum property values

Level	Max decoding speed		Max frame size		Max video bit rate for video coding layer (VCL) kbit/s			Examples for high resolution @ highest frame rate (max stored frames) Toggle additional details
	Luma samples/s	Macroblocks/s	Luma samples	Macroblocks	Baseline, Extended and Main Profiles	High Profile	High 10 Profile	
1	380,160	1,485	25,344	99	64	80	192	176x144@15.0 (4)
1b	380,160	1,485	25,344	99	128	160	384	176x144@15.0 (4)
1.1	768,000	3,000	101,376	396	192	240	576	352x288@7.5 (2)
1.2	1,536,000	6,000	101,376	396	384	480	1,152	352x288@15.2 (6)
1.3	3,041,280	11,880	101,376	396	768	960	2,304	352x288@30.0 (6)
2	3,041,280	11,880	101,376	396	2,000	2,500	6,000	352x288@30.0 (6)
2.1	5,068,800	19,800	202,752	792	4,000	5,000	12,000	352x576@25.0 (6)
2.2	5,184,000	20,250	414,720	1,620	4,000	5,000	12,000	720x576@12.5 (5)
3	10,368,000	40,500	414,720	1,620	10,000	12,500	30,000	720x576@25.0 (5)
3.1	27,648,000	108,000	921,600	3,600	14,000	17,500	42,000	1,280x720@30.0 (5)
3.2	55,296,000	216,000	1,310,720	5,120	20,000	25,000	60,000	1,280x1,024@42.2 (4)
4	62,914,560	245,760	2,097,152	8,192	20,000	25,000	60,000	2,048x1,024@30.0 (4)
4.1	62,914,560	245,760	2,097,152	8,192	50,000	62,500	150,000	2,048x1,024@30.0 (4)
4.2	133,693,440	522,240	2,228,224	8,704	50,000	62,500	150,000	2,048x1,080@60.0 (4)
5	150,994,944	589,824	5,652,480	22,080	135,000	168,750	405,000	3,672x1,536@26.7 (5)
5.1	251,658,240	983,040	9,437,184	36,864	240,000	300,000	720,000	4,096x2,304@26.7 (5)
5.2	530,841,600	2,073,600	9,437,184	36,864	240,000	300,000	720,000	4,096x2,304@56.3 (5)

82. A video data block is organized by the group of pictures (GOP) structure, which is a “collection of successive pictures within a coded video stream.” See Wikipedia Article on Group of Pictures, https://en.wikipedia.org/wiki/Group_of_pictures. A GOP structure can contain intra coded pictures (I picture or I frame), predictive coded pictures (P picture or P frame), bipredictive coded pictures (B picture or B frame) and direct coded pictures (D picture or D frames, or DC direct coded pictures which are used only in MPEG-1 video). See Wikipedia Articles on Video Compression Types and MPEG-1, https://en.wikipedia.org/wiki/Video_compression_picture_types (for descriptions of I frames, P frames and B frames); <https://en.wikipedia.org/wiki/MPEG-1#D-frames> (for descriptions of D frames). Thus, at least a portion of a video data block would also make up a GOP structure and could also contain I frames, P frames, B frames and/or D frames. The GOP structure also reflects the size of a video data block, and the GOP structure can be controlled and used to fine-tune other parameters (e.g. bitrate, max video bitrate and resolution parameters) or even be considered as a parameter by itself.

83. Based on the bitrate and/or resolution parameter identified (e.g. bitrate, max video bitrate, resolution, GOP structure or frame type within a GOP structure), any H.264-compliant

1 system such as the Accused Instrumentalities would determine which profile (e.g., “baseline,”
 2 “extended,” “main”, or “high”) corresponds with that parameter, then select between at least two
 3 asymmetric compressors. If baseline or extended is the corresponding profile, then the system will
 4 select a Context-Adaptive Variable Length Coding (“CAVLC”) entropy encoder. If main or high is
 5 the corresponding profile, then the system will select a Context-Adaptive Binary Arithmetic Coding
 6 (“CABAC”) entropy encoder. Both encoders are asymmetric compressors because it takes a longer
 7 period of time for them to compress data than to decompress data. *See*

8 <https://sonnati.wordpress.com/2007/10/29/how-h-264-works-part-ii/>:

	Baseline	Extended	Main	High	High 10
I and P Slices	Yes	Yes	Yes	Yes	Yes
B Slices	No	Yes	Yes	Yes	Yes
SI and SP Slices	No	Yes	No	No	No
Multiple Reference Frames	Yes	Yes	Yes	Yes	Yes
In-Loop Deblocking Filter	Yes	Yes	Yes	Yes	Yes
CAVLC Entropy Coding	Yes	Yes	Yes	Yes	Yes
CABAC Entropy Coding	No	No	Yes	Yes	Yes
Flexible Macroblock Ordering (FMO)	Yes	Yes	No	No	No
Arbitrary Slice Ordering (ASO)	Yes	Yes	No	No	No
Redundant Slices (RS)	Yes	Yes	No	No	No
Data Partitioning	No	Yes	No	No	No
Interlaced Coding (PicAFF, MBAFF)	No	Yes	Yes	Yes	Yes
4:2:0 Chroma Format	Yes	Yes	Yes	Yes	Yes
Monochrome Video Format (4:0:0)	No	No	No	Yes	Yes
4:2:2 Chroma Format	No	No	No	No	No
4:4:4 Chroma Format	No	No	No	No	No
8 Bit Sample Depth	Yes	Yes	Yes	Yes	Yes
9 and 10 Bit Sample Depth	No	No	No	No	Yes
11 to 14 Bit Sample Depth	No	No	No	No	No
8x8 vs. 4x4 Transform Adaptivity	No	No	No	Yes	Yes
Quantization Scaling Matrices	No	No	No	Yes	Yes
Separate Cb and Cr QP control	No	No	No	Yes	Yes
Separate Color Plane Coding	No	No	No	No	No
Predictive Lossless Coding	No	No	No	No	No

1 See http://web.cs.ucla.edu/classes/fall03/cs218/paper/H.264_MPEG4_Tutorial.pdf at 7:

2 The following table summarizes the two major types of entropy coding: Variable Length
3 Coding (VLC) and Context Adaptive Binary Arithmetic Coding (CABAC). CABAC offers
4 superior coding efficiency over VLC by adapting to the changing probability distribution
5 of symbols, by exploiting correlation between symbols, and by adaptively exploiting bit
6 correlations using arithmetic coding. H.264 also supports Context Adaptive Variable Length
7 Coding (CAVLC) which offers superior entropy coding over VLC without the full cost of
8 CABAC.

9 H.264 Entropy Coding – Comparison of Approaches

10 Characteristics	11 Variable Length Coding (VLC)	12 Context Adaptive Binary Arithmetic Coding (CABAC)
13 • Where it is used	MPEG-2, MPEG-4 ASP	H.264/MPEG-4 AVC (high efficiency option)
14 • Probability distribution	Static - Probabilities never change	Adaptive - Adjusts probabilities based on actual data
15 • Leverages correlation between symbols	No - Conditional probabilities ignored	Yes - Exploits symbol correlations by using "contexts"
16 • Non-integer code words	No - Low coding efficiency for high probability symbols	Yes - Exploits "arithmetic coding" which generates non-integer code words for higher efficiency

17 Moreover, the H.264 Standard requires a bit-flag descriptor, which is set to determine the
18 correct decoder for the corresponding encoder. As shown below, if the flag = 0, then CAVLC must
19 have been selected as the encoder; if the flag = 1, then CABAC must have been selected as the
20 encoder. See https://www.itu.int/rec/dologin_pub.asp?lang=e&id=T-REC-H.264-201304-S!!PDF-E&type=items (Rec. ITU-T H.264 (04/2013)) at 80:

21 **entropy_coding_mode_flag** selects the entropy decoding method to be applied for the syntax elements for which two
22 descriptors appear in the syntax tables as follows:

- 23 – If **entropy_coding_mode_flag** is equal to 0, the method specified by the left descriptor in the syntax table is applied (Exp-Golomb coded, see clause 9.1 or CAVLC, see clause 9.2).
- 24 – Otherwise (**entropy_coding_mode_flag** is equal to 1), the method specified by the right descriptor in the syntax table is applied (CABAC, see clause 9.3).

25 84. The Accused Instrumentalities compress the at least the portion of the data block with
26 the selected one or more asymmetric compressors to provide one or more compressed data blocks,
27 which can be organized in a GOP structure (see above). After its selection, the asymmetric
28 compressor (CAVLC or CABAC) will compress the video data to provide various compressed data
29 blocks, which can also be organized in a GOP structure, as discussed previously above. See
30 <https://sonnati.wordpress.com/2007/10/29/how-h-264-works-part-ii/>:

Entropy Coding

For entropy coding, H.264 may use an enhanced VLC, a more complex context-adaptive variable-length coding (CAVLC) or an ever more complex Context-adaptive binary-arithmetic coding (CABAC) which are complex techniques to losslessly compress syntax elements in the video stream knowing the probabilities of syntax elements in a given context. The use of CABAC can improve the compression of around 5-7%. CABAC may requires a 30-40% of total processing power to be accomplished.

See <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.602.1581&rep=rep1&type=pdf> at 13:

Typical compression ratios to maintain excellent quality are:

- 10:1 for general images using JPEG
- 30:1 for general video using H.263 and MPEG-2
- 60:1 for general video using H.264 and WMV9

See http://www.ijera.com/papers/Vol3_issue4/BM34399403.pdf at 2:

Most visual communication systems today use Baseline Profile. Baseline is the simplest H.264 profile and defines, for example, zigzag scanning of the picture and using 4:2:0 (YUV video formats) chrominance sampling. In Baseline Profile, the picture is split in blocks consisting of 4x4 pixels, and each block is processed separately. Another important element of the Baseline Profile is the use of Universal Variable Length Coding (UVLC) and Context Adaptive Variable Length Coding (CAVLC) entropy coding techniques.

The Extended and Main Profiles includes the functionality of the Baseline Profile and add improvements to the predictions algorithms. Since transmitting every single frame (think 30 frames per second for good quality video) is not feasible if you are trying to reduce the bit rate 1000-2000 times, temporal and motion prediction are heavily used in H.264, and allow transmitting only the difference between one frame and the previous frames. The result is spectacular efficiency gain, especially for scenes with little change and motion.

The High Profile is the most powerful profile in H.264, and it allows most efficient coding of video. For example, large coding gain achieved through the use of Context Adaptive Binary Arithmetic Coding (CABAC) encoding which is more efficient than the UVLC/CAVLC used in Baseline Profile.

The High Profile also uses adaptive transform that decides on the fly if 4x4 or 8x8-pixel blocks should be used. For example, 4x4 blocks are used for the parts of the picture that are dense with detail, while parts that have little detail are transformed using 8x8 blocks.

1 85. Therefore, on information and belief, Hulu has directly infringed and continues to
2 infringe the '046 patent, for example, through its sale, offer for sale, importation, use and testing of
3 the Accused Instrumentalities, which practices the system claimed by Claim 40 of the '046 patent,
4 namely, a system, comprising: a data compression system for compressing and decompressing data
5 input; a plurality of compression routines selectively utilized by the data compression system,
6 wherein a first one of the plurality of compression routines includes a first compression algorithm
7 and a second one of the plurality of compression routines includes a second compression algorithm;
8 and a controller for tracking throughput and generating a control signal to select a compression
9 routine based on the throughput, wherein said tracking throughput comprises tracking a number of
10 pending access requests to a storage device; and wherein when the controller determines that the
11 throughput falls below a predetermined throughput threshold, the controller commands the data
12 compression engine to use one of the plurality of compression routines to provide a faster rate of
13 compression so as to increase the throughput.

14 86. On information and belief, the Accused Instrumentalities store at least a portion of the
15 one or more compressed data blocks in buffers, hard disk, or other forms of memory/storage.

16 87. On information and belief, Hulu also directly infringes and continues to infringe other
17 claims of the '046 patent, for similar reasons as explained above with respect to Claim 40 of the '046
18 patent.

19 88. On information and belief, all of the Accused Instrumentalities perform the claimed
20 methods in substantially the same way, e.g., in the manner specified in the H.264 standard.

21 89. On information and belief, use of the Accused Instrumentalities in their ordinary and
22 customary fashion results in infringement of the methods claimed by the '046 patent.

23 90. On information and belief, Hulu has had knowledge of the '046 patent since at least
24 the filing of this Complaint or shortly thereafter, and on information and belief, Hulu knew of
25 the '046 patent and knew of its infringement, including by way of this lawsuit. By the time of trial,
26 Hulu will have known and intended (since receiving such notice) that its continued actions would
27 actively induce and contribute to the infringement of the claims of the '046 patent.

28 91. Upon information and belief, Hulu's affirmative acts of making, using, and selling the

1 Accused Instrumentalities, and providing implementation services and technical support to users of
2 the Accused Instrumentalities, including, e.g., through training, demonstrations, brochures,
3 installation and user guides, have induced (at least since filing of this action) and continue to induce
4 users of the Accused Instrumentalities to use them in their normal and customary way to infringe
5 the '046 patent by practicing a system, comprising: a data compression system for compressing and
6 decompressing data input; a plurality of compression routines selectively utilized by the data
7 compression system, wherein a first one of the plurality of compression routines includes a first
8 compression algorithm and a second one of the plurality of compression routines includes a second
9 compression algorithm; and a controller for tracking throughput and generating a control signal to
10 select a compression routine based on the throughput, wherein said tracking throughput comprises
11 tracking a number of pending access requests to a storage device; and wherein when the controller
12 determines that the throughput falls below a predetermined throughput threshold, the controller
13 commands the data compression engine to use one of the plurality of compression routines to
14 provide a faster rate of compression so as to increase the throughput. For example, Hulu adopted
15 H.264 as its video codec in its streaming products/services, such as, e.g., Hulu's streaming service,
16 Hulu's video compression media encoders, and Hulu's ad products for brands. For similar reasons,
17 Hulu also induces its customers to use the Accused Instrumentalities to infringe other claims of
18 the '046 patent. Hulu specifically intended and was aware that these normal and customary
19 activities would infringe the '046 patent. Hulu performed the acts that constitute induced
20 infringement, and would induce actual infringement, with the knowledge of the '046 patent and with
21 the knowledge, or willful blindness to the probability, that the induced acts would constitute
22 infringement. On information and belief, Hulu engaged in such inducement to promote the sales of
23 the Accused Instrumentalities. Accordingly, Hulu has induced (at least since filing of this action)
24 and continues to induce users of the Accused Instrumentalities to use the Accused Instrumentalities
25 in their ordinary and customary way to infringe the '046 patent, knowing that such use constitutes
26 infringement of the '046 patent. Accordingly, Hulu has been (at least since filing of this action), and
27 currently is, inducing infringement of the '046 patent, in violation of 35 U.S.C. § 271(b).

28 92. Hulu has also infringed, and continues to infringe, claims of the '046 patent by

1 offering to commercially distribute, commercially distributing, making, and/or importing the
2 Accused Instrumentalities, which are used in practicing the process, or using the systems, of the '046
3 patent, and constitute a material part of the invention. Hulu knows the components in the Accused
4 Instrumentalities to be especially made or especially adapted for use in infringement of the '046
5 patent, not a staple article, and not a commodity of commerce suitable for substantial noninfringing
6 use. Accordingly, Hulu has been, and currently is, contributorily infringing the '046 patent, in
7 violation of 35 U.S.C. § 271(c).

8 93. By making, using, offering for sale, selling and/or importing into the United States
9 the Accused Instrumentalities, and touting the benefits of using the Accused Instrumentalities'
10 compression features, Hulu has injured Realtime and is liable to Realtime for infringement of
11 the '046 patent pursuant to 35 U.S.C. § 271.

12 94. As a result of Hulu's infringement of the '046 patent, Plaintiff Realtime is entitled to
13 monetary damages in an amount adequate to compensate for Hulu's infringement, but in no event
14 less than a reasonable royalty for the use made of the invention by Hulu, together with interest and
15 costs as fixed by the Court.

16 COUNT V

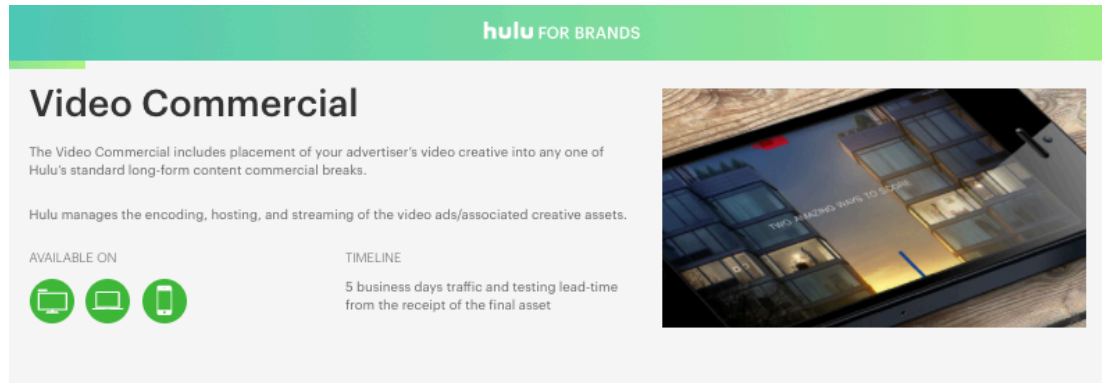
17 INFRINGEMENT OF U.S. PATENT NO. 8,867,610

18 95. Plaintiff re-alleges and incorporates by reference the foregoing paragraphs, as if fully
19 set forth herein.

20 96. On information and belief, Hulu has made, used, offered for sale, sold and/or
21 imported into the United States Hulu products that infringe the '610 patent, and continues to do so.
22 By way of illustrative example, these infringing products include, without limitation, Hulu's
23 streaming products/services, such as, e.g., Hulu's streaming service, Hulu's video compression
24 media encoders, Hulu's ad products for brands including Hulu's Ad Selector, Hulu's Blockbuster,
25 Hulu's Branded Entertainment Selector, Hulu's Custom Integrated Commercial, Hulu's Interactive
26 Interstitial, Hulu's Interactive Interstitial Template (DR), Hulu's Masthead Brand Placement, Hulu's
27 Page Brand Placement, Hulu's Premium Slate, Hulu's Slate, Hulu's T-Commerce, Hulu's Video
28 Commercial, Hulu VR, Hulu's 4K video services, and all versions and variations thereof since the

1 issuance of the '610 patent (“Accused Instrumentalities”)

2 97. For example, the Accused Instrumentalities utilize the H.264 video compression
 3 standard, as can be seen by the below screenshot of Hulu’s Video Commercial ad product for brands
 4 (<https://www.hulu.com/advertising/ad-product/video-commercial/>):



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13 **Specs**

DELIVERABLES TO HULU

- Video Commercial – ProRes .MOV
- 3rd Party Tracking Tags (if applicable).
- Video: 1 x 1 trackers and click commands
- Max standard video commercial length is :60s

SIZE

- SD
- 720 x 480
 - 4:3 or 16:9 pixel aspect ratio
 - No black bars
 - 3:2 display aspect ratio is not accepted
 - No letterboxing or pillarboxing
 - Bitrate: Greater than 2mbps.
 - Main Profile @ Main Level (MP@ML)
 - 4:2:2 Color Space
- HD
- 1280 x 720 or 1920 x 1080 (16:9)
 - 1440 x 1080 (4:3)
 - No black bars
 - Constant Bitrate (CBR) 15-30 Mbps
 - Main Profile @ Main Level (MP@ML)
 - 4:2:2 Color Space

FILE FORMATS

- Quicktime movie (.mov)
- MPEG-4 (.mp4) format only

AUDIO

- 2 channels only
- PCM (preferred) or AAC codec
- 192 kbps minimum
- 16 or 24 bit only
- 48 kHz sample rate
- Audio is required

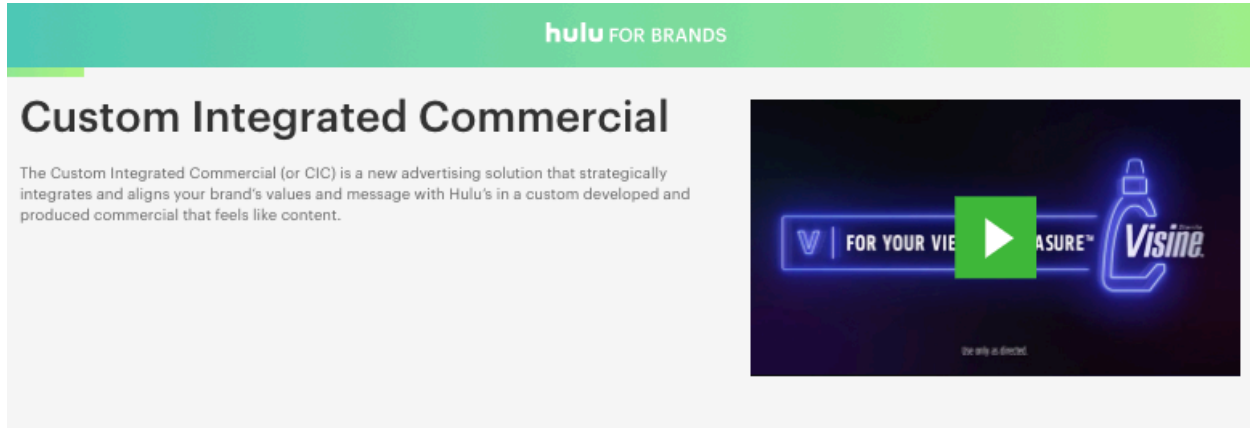
FRAME RATE

- 23.98, 25, or 29.97 based on native frame rate
- Remove any pull-down added for broadcast
- Constant frame rate only
- Please make content progressive using adaptive de-interlace with no frame blending.

CODEC

- Apple ProRes 422 HQ codec preferred
- **H.264** codec
- Interlaced video is not accepted

1 98. The Accused Instrumentalities also accept the usage of the H.264 video compression
 2 standard. For example, on the page for Hulu’s Custom Integrated Commercial ad product
 3 (<https://www.hulu.com/advertising/ad-product/custom-integrated-commercial/>), under header
 4 “Specs” and sub-header “Codec” is listed the text “H.264 codec is accepted.”:



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14 **Specs**

15 **DELIVERABLES TO HULU**

While Hulu is able to work with a great variety of assets in the creation of a Custom Integrated Commercial (or “CIC”), the preferred formats, where appropriate and available, include:

- Apple ProRes 422 (HQ) video files
- Accompanying audio, split-track (if available)
- Vector brand logos in .eps or .ai format (if available)
- Brand style guides
- Brand font
- For motion graphics assets, AE project files with associated media (if available)

16 **SIZE**

- 1280 x 720 or 1920 x 1080 (16:9)
- 1440 x 1080 (4:3)
- No black bars
- Constant Bitrate (CBR) 15-30 Mbps
- Main Profile @ Main Level (MP@ML)
- 4:2:2 Color Space

17 **FILE FORMATS**

- Quicktime movie (.mov)
- MPEG-4 (.mp4) format only

18 **AUDIO**

- 2 channels only
- Audio (HD/SD): 192 kbps minimum & PCM (preferred) or AAC codec
- 16 or 24 bit only
- 48 kHz sample rate
- Audio is required

19 **FRAME RATE**

- 23.98, 25, or 29.97 based on native frame rate
- Remove any pull-down added for broadcast
- Constant frame rate only
- Please make content progressive using adaptive de-interlace with no frame blending.

20 **CODEC**

- Apple ProRes 422 HQ codec preferred
- **H.264** codec is accepted
- Interlaced video is not accepted

1 99. Similarly, on the page for Hulu’s Interactive Interstitial ad product
 2 (<https://www.hulu.com/advertising/ad-product/interactive-interstitial/>) under header “Specs” and
 3 sub-header “Video” is listed the text “H.264 codec is accepted, but bitrate must be at least 50 Mbps.”
 4 Likewise, on the page for Hulu’s Interactive Interstitial Template (DR)
 5 (<https://www.hulu.com/advertising/ad-product/interactive-interstitial-template-dr/>) , the same text
 6 “H.264 codec is accepted, but bitrate must be at least 50 Mbps” is listed under header “Specs” and
 7 sub-header “Video.” In addition, on the page for Hulu’s Premium Slate ad product
 8 (<https://www.hulu.com/advertising/ad-product/premium-slate/>) the text “(H.264 codec is accepted,
 9 but bitrate must be at least 50 Mbps)” is listed under header “Specs” and sub-header “Codec.”
 10 Representative screenshots are shown below:

Specs

DELIVERABLES TO HULU

- Product Images (if applicable)
- Audio (background audio must be heard throughout entire unit)
- Brand logo (Vector .AI or .EPS preferred, .PSD accepted)
- Copy & calls-to-action (if applicable)
- Third-party tags
- Click-thru URLs

LEAN-BACK / LEAN-FORWARD

- Lean-back experience**
 Will time out if the user does not interact with the unit. Will include the standard Hulu ad countdown bar in the top 35 pixels of the player window.
 Click through to another site from within the interstitial will open a new browser window.
- Lean-forward experience**
 If interaction options are available within the unit, a "Return to Video" option will appear if a user decides to click somewhere within the unit allowing them to return to the content experience whenever they are ready (this prevents a user from voluntarily becoming engaged and the user getting "kicked out" at the end of the experience).

VIDEO

- If client is providing uncompressed video:
- 23.98 or 29.97
 - Constant frame rate only
 - Apple ProRes 422 HQ codec preferred
 - Audio (HD/SD): PCM (preferred) or AAC codec & 192 kbps minimum
 - **H.264** codec is accepted, but bitrate must be at least 50 Mbps
 - Interlaced video is not accepted
 - Constant Bitrate (CBR) 15-30 Mbps
 - Main Profile @ Main Level (MP@ML)
 - 4:2:0 Color Space
 - Please make content progressive.
 - Video must be submitted without leaders (i.e. slates, countdowns).
 - If assets are delivered with leaders, Hulu will edit them and a Production Fee will be added to the final invoice.

Specs

DELIVERABLES TO HULU

- Brand logo (Vector .AI or .EPS preferred, .PSD accepted)
- Social media urls (click-trackers accepted)
- Click-thru URL for Video
- Click-thru URL for Logo
- Click-thru URL for CTA Button
- Copy for the body of the unit
- CTA copy for button
- Time when video should start shrinking
- Solid Background: HEX color code for the top portion of the unit, HEX color code for the bottom portion of the unit and HEX color code for the button
- Background Image: Please reference template for specs

SIZE

1184x666

VIDEO

- If client is providing uncompressed video:
- 23.98 or 29.97
 - Constant frame rate only
 - Apple ProRes 422 HQ codec preferred
 - Audio (HD/SD): PCM (preferred) or AAC codec & 192 kbps minimum
 - **H.264** codec is accepted, but bitrate must be at least 50 Mbps
 - Interlaced video is not accepted
 - Constant Bitrate (CBR) 15-30 Mbps
 - Main Profile @ Main Level (MP@ML)
 - 4:2:0 Color Space
 - Please make content progressive.
 - Video must be submitted without leaders (i.e. slates, countdowns).
 - If assets are delivered with leaders, Hulu will edit them and a Production Fee will be added to the final invoice.

Premium Slate

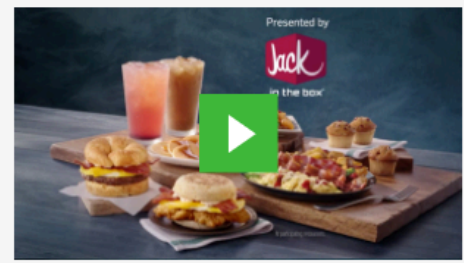
A Premium Slate is a branded :07 video introduction that appears before the advertiser's video commercial at the beginning of the show. Advertisers can create custom videos or leverage existing video creative. The video execution is accompanied by the standard intro text and "presented by" voice over.

AVAILABLE ON



TIMELINE

10 business days production lead-time from the receipt of the final asset



Specs

DELIVERABLES TO HULU

- Required video clip can either be created by Hulu using your :15 or :30 video or the brand can create a custom video clip.
- 3rd Party Tracking Tags (if applicable)

FILE FORMATS

- Video Option:
- Quicktime Movie (.mov) or MPEG-4 (.mp4) format only
- Static Image Option:
- Any full screen image in PSD format

SIZE

- SD
- 720 x 480
 - 4:3 or 16:9 pixel aspect ratio
 - No black bars
 - 3:2 display aspect ratio is not accepted
 - No letterboxing or pillarboxing
 - Bitrate: Greater than 2mbps.
 - Main Profile @ Main Level (MP@ML)
 - 4:2:2 Color Space
- HD
- 1280 x 720 or 1920 x 1080 (16:9)
 - 1440 x 1080 (4:3)
 - No black bars
 - Constant Bitrate (CBR) 15-30 Mbps
 - Main Profile @ Main Level (MP@ML)
 - 4:2:2 Color Space

MAX FILE SIZE

10 GB

CODEC

- Apple ProRes 422 HQ codec preferred
- H.264 codec is accepted, but bitrate must be at least 50 Mbps
- Interlaced video is not accepted

LENGTH

:07 seconds exactly

100. The Accused Instrumentalities also use H.264 video compression to select and compress based on parameters such as bitrate, as explained by the website "How Stuff Works" (<http://computer.howstuffworks.com/internet/basics/hulu4.htm>):

"Hulu.com uses Cascading Style Sheets (CSS) and JavaScript to lay out its web pages, and it powers the video and controls through the Flash player and browser on your computer. When you request a video, Hulu sends it to you it as a Flash format streaming video file (FLV) along with the video player and the sponsors' advertisements.

Hulu encodes the video file for one of two types of video encoding devices (known as codecs) that translates streaming data into the moving images on your screen and the sound in your speakers. Hulu sends the file to you at one of **five speeds, or bitrates, measured as the amount of data sent per second**. When you play a video, the codec Hulu uses depends on the bitrate at which it's sending the video to you.

1 The site uses the On2 Flash VP6 codec for video streams that run at bitrates of
2 480 kilobits per second (Kbps) and 700 Kbps. This codec is supported by
3 Flash versions 8.0 and higher, which is installed in more than 98 percent of
4 computers in the U.S. Hulu's higher bitrate streams of 1,000 Kbps and 2,500
Kbps use a codec that requires a bit more from your Internet connection. This
more intensive codec **follows the H.264 video coding standard**, which
requires Flash 9.0.124.0 or higher [source: Hulu].

5 How does all of this come together? While you're viewing most videos on
6 Hulu, **you control the bitrate** when you switch between two progressive scan
rates: 360p (standard resolution) or 480p (high resolution).

7 101. The Accused Instrumentalities determine a parameter of at least a portion of a video
8 data block. As shown below, examples of such parameters include bitrate (or max video bitrate) and
9 resolution parameters. Different parameters correspond with different end applications. H.264
10 provides for multiple different ranges of such parameters, each included in the “profiles” and
11 “levels” as defined by the H.264 standard, from the below shown paragraphs from a white paper and
12 Wikipedia. See http://www.axis.com/files/whitepaper/wp_h264_31669_en_0803_lo.pdf at 5:

13 4. H.264 profiles and levels

14 The joint group involved in defining H.264 focused on creating a simple and clean solution, limiting
15 options and features to a minimum. An important aspect of the standard, as with other video standards,
16 is providing the capabilities in profiles (sets of algorithmic features) and levels (performance classes)
that optimally support popular productions and common formats.

17 H.264 has seven profiles, each targeting a specific class of applications. Each profile defines what
18 feature set the encoder may use and limits the decoder implementation complexity.

19 Network cameras and video encoders will most likely use a profile called the baseline profile, which is
20 intended primarily for applications with limited computing resources. The baseline profile is the most
21 suitable given the available performance in a real-time encoder that is embedded in a network video
product. The profile also enables low latency, which is an important requirement of surveillance video and
also particularly important in enabling real-time, pan/tilt/zoom (PTZ) control in PTZ network cameras.

22 H.264 has 11 levels or degree of capability to limit performance, bandwidth and memory requirements.
23 Each level defines the bit rate and the encoding rate in macroblock per second for resolutions ranging
from QCIF to HDTV and beyond. The higher the resolution, the higher the level required.

24
25 See https://en.wikipedia.org/wiki/H.264/MPEG-4_AVC:
26
27
28

Levels with maximum property values

Level	Max decoding speed		Max frame size		Max video bit rate for video coding layer (VCL) kbit/s			Examples for high resolution @ highest frame rate (max stored frames) Toggle additional details
	Luma samples/s	Macroblocks/s	Luma samples	Macroblocks	Baseline, Extended and Main Profiles	High Profile	High 10 Profile	
1	380,160	1,485	25,344	99	64	80	192	176x144@15.0 (4)
1b	380,160	1,485	25,344	99	128	160	384	176x144@15.0 (4)
1.1	768,000	3,000	101,376	396	192	240	576	352x288@7.5 (2)
1.2	1,536,000	6,000	101,376	396	384	480	1,152	352x288@15.2 (6)
1.3	3,041,280	11,880	101,376	396	768	960	2,304	352x288@30.0 (6)
2	3,041,280	11,880	101,376	396	2,000	2,500	6,000	352x288@30.0 (6)
2.1	5,068,800	19,800	202,752	792	4,000	5,000	12,000	352x576@25.0 (6)
2.2	5,184,000	20,250	414,720	1,620	4,000	5,000	12,000	720x576@12.5 (5)
3	10,368,000	40,500	414,720	1,620	10,000	12,500	30,000	720x576@25.0 (5)
3.1	27,648,000	108,000	921,600	3,600	14,000	17,500	42,000	1,280x720@30.0 (5)
3.2	55,296,000	216,000	1,310,720	5,120	20,000	25,000	60,000	1,280x1,024@42.2 (4)
4	62,914,560	245,760	2,097,152	8,192	20,000	25,000	60,000	2,048x1,024@30.0 (4)
4.1	62,914,560	245,760	2,097,152	8,192	50,000	62,500	150,000	2,048x1,024@30.0 (4)
4.2	133,693,440	522,240	2,228,224	8,704	50,000	62,500	150,000	2,048x1,080@60.0 (4)
5	150,994,944	589,824	5,652,480	22,080	135,000	168,750	405,000	3,672x1,536@26.7 (5)
5.1	251,658,240	983,040	9,437,184	36,864	240,000	300,000	720,000	4,096x2,304@26.7 (5)
5.2	530,841,600	2,073,600	9,437,184	36,864	240,000	300,000	720,000	4,096x2,304@56.3 (5)

102. A video data block is organized by the group of pictures (GOP) structure, which is a “collection of successive pictures within a coded video stream.” *See* Wikipedia Article on Group of Pictures, https://en.wikipedia.org/wiki/Group_of_pictures. A GOP structure can contain intra coded pictures (I picture or I frame), predictive coded pictures (P picture or P frame), bipredictive coded pictures (B picture or B frame) and direct coded pictures (D picture or D frames, or DC direct coded pictures which are used only in MPEG-1 video). *See* Wikipedia Articles on Video Compression Types and MPEG-1, https://en.wikipedia.org/wiki/Video_compression_picture_types (for descriptions of I frames, P frames and B frames); <https://en.wikipedia.org/wiki/MPEG-1#D-frames> (for descriptions of D frames). Thus, at least a portion of a video data block would also make up a GOP structure and could also contain I frames, P frames, B frames and/or D frames. The GOP structure also reflects the size of a video data block, and the GOP structure can be controlled and used to fine-tune other parameters (e.g. bitrate, max video bitrate and resolution parameters) or even be considered as a parameter by itself.

103. Based on the bitrate and/or resolution parameter identified (e.g. bitrate, max video bitrate, resolution, GOP structure or frame type within a GOP structure), any H.264-compliant

1 system such as the Accused Instrumentalities would determine which profile (e.g., “baseline,”
 2 “extended,” “main”, or “high”) corresponds with that parameter, then select between at least two
 3 asymmetric compressors. If baseline or extended is the corresponding profile, then the system will
 4 select a Context-Adaptive Variable Length Coding (“CAVLC”) entropy encoder. If main or high is
 5 the corresponding profile, then the system will select a Context-Adaptive Binary Arithmetic Coding
 6 (“CABAC”) entropy encoder. Both encoders are asymmetric compressors because it takes a longer
 7 period of time for them to compress data than to decompress data. *See*

8 <https://sonnati.wordpress.com/2007/10/29/how-h-264-works-part-ii/>:

	Baseline	Extended	Main	High	High 10
I and P Slices	Yes	Yes	Yes	Yes	Yes
B Slices	No	Yes	Yes	Yes	Yes
SI and SP Slices	No	Yes	No	No	No
Multiple Reference Frames	Yes	Yes	Yes	Yes	Yes
In-Loop Deblocking Filter	Yes	Yes	Yes	Yes	Yes
CAVLC Entropy Coding	Yes	Yes	Yes	Yes	Yes
CABAC Entropy Coding	No	No	Yes	Yes	Yes
Flexible Macroblock Ordering (FMO)	Yes	Yes	No	No	No
Arbitrary Slice Ordering (ASO)	Yes	Yes	No	No	No
Redundant Slices (RS)	Yes	Yes	No	No	No
Data Partitioning	No	Yes	No	No	No
Interlaced Coding (PicAFF, MBAFF)	No	Yes	Yes	Yes	Yes
4:2:0 Chroma Format	Yes	Yes	Yes	Yes	Yes
Monochrome Video Format (4:0:0)	No	No	No	Yes	Yes
4:2:2 Chroma Format	No	No	No	No	No
4:4:4 Chroma Format	No	No	No	No	No
8 Bit Sample Depth	Yes	Yes	Yes	Yes	Yes
9 and 10 Bit Sample Depth	No	No	No	No	Yes
11 to 14 Bit Sample Depth	No	No	No	No	No
8x8 vs. 4x4 Transform Adaptivity	No	No	No	Yes	Yes
Quantization Scaling Matrices	No	No	No	Yes	Yes
Separate Cb and Cr QP control	No	No	No	Yes	Yes
Separate Color Plane Coding	No	No	No	No	No
Predictive Lossless Coding	No	No	No	No	No

1 See http://web.cs.ucla.edu/classes/fall03/cs218/paper/H.264_MPEG4_Tutorial.pdf at 7:

2 The following table summarizes the two major types of entropy coding: Variable Length
3 Coding (VLC) and Context Adaptive Binary Arithmetic Coding (CABAC). CABAC offers
4 superior coding efficiency over VLC by adapting to the changing probability distribution
5 of symbols, by exploiting correlation between symbols, and by adaptively exploiting bit
6 correlations using arithmetic coding. H.264 also supports Context Adaptive Variable Length
7 Coding (CAVLC) which offers superior entropy coding over VLC without the full cost of
8 CABAC.

9 H.264 Entropy Coding – Comparison of Approaches

10 Characteristics	11 Variable Length Coding (VLC)	12 Context Adaptive Binary Arithmetic Coding (CABAC)
13 • Where it is used	MPEG-2, MPEG-4 ASP	H.264/MPEG-4 AVC (high efficiency option)
14 • Probability distribution	Static - Probabilities never change	Adaptive - Adjusts probabilities based on actual data
15 • Leverages correlation between symbols	No - Conditional probabilities ignored	Yes - Exploits symbol correlations by using "contexts"
16 • Non-integer code words	No - Low coding efficiency for high probability symbols	Yes - Exploits "arithmetic coding" which generates non-integer code words for higher efficiency

17 Moreover, the H.264 Standard requires a bit-flag descriptor, which is set to determine the
18 correct decoder for the corresponding encoder. As shown below, if the flag = 0, then CAVLC must
19 have been selected as the encoder; if the flag = 1, then CABAC must have been selected as the
20 encoder. See https://www.itu.int/rec/dologin_pub.asp?lang=e&id=T-REC-H.264-201304-S!!PDF-E&type=items (Rec. ITU-T H.264 (04/2013)) at 80:

21 **entropy_coding_mode_flag** selects the entropy decoding method to be applied for the syntax elements for which two
22 descriptors appear in the syntax tables as follows:

- 23 – If **entropy_coding_mode_flag** is equal to 0, the method specified by the left descriptor in the syntax table is applied (Exp-Golomb coded, see clause 9.1 or CAVLC, see clause 9.2).
- 24 – Otherwise (**entropy_coding_mode_flag** is equal to 1), the method specified by the right descriptor in the syntax table is applied (CABAC, see clause 9.3).

25 104. The Accused Instrumentalities compress the at least the portion of the data block with
26 the selected one or more asymmetric compressors to provide one or more compressed data blocks,
27 which can be organized in a GOP structure (see above). After its selection, the asymmetric
28 compressor (CAVLC or CABAC) will compress the video data to provide various compressed data
blocks, which can also be organized in a GOP structure, as discussed previously above. See
<https://sonnati.wordpress.com/2007/10/29/how-h-264-works-part-ii/>:

Entropy Coding

For entropy coding, H.264 may use an enhanced VLC, a more complex context-adaptive variable-length coding (CAVLC) or an ever more complex Context-adaptive binary-arithmetic coding (CABAC) which are complex techniques to losslessly compress syntax elements in the video stream knowing the probabilities of syntax elements in a given context. The use of CABAC can improve the compression of around 5-7%. CABAC may requires a 30-40% of total processing power to be accomplished.

See <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.602.1581&rep=rep1&type=pdf> at 13:

Typical compression ratios to maintain excellent quality are:

- 10:1 for general images using JPEG
- 30:1 for general video using H.263 and MPEG-2
- 60:1 for general video using H.264 and WMV9

See http://www.ijera.com/papers/Vol3_issue4/BM34399403.pdf at 2:

Most visual communication systems today use Baseline Profile. Baseline is the simplest H.264 profile and defines, for example, zigzag scanning of the picture and using 4:2:0 (YUV video formats) chrominance sampling. In Baseline Profile, the picture is split in blocks consisting of 4x4 pixels, and each block is processed separately. Another important element of the Baseline Profile is the use of Universal Variable Length Coding (UVLC) and Context Adaptive Variable Length Coding (CAVLC) entropy coding techniques.

The Extended and Main Profiles includes the functionality of the Baseline Profile and add improvements to the predictions algorithms. Since transmitting every single frame (think 30 frames per second for good quality video) is not feasible if you are trying to reduce the bit rate 1000-2000 times, temporal and motion prediction are heavily used in H.264, and allow transmitting only the difference between one frame and the previous frames. The result is spectacular efficiency gain, especially for scenes with little change and motion.

The High Profile is the most powerful profile in H.264, and it allows most efficient coding of video. For example, large coding gain achieved through the use of Context Adaptive Binary Arithmetic Coding (CABAC) encoding which is more efficient than the UVLC/CAVLC used in Baseline Profile.

The High Profile also uses adaptive transform that decides on the fly if 4x4 or 8x8-pixel blocks should be used. For example, 4x4 blocks are used for the parts of the picture that are dense with detail, while parts that have little detail are transformed using 8x8 blocks.

1 105. Therefore, on information and belief, Hulu has directly infringed and continues to
2 infringe the '610 patent, for example, through its sale, offer for sale, importation, use and testing of
3 the Accused Instrumentalities, which practices the system claimed by Claim 1 of the '610 patent,
4 namely, a method, comprising: determining, a parameter or an attribute of at least a portion of a data
5 block having video or audio data; selecting one or more compression algorithms from among a
6 plurality of compression algorithms to apply to the at least the portion of the data block based upon
7 the determined parameter or attribute and a throughput of a communication channel, at least one of
8 the plurality of compression algorithms being asymmetric; and compressing the at least the portion
9 of the data block with the selected compression algorithm after selecting the one or more
10 compression algorithms.

11 106. On information and belief, the Accused Instrumentalities store at least a portion of the
12 one or more compressed data blocks in buffers, hard disk, or other forms of memory/storage.

13 107. On information and belief, Hulu also directly infringes and continues to infringe other
14 claims of the '610 patent, for similar reasons as explained above with respect to Claim 1 of the '610
15 patent.

16 108. On information and belief, all of the Accused Instrumentalities perform the claimed
17 methods in substantially the same way, e.g., in the manner specified in the H.264 standard.

18 109. On information and belief, use of the Accused Instrumentalities in their ordinary and
19 customary fashion results in infringement of the methods claimed by the '610 patent.

20 110. On information and belief, Hulu has had knowledge of the '610 patent since at least
21 the filing of this Complaint or shortly thereafter, and on information and belief, Hulu knew of
22 the '610 patent and knew of its infringement, including by way of this lawsuit. By the time of trial,
23 Hulu will have known and intended (since receiving such notice) that its continued actions would
24 actively induce and contribute to the infringement of the claims of the '610 patent.

25 111. Upon information and belief, Hulu's affirmative acts of making, using, and selling the
26 Accused Instrumentalities, and providing implementation services and technical support to users of
27 the Accused Instrumentalities, including, e.g., through training, demonstrations, brochures,
28 installation and user guides, have induced (at least since filing of this action) and continue to induce

1 users of the Accused Instrumentalities to use them in their normal and customary way to infringe
2 the '610 patent by practicing a method, comprising: determining, a parameter or an attribute of at
3 least a portion of a data block having video or audio data; selecting one or more compression
4 algorithms from among a plurality of compression algorithms to apply to the at least the portion of
5 the data block based upon the determined parameter or attribute and a throughput of a
6 communication channel, at least one of the plurality of compression algorithms being asymmetric;
7 and compressing the at least the portion of the data block with the selected compression algorithm
8 after selecting the one or more compression algorithms. For example, Hulu adopted H.264 as its
9 video codec in its streaming products/services, such as, e.g., Hulu's streaming service, Hulu's video
10 compression media encoders, and Hulu's ad products for brands. For similar reasons, Hulu also
11 induces its customers to use the Accused Instrumentalities to infringe other claims of the '610 patent.
12 Hulu specifically intended and was aware that these normal and customary activities would infringe
13 the '610 patent. Hulu performed the acts that constitute induced infringement, and would induce
14 actual infringement, with the knowledge of the '610 patent and with the knowledge, or willful
15 blindness to the probability, that the induced acts would constitute infringement. On information
16 and belief, Hulu engaged in such inducement to promote the sales of the Accused Instrumentalities.
17 Accordingly, Hulu has induced (at least since filing of this action) and continues to induce users of
18 the Accused Instrumentalities to use the Accused Instrumentalities in their ordinary and customary
19 way to infringe the '610 patent, knowing that such use constitutes infringement of the '610 patent.
20 Accordingly, Hulu has been (at least since filing of this action), and currently is, inducing
21 infringement of the '610 patent, in violation of 35 U.S.C. § 271(b).

22 112. Hulu has also infringed, and continues to infringe, claims of the '610 patent by
23 offering to commercially distribute, commercially distributing, making, and/or importing the
24 Accused Instrumentalities, which are used in practicing the process, or using the systems, of the '610
25 patent, and constitute a material part of the invention. Hulu knows the components in the Accused
26 Instrumentalities to be especially made or especially adapted for use in infringement of the '610
27 patent, not a staple article, and not a commodity of commerce suitable for substantial noninfringing
28 use. Accordingly, Hulu has been, and currently is, contributorily infringing the '610 patent, in

1 violation of 35 U.S.C. § 271(c).

2 113. By making, using, offering for sale, selling and/or importing into the United States
3 the Accused Instrumentalities, and touting the benefits of using the Accused Instrumentalities’
4 compression features, Hulu has injured Realtime and is liable to Realtime for infringement of
5 the ’610 patent pursuant to 35 U.S.C. § 271.

6 114. As a result of Hulu’s infringement of the ’610 patent, Plaintiff Realtime is entitled to
7 monetary damages in an amount adequate to compensate for Hulu’s infringement, but in no event
8 less than a reasonable royalty for the use made of the invention by Hulu, together with interest and
9 costs as fixed by the Court.

10 **COUNT VI**

11 **INFRINGEMENT OF U.S. PATENT NO. 8,634,462**

12 115. Plaintiff re-alleges and incorporates by reference the foregoing paragraphs, as if fully
13 set forth herein.

14 116. On information and belief, Hulu has made, used, offered for sale, sold and/or
15 imported into the United States Hulu products that infringe the ’462 patent, and continues to do so.
16 By way of illustrative example, these infringing products include, without limitation, Hulu’s
17 streaming products/services, such as, e.g., Hulu’s streaming service, Hulu’s video compression
18 media encoders, Hulu’s ad products for brands including Hulu’s Ad Selector, Hulu’s Blockbuster,
19 Hulu’s Branded Entertainment Selector, Hulu’s Custom Integrated Commercial, Hulu’s Interactive
20 Interstitial, Hulu’s Interactive Interstitial Template (DR), Hulu’s Masthead Brand Placement, Hulu’s
21 Page Brand Placement, Hulu’s Premium Slate, Hulu’s Slate, Hulu’s T-Commerce, Hulu’s Video
22 Commercial, Hulu VR, Hulu’s 4K video services, and all versions and variations thereof since the
23 issuance of the ’462 patent (“Accused Instrumentalities”)

24 117. For example, in an official Hulu blog post on the “Hulu Tech Blog” by Julian
25 Eggbrecht, Vice President of Device Platforms, Eggbrecht writes that as a result of the “Hulu
26 VR” application experiencing the challenges of “streaming full 360 degree videos, some even
27 running at 60 frames-per-second, and being fully stereoscopic with individual frames for each eye,”
28 and knowing that “the videos would have to have a resolution close to 4K” but also “bitrates for

1 streaming [that would be kept] somewhat manageable” a solution emerged that was “the first use by
2 Hulu of the new **HEVC** [or H.265] video codec, which compresses video roughly twice as
3 efficiently while maintaining the same quality as the older H.264 standard.” *See*
4 [https://web.archive.org/web/20160328225322/http://tech.hulu.com/blog/2016/03/24/creating-hulu-](https://web.archive.org/web/20160328225322/http://tech.hulu.com/blog/2016/03/24/creating-hulu-vr/)
5 [vr/](http://tech.hulu.com/blog/2016/03/24/creating-hulu-vr/) (cached version of: <http://tech.hulu.com/blog/2016/03/24/creating-hulu-vr/> which is no longer
6 available online) (emphasis added); [http://www.multichannel.com/blog/bauminator/hulu-s-vr-app-](http://www.multichannel.com/blog/bauminator/hulu-s-vr-app-could-serve-subscriber-acquisition-tool/403602)
7 [could-serve-subscriber-acquisition-tool/403602](http://www.multichannel.com/blog/bauminator/hulu-s-vr-app-could-serve-subscriber-acquisition-tool/403602) (“As explained in [the above-linked] blog post from
8 Hulu’s VP of device platforms Julian Eggebrecht, one big challenge was to make the streaming of
9 360-degree content as bandwidth efficient as possible. ‘We knew from the outset that the videos
10 would have to have a resolution close to 4K, but we also wanted to keep the bitrates for streaming
11 somewhat manageable, considering our first device would be the mobile Samsung Gear VR,’
12 Eggebrecht explained. Hulu, he added, addressed that by using **the H.265/HEVC code[c]**, which is
13 about 50% more efficient than H.264, and by optimizing the video data.”) (emphasis added).

14 118. Furthermore, another industry website article covering Hulu Chief Technology
15 Officer Tian Lim’s comments on Hulu’s public beta launch of a new live TV service in 2017 states
16 that: “Lim also explained why Hulu opted to go with H.264 encoding for its live streams, rather than
17 with **H.265/ HEVC, a more efficient codec that Hulu’s already using for its on-demand 4K and**
18 **virtual reality content.** The big issue is that Hulu must support a massive footprint of devices that
19 doesn’t support HEVC. Lim said it would be technically possible to go with double live encoders —
20 one for H.264 and one for H.265 — but that the move would likewise multiply origin and cloud
21 DVR storage requirements. Additionally the quality gains for video at resolutions below 1080p,
22 which includes a lot of live TV content, aren’t as dramatic with HEVC as they are with higher-
23 resolution content, so those tradeoffs made sense in more ways than one, he said.” *See*
24 <http://www.multichannel.com/hulu-s-aim-modernizing-tv-experience/412840> (emphasis added).

25 119. Another industry website article covering Hulu’s 4K video services or Hulu’s 4K
26 video streaming service states that: “Hulu has also told us that all 4K titles are encoded using the
27 **HEVC codec** which will also improve the efficiency and quality of all resolutions, so even if you are
28 watching on a Full HD display, there should be some improvements as well.” *See*

1 <http://www.ubergizmo.com/2016/12/hulu-stream-in-4k/> (emphasis added).

2 120. The Accused Instrumentalities performs a method for coding a video signal using
3 hybrid coding. For example, the aim of the coding process is the production of a bitstream, as
4 defined in definition 3.12 of the ITU-T H.265 Series H: Audiovisual and Multimedia Systems,
5 “Infrastructure of audiovisual services – Coding of moving video” High efficiency video coding
6 (“HEVC Spec”): “bitstream: A sequence of bits, in the form of a NAL unit stream or a byte stream,
7 that forms the representation of coded pictures and associated data forming one or more coded video
8 sequences (CVSs).” *See also, e.g.*, “Overview of the High Efficiency Video Coding (HEVC)
9 Standard” by Gary J. Sullivan, Fellow, IEEE, Jens-Rainer Ohm, Member, IEEE, Woo-Jin Han,
10 Member, IEEE, and Thomas Wiegand, Fellow, IEEE, published in IEEE TRANSACTIONS ON
11 CIRCUITS AND SYSTEMS FOR VIDEO TECHNOLOGY, VOL. 22, NO. 12, DECEMBER 2012
12 (“IEEE HEVC”) (“The video coding layer of HEVC employs the same hybrid approach (inter-
13 /intrapicture prediction and 2-D transform coding) used in all video compression standards since
14 H.261”). *See also, e.g.*, HEVC Spec at 0.7 “Overview of the design characteristics.”

15 121. The Accused Instrumentalities reduce temporal redundancy by block based motion
16 compensated prediction in order to establish a prediction error signal. For example, clause 8.5.3
17 Decoding process for prediction units in inter prediction mode and the subclauses thereof of the
18 HEVC Spec describe the block based motion compensation techniques used in the decoding process.
19 *See also, e.g.*, IEEE HEVC at 1651-1652 6) Motion compensation: Quarter-sample precision is used
20 for the MVs, and 7-tap or 8-tap filters are used for interpolation of fractional-sample positions
21 (compared to six-tap filtering of half-sample positions followed by linear interpolation for quarter-
22 sample positions in H.264/MPEG-4 AVC). Similar to H.264/MPEG-4 AVC, multiple reference
23 pictures are used. For each PB, either one or two motion vectors can be transmitted, resulting either
24 in unipredictive or bipredictive coding, respectively. As in H.264/MPEG-4 AVC, a scaling and
25 offset operation may be applied to the prediction signal(s) in a manner known as weighted
26 prediction.”).

27 122. The Accused Instrumentalities perform quantization on samples of the prediction
28 error signal or on coefficients resulting from a transformation of the prediction error signal into the

1 frequency domain to obtain quantized values, representing quantized samples or quantized
2 coefficients respectively. For example, the quantization parameter and the scaling (inverse
3 quantization) are defined in definitions 3.112 (page 10) and 3.131 (page 11), respectively, the usage
4 of the scaling process in the decoding being described in clause and 8.6 Scaling, transformation and
5 array construction process prior to deblocking filter process of the HEVC Spec. *See also, e.g.,* IEEE
6 HEVC at 1652 (“8) Quantization control: As in H.264/MPEG-4 AVC, uniform reconstruction
7 quantization (URQ) is used in HEVC, with quantization scaling matrices supported for the various
8 transform block sizes.”).

9 123. The Accused Instrumentalities perform a method wherein the prediction error signal
10 includes a plurality of subblocks each including a plurality of quantized values. For example, the
11 quantized samples or transform coefficients from the subblock are scaled and transformed as
12 described in above mentioned clause 8.6 of the HEVC Spec. *See also, e.g.,* IEEE HEVC at 1652
13 (“Prediction units and prediction blocks (PBs): The decision whether to code a picture area using
14 interpicture or intrapicture prediction is made at the CU level. A PU partitioning structure has its
15 root at the CU level. Depending on the basic prediction-type decision, the luma and chroma CBs can
16 then be further split in size and predicted from luma and chroma prediction blocks (PBs). HEVC
17 supports variable PB sizes from 64×64 down to 4×4 samples.”).

18 124. The Accused Instrumentalities perform a method of calculating a first quantization
19 efficiency for the quantized values of at least one subblock of the plurality of subblocks; setting the
20 quantized values of the at least one subblock to all zeroes; calculating a second quantization
21 efficiency for the at least one subblock while all of the quantized values are zeroes; selecting which
22 of the first and second quantization efficiencies is a higher efficiency; and selecting, for further
23 proceeding, the at least one subblock with the quantized values prior to setting the quantized values
24 of the at least one subblock to all zeroes if the first quantization efficiency is higher and selecting the
25 at least one subblock with the quantized values set to zero, for further proceeding, if the second
26 quantization efficiency is higher. For example, the bitstream resulting from the encoding as
27 described in this last item of the claim contains all the relevant information as needed by the decoder
28 for proper decoding. If the coefficients of the subblock are set to zero as a consequence of the

1 efficiency calculation, the coded_sub_block_flag, as described in clause 7.4.9.11 Residual coding
 2 semantics, HEVC Spec, is set to 0, indicating that all the 16 coefficients of the coded sub block have
 3 been set to 0: “coded_sub_block_flag[xS][yS] specifies the following for the sub-block at
 4 location (xS, yS) within the current transform block, where a sub-block is a (4x4) array of 16
 5 transform coefficient levels: – If coded_sub_block_flag[xS][yS] is equal to 0, the 16 transform
 6 coefficient levels of the sub-block at location (xS, yS) are inferred to be equal to 0.”

7 125. When coded_sub_block_flag[xS][yS] has not been set equal to 0, the position in
 8 the array of non 0 coefficients can be determined as follows:

9 – Otherwise (coded_sub_block_flag[xS][yS] is equal to 1), the following applies:

10 – If (xS, yS) is equal to (0, 0) and (LastSignificantCoeffX,
 11 LastSignificantCoeffY) is not equal to (0, 0), at least one of the 16 sig_coeff_flag
 12 syntax elements is present for the sub-block at location (xS, yS).

13 – Otherwise, at least one of the 16 transform coefficient levels of the sub-
 14 block at location (xS, yS) has a non zero value.

15 When coded_sub_block_flag[xS][yS] is not present, it is inferred as follows:

16 – If one or more of the following conditions are true,

17 coded_sub_block_flag[xS][yS] is inferred to be equal to 1:

18 – (xS, yS) is equal to (0, 0)

19 – (xS, yS) is equal to (LastSignificantCoeffX >> 2 , LastSignificantCoeffY
 20 >> 2)

21 – Otherwise, coded_sub_block_flag[xS][yS] is inferred to be equal to 0.

22 HEVC Spec at 7.4.9.11 Residual coding semantics. Therefore, even though the coding
 23 algorithms than can be used for reaching specific efficiency targets are not specified by the HEVC
 24 Spec (as stated in clause 0.7), this particular combination of choices produces a valid bitstream that
 25 has to be decoded by a conformant decoder.

26 126. The infringement of the Accused Instrumentalities is also shown by way of
 27 considering the reference software (*see, e.g., <https://hevc.hhi.fraunhofer.de/>*). Setting the flag
 28 RDOQ=true in the encoder configuration file enables rate-distortion-optimized quantization for

1 transformed TUs. This feature is implemented in the HM reference software as function
 2 xRateDistOptQuant in file TComTrQuant.cpp. In the function xRateDistOptQuant, the efficiency
 3 for setting all quantized values to zero is calculated and stored in the variable d64BestCost. In the
 4 variable iBestLastIdxP1, a 0 is stored indicating that all values starting from the 0th position are set
 5 to zero. Afterwards, the efficiency for keeping quantized values unequal to zero is calculated and
 6 stored in the variable totalCost. The variable iBestLastIdxP1 is adjusted correspondingly to values
 7 unequal to 0. The two efficiencies d64BestCost and totalCost are compared, and selecting for
 8 further proceeding either quantized values, which are all set to zero or quantized values, which are
 9 not all set to zero. All values starting from the position defined by the variable iBestLastIdxP1 are
 10 set to zero.

11 127. Calculation of the efficiency for setting all quantized values to zero and storing the
 12 result in the variable d64BestCost:

```

13 Double d64BestCost = 0;
14 Int ui16CtxCbf = 0;
15 Int iBestLastIdxP1 = 0;
16 if( !pcCU->isIntra( uiAbsPartIdx ) && isLuma(compID) && pcCU->getTransformIdx( uiAbsPartIdx ) == 0 )
17 {
18     ui16CtxCbf = 0;
19     d64BestCost = d64BlockUncodedCost + xGetICost( m_pcEstBitsSbac->blockRootCbpBits[ ui16CtxCbf ][ 0 ] );
20     d64BaseCost += xGetICost( m_pcEstBitsSbac->blockRootCbpBits[ ui16CtxCbf ][ 1 ] );
21 }
22 else
23 {
24     ui16CtxCbf = pcCU->getCtxQtCbf( rTu, channelType );
25     ui16CtxCbf += getCBFContextOffset(compID);
26     d64BestCost = d64BlockUncodedCost + xGetICost( m_pcEstBitsSbac->blockCbpBits[ ui16CtxCbf ][ 0 ] );
27     d64BaseCost += xGetICost( m_pcEstBitsSbac->blockCbpBits[ ui16CtxCbf ][ 1 ] );
28 }
  
```

19 HEVC Reference Software (<https://hevc.hhi.fraunhofer.de/>).

20 128. Calculating the efficiency for keeping quantized values unequal to zero and storing
 21 the result in the variable totalCost:

```

22 Bool bFoundLast = false;
23 for (Int iCGScanPos = iCGLastScanPos; iCGScanPos >= 0; iCGScanPos--)
24 {
25     UInt uiCGBlkPos = codingParameters.scanCG[ iCGScanPos ];
26
27     d64BaseCost -= pdCostCoeffGroupSig [ iCGScanPos ];
28     if (uiSigCoeffGroupFlag[ uiCGBlkPos ])
29     {
30         for (Int iScanPosinCG = uiCGSize-1; iScanPosinCG >= 0; iScanPosinCG--)
31         {
32             iScanPos = iCGScanPos*uiCGSize + iScanPosinCG;
33
34             if (iScanPos > iLastScanPos) continue;
35             UInt uiBlkPos = codingParameters.scan[iScanPos];
36
37             if ( piDstCoeff[ uiBlkPos ] )
38             {
39                 UInt uiPosY = uiBlkPos >> uiLog2BlockWidth;
40                 UInt uiPosX = uiBlkPos - ( uiPosY << uiLog2BlockWidth );
41
42                 Double d64CostLast= codingParameters.scanType == SCAN_VER ? xGetRateLast( uiPosY, uiPosX, compID ) :
43                                     xGetRateLast( uiPosX, uiPosY, compID );
44                 Double totalCost = d64BaseCost + d64CostLast - pdCostSig[ iScanPos ];
  
```

1 HEVC Reference Software (<https://hevc.hhi.fraunhofer.de/>).

2 129. Comparing the two efficiencies d64BestCost and totalCost:

```
3  if( totalCost < d64BestCost )
4  {
5      iBestLastIdxP1 = iScanPos + 1;
6      d64BestCost    = totalCost;
7  }
```

6 HEVC Reference Software (<https://hevc.hhi.fraunhofer.de/>).

7 130. Selecting for further proceeding either quantized values, which are all set to zero or
8 quantized values, which are not all set to zero:

```
9  //===== clean uncoded coefficients =====
10 for ( Int scanPos = iBestLastIdxP1; scanPos <= iLastScanPos; scanPos++ )
11 {
12     piDstCoeff[ codingParameters.scan[ scanPos ] ] = 0;
13 }
```

12 HEVC Reference Software (<https://hevc.hhi.fraunhofer.de/>).

13 131. On information and belief, Hulu also directly infringes and continues to infringe other
14 claims of the '462 patent, for similar reasons as explained above with respect to Claim 1 of the '462
15 patent, namely, a method for coding a video signal using hybrid coding, comprising: reducing
16 temporal redundancy by block based motion compensated prediction in order to establish a
17 prediction error signal; performing quantization on samples of the prediction error signal or on
18 coefficients resulting from a transformation of the prediction error signal into the frequency domain
19 to obtain quantized values, representing quantized samples or quantized coefficients respectively,
20 wherein the prediction error signal includes a plurality of subblocks each including a plurality of
21 quantized values; calculating a first quantization efficiency for the quantized values of at least one
22 subblock of the plurality of subblocks; setting the quantized values of the at least one subblock to all
23 zeroes; calculating a second quantization efficiency for the at least one subblock while all of the
24 quantized values are zeroes; selecting which of the first and second quantization efficiencies is a
25 higher efficiency; and selecting, for further proceeding, the at least one subblock with the quantized
26 values prior to setting the quantized values of the at least one subblock to all zeroes if the first
27 quantization efficiency is higher and selecting the at least one subblock with the quantized values set
28 to zero, for further proceeding, if the second quantization efficiency is higher.

1 132. On information and belief, all of the Accused Instrumentalities perform the claimed
2 methods in substantially the same way, e.g., in the manner specified in the HEVC (or H.265)
3 standard.

4 133. On information and belief, use of the Accused Instrumentalities in their ordinary and
5 customary fashion results in infringement of the methods and/or systems claimed by the '462 patent.

6 134. On information and belief, Hulu has had knowledge of the '462 patent since at least
7 the filing of this Complaint or shortly thereafter, and on information and belief, Hulu knew of
8 the '462 patent and knew of its infringement, including by way of this lawsuit. By the time of trial,
9 Hulu will have known and intended (since receiving such notice) that its continued actions would
10 actively induce and contribute to the infringement of the claims of the '462 patent.

11 135. Upon information and belief, Hulu's affirmative acts of making, using, and selling
12 the Accused Instrumentalities, and providing implementation services and technical support to users
13 of the Accused Instrumentalities, including, e.g., through training, demonstrations, brochures,
14 installation and user guides, have induced (at least since filing of this action) and continue to induce
15 users of the Accused Instrumentalities to use them in their normal and customary way to infringe
16 the '462 patent by practicing a method for coding a video signal using hybrid coding, comprising:
17 reducing temporal redundancy by block based motion compensated prediction in order to establish a
18 prediction error signal; performing quantization on samples of the prediction error signal or on
19 coefficients resulting from a transformation of the prediction error signal into the frequency domain
20 to obtain quantized values, representing quantized samples or quantized coefficients respectively,
21 wherein the prediction error signal includes a plurality of subblocks each including a plurality of
22 quantized values; calculating a first quantization efficiency for the quantized values of at least one
23 subblock of the plurality of subblocks; setting the quantized values of the at least one subblock to all
24 zeroes; calculating a second quantization efficiency for the at least one subblock while all of the
25 quantized values are zeroes; selecting which of the first and second quantization efficiencies is a
26 higher efficiency; and selecting, for further proceeding, the at least one subblock with the quantized
27 values prior to setting the quantized values of the at least one subblock to all zeroes if the first
28 quantization efficiency is higher and selecting the at least one subblock with the quantized values set

1 to zero, for further proceeding, if the second quantization efficiency is higher. For example, Hulu
2 adopted HEVC (or H.265) as their video codec in their VR and 4K applications, products and
3 services. For similar reasons, Hulu also induces its customers to use the Accused Instrumentalities to
4 infringe other claims of the '462 patent. Hulu specifically intended and were aware that these
5 normal and customary activities would infringe the '462 patent. Hulu performed the acts that
6 constitute induced infringement, and would induce actual infringement, with the knowledge of
7 the '462 patent and with the knowledge, or willful blindness to the probability, that the induced acts
8 would constitute infringement. On information and belief, Hulu engaged in such inducement to
9 promote the sales of the Accused Instrumentalities. Accordingly, Hulu has induced (at least since
10 filing of this action) and continues to induce users of the Accused Instrumentalities to use the
11 Accused Instrumentalities in their ordinary and customary way to infringe the '462 patent, knowing
12 that such use constitutes infringement of the '462 patent. Accordingly, Hulu has been (at least since
13 filing of this action), and currently is, inducing infringement of the '462 patent, in violation of 35
14 U.S.C. § 271(b).

15 136. Hulu has also infringed, and continues to infringe, claims of the '462 patent by
16 offering to commercially distribute, commercially distributing, making, and/or importing the
17 Accused Instrumentalities, which are used in practicing the process, or using the systems, of the '462
18 patent, and constitute a material part of the invention. Hulu knows the components in the Accused
19 Instrumentalities to be especially made or especially adapted for use in infringement of the '462
20 patent, not a staple article, and not a commodity of commerce suitable for substantial noninfringing
21 use. Accordingly, Hulu has been, and currently is, contributorily infringing the '462 patent, in
22 violation of 35 U.S.C. § 271(c).

23 137. By making, using, offering for sale, selling and/or importing into the United States
24 the Accused Instrumentalities, and touting the benefits of using the Accused Instrumentalities'
25 compression features, Hulu has injured Realtime and is liable to Realtime for infringement of
26 the '462 patent pursuant to 35 U.S.C. § 271.

27 138. As a result of Hulu's infringement of the '462 patent, Plaintiff Realtime is entitled to
28 monetary damages in an amount adequate to compensate for Hulu's infringement, but in no event

1 less than a reasonable royalty for the use made of the invention by Hulu, together with interest and
 2 costs as fixed by the Court.

3 **COUNT VII**

4 **INFRINGEMENT OF U.S. PATENT NO. 9,578,298**

5 139. Plaintiff re-alleges and incorporates by reference the foregoing paragraphs, as if fully
 6 set forth herein.

7 140. On information and belief, Hulu has made, used, offered for sale, sold and/or
 8 imported into the United States Hulu products that infringe the '298 patent, and continues to do so.
 9 By way of illustrative example, these infringing products include, without limitation, Hulu's
 10 streaming products/services, such as, e.g., Hulu's streaming service, Hulu's video compression
 11 media encoders, Hulu's ad products for brands including Hulu's Ad Selector, Hulu's Blockbuster,
 12 Hulu's Branded Entertainment Selector, Hulu's Custom Integrated Commercial, Hulu's Interactive
 13 Interstitial, Hulu's Interactive Interstitial Template (DR), Hulu's Masthead Brand Placement, Hulu's
 14 Page Brand Placement, Hulu's Premium Slate, Hulu's Slate, Hulu's T-Commerce, Hulu's Video
 15 Commercial, Hulu VR, Hulu's 4K video services, and all versions and variations thereof since the
 16 issuance of the '298 patent ("Accused Instrumentalities")

17 141. For example, in an official Hulu blog post on the "Hulu Tech Blog" by Julian
 18 Eggbrecht, Vice President of Device Platforms, Eggbrecht writes that as a result of the "Hulu
 19 VR" application experiencing the challenges of "streaming full 360 degree videos, some even
 20 running at 60 frames-per-second, and being fully stereoscopic with individual frames for each eye,"
 21 and knowing that "the videos would have to have a resolution close to 4K" but also "bitrates for
 22 streaming [that would be kept] somewhat manageable" a solution emerged that was "the first use by
 23 Hulu of the new **HEVC** [or H.265] video codec, which compresses video roughly twice as
 24 efficiently while maintaining the same quality as the older H.264 standard." *See*
 25 [https://web.archive.org/web/20160328225322/http://tech.hulu.com/blog/2016/03/24/creating-hulu-](https://web.archive.org/web/20160328225322/http://tech.hulu.com/blog/2016/03/24/creating-hulu-vr/)
 26 [vr/](http://tech.hulu.com/blog/2016/03/24/creating-hulu-vr/) (cached version of: <http://tech.hulu.com/blog/2016/03/24/creating-hulu-vr/> which is no longer
 27 available online) (emphasis added); [http://www.multichannel.com/blog/bauminator/hulu-s-vr-app-](http://www.multichannel.com/blog/bauminator/hulu-s-vr-app-could-serve-subscriber-acquisition-tool/403602)
 28 [could-serve-subscriber-acquisition-tool/403602](http://www.multichannel.com/blog/bauminator/hulu-s-vr-app-could-serve-subscriber-acquisition-tool/403602) ("As explained in [the above-linked] blog post from

1 Hulu’s VP of device platforms Julian Eggebrecht, one big challenge was to make the streaming of
2 360-degree content as bandwidth efficient as possible. ‘We knew from the outset that the videos
3 would have to have a resolution close to 4K, but we also wanted to keep the bitrates for streaming
4 somewhat manageable, considering our first device would be the mobile Samsung Gear VR,’
5 Eggebrecht explained. Hulu, he added, addressed that by using **the H.265/HEVC code[c]**, which is
6 about 50% more efficient than H.264, and by optimizing the video data.’) (emphasis added).

7 142. Furthermore, another industry website article covering Hulu Chief Technology
8 Officer Tian Lim’s comments on Hulu’s public beta launch of a new live TV service in 2017 states
9 that: “Lim also explained why Hulu opted to go with H.264 encoding for its live streams, rather than
10 with **H.265/ HEVC, a more efficient codec that Hulu’s already using for its on-demand 4K and**
11 **virtual reality content.** The big issue is that Hulu must support a massive footprint of devices that
12 doesn’t support HEVC. Lim said it would be technically possible to go with double live encoders —
13 one for H.264 and one for H.265 — but that the move would likewise multiply origin and cloud
14 DVR storage requirements. Additionally the quality gains for video at resolutions below 1080p,
15 which includes a lot of live TV content, aren’t as dramatic with HEVC as they are with higher-
16 resolution content, so those tradeoffs made sense in more ways than one, he said.” *See*
17 <http://www.multichannel.com/hulu-s-aim-modernizing-tv-experience/412840> (emphasis added).

18 143. Another industry website article covering Hulu’s 4K video services or Hulu’s 4K
19 video streaming service states that: “Hulu has also told us that all 4K titles are encoded using the
20 **HEVC codec** which will also improve the efficiency and quality of all resolutions, so even if you are
21 watching on a Full HD display, there should be some improvements as well.” *See*
22 <http://www.ubergizmo.com/2016/12/hulu-stream-in-4k/> (emphasis added).

23 144. The Accused Instrumentalities receive the video stream which comprises at least one
24 composite frame (FC), each composite frame containing a pair of stereoscopic digital images (L,R)
25 according to a predetermined frame packing format. For example, the coded bitstream when it
26 contains a stereoscopic video in one of the frame packing arrangements such as side-by-side or top-
27 and-bottom or segmented rectangular frame packing format as defined in the following sections of
28 the ITU-T H.265 Series H: Audiovisual and Multimedia Systems, “Infrastructure of audiovisual

1 services – Coding of moving video” High efficiency video coding (“HEVC Spec”): D.2.16 Frame
2 packing arrangement SEI message syntax, D.3.16 Frame packing arrangement SEI message
3 semantics, D.2.29 Segmented rectangular frame packing arrangement SEI message syntax, D.3.29
4 Segmented rectangular frame packing arrangement SEI message semantics.

5 145. The Accused Instrumentalities generate an output video stream which can be
6 reproduced on a visualization apparatus. For example, the output of the decoding process as defined
7 above is a sequence of decoded pictures. *See, e.g.*, HEVC Spec at 3.39 (“3.39 decoded picture: A
8 decoded picture is derived by decoding a coded picture”). Decoded pictures are the input of the
9 display process. *Id.* at 3.47 (“3.47 display process: A process not specified in this Specification
10 having, as its input, the cropped decoded pictures that are the output of the decoding process.”).

11 146. The Accused Instrumentalities receive metadata which determine an area occupied by
12 one of the two images within said composite frame, said metadata indicating either a geometry of the
13 frame packing format or a frame packing type of said composite frame. For example, the HEVC
14 spec provides the default display window parameter to support 2D compatible decoding of stereo
15 formats. *See, e.g.*, HEVC Spec (“NOTE 9 – The default display window parameters in the VUI
16 parameters of the SPS can be used by an encoder to indicate to a decoder that does not interpret the
17 frame packing arrangement SEI message that the default display window is an area within only one
18 of the two constituent frames.”).

19 147. The Accused Instrumentalities determine the area in the composite frame (FC) which
20 is occupied by said one image of the stereoscopic pair within the composite frame based on said
21 metadata. For example, the default display window parameter has been defined to support this
22 application. The parameter syntax is defined in clause E.2.1 VUI parameters syntax, the semantics
23 thereof being described in clause E.3.1 VUI parameters semantics. The usage of the Default Display
24 Window for signaling the 2D single view in a stereoscopic frame packing format is illustrated in
25 Note 9 of clause D.3.16 and Note 3 in Clause D.3.29 cited above.

1 148. The Accused Instrumentalities decode only that part of the composite frame which
 2 contains said one image to be displayed. For example, tiles are intended to support independent
 3 decoding of different picture regions. Clause 7.4.3.2.1 cited above illustrates the process to convert
 4 CTB picture scan in CTB tile scan to enable independent decoding of the tile. *See also* HEVC Spec:

5 **row_height_minus1[i]** plus 1 specifies the height of the i-th tile row in units of coding tree blocks.

6 The following variables are derived by invoking the coding tree block raster and tile scanning conversion process as specified in clause 6.5.1:

- 7 – The list CtbAddrRsToTs[ctbAddrRs] for ctbAddrRs ranging from 0 to PicSizeInCtbsY – 1, inclusive, specifying the conversion from a CTB address in the CTB raster scan of a picture to a CTB address in the tile scan,
- 8 – the list CtbAddrTsToRs[ctbAddrTs] for ctbAddrTs ranging from 0 to PicSizeInCtbsY – 1, inclusive, specifying the conversion from a CTB address in the tile scan to a CTB address in the CTB raster scan of a picture,
- 9 – the list TileId[ctbAddrTs] for ctbAddrTs ranging from 0 to PicSizeInCtbsY – 1, inclusive, specifying the conversion from a CTB address in tile scan to a tile ID,
- 10 – the list ColumnWidthInLumaSamples[i] for i ranging from 0 to num_tile_columns_minus1, inclusive, specifying the width of the i-th tile column in units of luma samples,
- 11 – the list RowHeightInLumaSamples[j] for j ranging from 0 to num_tile_rows_minus1, inclusive, specifying the height of the j-th tile row in units of luma samples.

12 The values of ColumnWidthInLumaSamples[i] for i ranging from 0 to num_tile_columns_minus1, inclusive, and RowHeightInLumaSamples[j] for j ranging from 0 to num_tile_rows_minus1, inclusive, shall all be greater than 0.

13 The array MinTbAddrZs with elements MinTbAddrZs[x][y] for x ranging from 0 to
 14 (PicWidthInCtbsY << (CtbLog2SizeY – MinTbLog2SizeY)) – 1, inclusive, and y ranging from 0 to
 15 (PicHeightInCtbsY << (CtbLog2SizeY – MinTbLog2SizeY)) – 1, inclusive, specifying the conversion from a location (x, y) in units of minimum transform blocks to a transform block address in z-scan order, is derived by invoking the z-scan order array initialization process as specified in clause 6.5.2.

16 149. The Accused Instrumentalities generate an output frame containing said extracted
 17 image. For example, there is an output of the tile decoding process. *See, e.g.,* HEVC Spec at 8.1.1
 18 (“8.1.1 General...Input to this process is a bitstream. Output of this process is a list of decoded
 19 pictures.”).

20 150. On information and belief, Hulu also directly infringes and continues to infringe other
 21 claims of the '298 patent, for similar reasons as explained above with respect to Claim 1 of the '298
 22 patent, namely, a method for processing a video stream of digital images, the method comprising the
 23 steps of: receiving the video stream which comprises at least one composite frame (FC), each
 24 composite frame containing a pair of stereoscopic digital images (L,R) according to a predetermined
 25 frame packing format; generating an output video stream which can be reproduced on a visualization
 26 apparatus, receiving metadata which determine an area occupied by one of the two images within
 27 said composite frame (FC), said metadata indicating either a geometry of the frame packing format
 28 or a frame packing type of said composite frame (FC); determining the area in the composite frame

1 (FC) which is occupied by said one image of the stereoscopic pair within the composite frame based
2 on said metadata; decoding only that part of the composite frame (FC) which contains said one
3 image to be displayed, and generating an output frame containing said decoded image.

4 151. On information and belief, all of the Accused Instrumentalities perform the claimed
5 methods in substantially the same way, e.g., in the manner specified in the HEVC (or H.265)
6 standard.

7 152. On information and belief, use of the Accused Instrumentalities in their ordinary and
8 customary fashion results in infringement of the methods claimed by the '298 patent.

9 153. On information and belief, Hulu has had knowledge of the '298 patent since at least
10 the filing of this Complaint or shortly thereafter, and on information and belief, Hulu knew of
11 the '298 patent and knew of its infringement, including by way of this lawsuit. By the time of trial,
12 Hulu will have known and intended (since receiving such notice) that its continued actions would
13 actively induce and contribute to the infringement of the claims of the '298 patent.

14 154. Upon information and belief, Hulu's affirmative acts of making, using, and selling the
15 Accused Instrumentalities, and providing implementation services and technical support to users of
16 the Accused Instrumentalities, including, e.g., through training, demonstrations, brochures,
17 installation and user guides, have induced (at least since filing of this action) and continue to induce
18 users of the Accused Instrumentalities to use them in their normal and customary way to infringe
19 the '298 by practicing a method for processing a video stream of digital images, the method
20 comprising the steps of: receiving the video stream which comprises at least one composite frame
21 (FC), each composite frame containing a pair of stereoscopic digital images (L,R) according to a
22 predetermined frame packing format; generating an output video stream which can be reproduced on
23 a visualization apparatus, receiving metadata which determine an area occupied by one of the two
24 images within said composite frame (FC), said metadata indicating either a geometry of the frame
25 packing format or a frame packing type of said composite frame (FC); determining the area in the
26 composite frame (FC) which is occupied by said one image of the stereoscopic pair within the
27 composite frame based on said metadata; decoding only that part of the composite frame (FC) which
28 contains said one image to be displayed, and generating an output frame containing said decoded

1 image. For example, Hulu adopted HEVC (or H.265) as their video codec in their VR and 4K
2 applications, products and services. For similar reasons, Hulu also induces its customers to use the
3 Accused Instrumentalities to infringe other claims of the '298 patent. Hulu specifically intended and
4 were aware that these normal and customary activities would infringe the '298 patent. Hulu
5 performed the acts that constitute induced infringement, and would induce actual infringement, with
6 the knowledge of the '298 patent and with the knowledge, or willful blindness to the probability, that
7 the induced acts would constitute infringement. On information and belief, Hulu engaged in such
8 inducement to promote the sales of the Accused Instrumentalities. Accordingly, Hulu has induced
9 (at least since filing of this action) and continues to induce users of the Accused Instrumentalities to
10 use the Accused Instrumentalities in their ordinary and customary way to infringe the '298 patent,
11 knowing that such use constitutes infringement of the '298 patent. Accordingly, Hulu has been (at
12 least since filing of this action), and currently is, inducing infringement of the '298 patent, in
13 violation of 35 U.S.C. § 271(b).

14 155. Hulu has also infringed, and continues to infringe, claims of the '298 patent by
15 offering to commercially distribute, commercially distributing, making, and/or importing the
16 Accused Instrumentalities, which are used in practicing the process, or using the systems, of the '298
17 patent, and constitute a material part of the invention. Hulu knows the components in the Accused
18 Instrumentalities to be especially made or especially adapted for use in infringement of the '298
19 patent, not a staple article, and not a commodity of commerce suitable for substantial noninfringing
20 use. Accordingly, Hulu has been, and currently is, contributorily infringing the '298 patent, in
21 violation of 35 U.S.C. § 271(c).

22 156. By making, using, offering for sale, selling and/or importing into the United States
23 the Accused Instrumentalities, and touting the benefits of using the Accused Instrumentalities'
24 compression features, Hulu has injured Realtime and is liable to Realtime for infringement of
25 the '298 patent pursuant to 35 U.S.C. § 271.

26 157. As a result of Hulu's infringement of the '298 patent, Plaintiff Realtime is entitled to
27 monetary damages in an amount adequate to compensate for Hulu's infringement, but in no event
28 less than a reasonable royalty for the use made of the invention by Defendants, together with interest

1 and costs as fixed by the Court.

2 **PRAYER FOR RELIEF**

3 WHEREFORE, Plaintiff Realtime respectfully requests that this Court enter:

4 a. A judgment in favor of Plaintiff that Hulu has infringed, literally and/or under the
5 doctrine of equivalents, the '535, '477, '907, '046, '610, '462, and '298 patents (the "asserted
6 patents" or "patents-in-suit");

7 b. A judgment and order requiring Hulu to pay Plaintiff its damages, costs, expenses,
8 and prejudgment and post-judgment interest for its infringement of the asserted patents, as provided
9 under 35 U.S.C. § 284;

10 c. A judgment and order requiring Hulu to provide an accounting and to pay
11 supplemental damages to Realtime, including without limitation, prejudgment and post-judgment
12 interest;

13 d. A judgment and order finding that this is an exceptional case within the meaning of
14 35 U.S.C. § 285 and awarding to Plaintiff its reasonable attorneys' fees against Hulu; and

15 e. Any and all other relief as the Court may deem appropriate and just under the
16 circumstances.

17 **DEMAND FOR JURY TRIAL**

18 1. Plaintiff, under Rule 38 of the Federal Rules of Civil Procedure, requests a trial by
19 jury of any issues so triable by right.

21 Respectfully Submitted,

22 Dated: December 29, 2017

/s/ C. Jay Chung _____

23 RUSS AUGUST & KABAT
24 Marc A. Fenster, SBN 181067
25 Email: mfenster@raklaw.com
26 Reza Mirzaie (CA SBN 246953)
27 Email: rmirzaie@raklaw.com
28 Brian D. Ledahl (CA SBN 186579)
Email: bledahl@raklaw.com
C. Jay Chung (CA SBN 252794)
Email: jchung@raklaw.com
Philip X. Wang (CA SBN 262239)
Email: pwang@raklaw.com

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Timothy T. Hsieh (CA SBN 255953)
Email: thsieh@raklaw.com

Attorneys for Plaintiff
REALTIME ADAPTIVE STREAMING LLC