IN THE UNITED STATES DISTRICT COURT
FOR THE EASTERN DISTRICT OF TEXAS
TYLER DIVISION

REALTIME DATA LLC d/b/a IXO, Plaintiff, v. ECHOSTAR TECHNOLOGIES L.L.C., DISH NETWORK L.L.C., AND ARRIS GROUP, INC., Defendants.	Case No. 6:17-cv-00421-RWS-JDL JURY TRIAL DEMANDED

AMENDED COMPLAINT FOR PATENT INFRINGEMENT

This is an action for patent infringement arising under the Patent Laws of the United States of America, 35 U.S.C. § 1 *et seq.* in which Plaintiff Realtime Data LLC d/b/a IXO ("Plaintiff," "Realtime," or "IXO") makes the following allegations against Defendants EchoStar Technologies, L.L.C., DISH Network L.L.C., and Arris Group, Inc.:

PARTIES

1. Realtime is a New York limited liability company. Realtime has places of business at 1828 E.S.E. Loop 323, Tyler, Texas 75701 and 66 Palmer Avenue, Suite 27, Bronxville, NY 10708. Since the 1990s, Realtime has researched and developed specific solutions for data compression, including, for example, those that increase the speeds at which data can be stored and accessed. As recognition of its innovations rooted in this technological field, Realtime holds over 47 United States patents and has numerous pending patent applications. Realtime has licensed patents in this portfolio to many of the world's leading technology companies. The patents-in-suit relate to Realtime's development of advanced systems and methods for fast and efficient data compression using numerous innovative compression techniques based on, for example, particular

attributes of the data.

2. On information and belief, EchoStar Technologies, L.L.C. is a Texas limited liability company with its principal place of business at 11717 Exploration Lane, Germantown, MD 20876 and a regular and established place of business at 10303 E Bankhead Hwy # 100, Aledo, TX 76008. See, e.g., https://www.yellowpages.com/aledo-tx/mip/echostar-satellite-11408900. Upon information and belief, EchoStar Technologies, L.L.C. has a regular and established place of business in this District. On information and belief, EchoStar Technologies, L.L.C. can be served through its registered agent, Corporation Service Company D/B/A CSC-Lawyers Inc., 211 E. 7th Street Suite 620, Austin, TX 78701. EchoStar Technologies LLC is an indirect subsidiary of DISH Networks LLC. EchoStar Technologies LLC designs the set-top boxes used to deliver the DISH TV service.

3. On information and belief, Defendant DISH Network L.L.C. ("DISH") is a Colorado limited liability company with its principal office at 9601 S. Meridian Blvd., Englewood, CO 80112 and a regular and established place of business at 1211 Broad St, Wichita Falls, TX 76301. See, e.g., https://www.mapquest.com/us/texas/business-wichita-falls/DISH-tv-9269051. Upon information and belief, DISH Network L.L.C. has a regular and established place of business in this District. See, e.g., https://www.DISH.com/availability/tx/beaumont ("Get DISH TV Programming in Beaumont, Texas"). On information and belief, Defendant DISH Network L.L.C. conducts business throughout the United States, including in this District. On information and belief, DISH can be served through its registered agent, R. Dodge Stanton, 9601 S. Meridian Blvd., Englewood, CO 80112. EchoStar Technologies, L.L.C. and DISH Network L.L.C. are hereinafter referred to collectively as "DISH" or "Dish".

4. On information and belief, Defendant Arris Group, Inc. ("Arris") is a Delaware Corporation with its principal office at 3871 Lakefield Drive, Suwanee, GA, 30024. On information and belief, Arris maintains a regular and established place of

business in this District, for example, at 101 E Park Blvd, Plano, TX 75074. See, e.g., http://www.buzzfile.com/business/Arris-Group,-Inc.-972-546-1700. On information and belief, Arris maintains a regular and established place of business at 4516 Seton Center Pkwy, Suite 185, Austin, TX 78759. See, e.g., http://www.Arris.com/company/offices/. On information and belief, Defendant Arris conducts business throughout the United States, including in this District. On information and belief, Arris can be served through its registered agent, Corporation Service Company, 40 Technology Pkwy South, #300, Norcross, GA 30092.

5. On information and belief, EchoStar, and DISH promotes and offers for sale DISH and Sling-branded products and services which infringe certain asserted patents. Accordingly, each of the Defendants is properly joined in this action pursuant to 35 U.S.C. § 299.

6. On information and belief, Arris sells and offers for sale products and services incorporating technology from Sling Media which infringes certain asserted patents. Accordingly, Arris is properly joined in this action pursuant to 35 U.S.C. § 299.

JURISDICTION AND VENUE

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

8. This Court has personal jurisdiction over EchoStar Technologies L.L.C. in this action because EchoStar Technologies L.L.C. has committed acts within the Eastern District of Texas giving rise to this action and has established minimum contacts with this forum such that the exercise of jurisdiction over EchoStar Technologies L.L.C. would not offend traditional notions of fair play and substantial justice. EchoStar Technologies L.L.C. directly and through subsidiaries (including DISH) or intermediaries (including distributors, retailers, and others), has committed and continues to commit acts of infringement in this District by, among other things, offering to sell and selling products

and/or services that infringe the asserted patents. In addition, EchoStar Technologies L.L.C. is incorporated under the laws of the state of Texas. Furthermore, upon information and belief, EchoStar Technologies L.L.C. has a regular and established place of business at 10303 E Bankhead Hwy # 100, Aledo, TX 76008. See, e.g., https://www.yellowpages.com/aledo-tx/mip/echostar-satellite-11408900. Upon information and belief, EchoStar Technologies L.L.C. has a regular and established place of business in this District.

9. This Court has personal jurisdiction over DISH Network L.L.C. in this action because DISH Network L.L.C. has committed acts within the Eastern District of Texas giving rise to this action and has established minimum contacts with this forum such that the exercise of jurisdiction over DISH Network L.L.C. would not offend traditional notions of fair play and substantial justice. DISH Network L.L.C. directly and/or through subsidiaries (including one or more of the named Co-Defendants) or intermediaries (including distributors, retailers, and others), has committed and continues to commit acts of infringement in this District by, among other things, offering to sell and selling products and/or services that infringe the asserted patents. For example, DISH Network L.L.C. advertises, "Get DISH TV Programming in Beaumont, Texas". See, e.g., https://www.DISH.com/availability/tx/beaumont. Upon information and belief, DISH has a regular and established place of business at 1211 Broad St, Wichita Falls, TX 76301. See, e.g., https://www.mapquest.com/us/texas/business-wichita-falls/DISH-tv-9269051. Upon information and belief, DISH Network L.L.C. has a regular and established place of business in this District. See, e.g., https://www.DISH.com/availability/tx/beaumont ("Get DISH TV Programming in Beaumont, Texas").

10. This Court has personal jurisdiction over Arris Group, Inc. in this action because Arris Group, Inc. has committed acts within the Eastern District of Texas giving rise to this action and has established minimum contacts with this forum such that the

exercise of jurisdiction over Arris Group, Inc. would not offend traditional notions of fair play and substantial justice. Arris Group, Inc. directly and/or through subsidiaries (including one or more of the named Co-Defendants) or intermediaries (including distributors, retailers, and others), has committed and continues to commit acts of infringement in this District by, among other things, offering to sell and selling products and/or services that infringe the asserted patents. On information and belief, Arris maintains a regular and established place of business in this District, for example, at 101 E Park Blvd, Plano, TX 75074. See, e.g., http://www.buzzfile.com/business/Arris-Group,-Inc.-972-546-1700. On information and belief, Arris also maintains a regular and established place of business at 4516 Seton Center Pkwy, Suite 185, Austin, TX 78759. See, e.g., http://www.Arris.com/company/offices/.

11. Venue is proper in this district under 28 U.S.C. §§ 1391(b), 1391(c) and 1400(b). Defendant Echostar Technologies L.L.C. is incorporated in Texas. Upon information and belief, all Defendants have transacted business in the Eastern District of Texas and have committed acts of direct and indirect infringement in the Eastern District of Texas. In addition, Echostar maintains an Uplink & Broadcast Center in Texas located at 710 Conrads Ln., New Braunfels, TX 78130. *See* http://www.echostar.com/company/locations.aspx. In addition, on information and belief, EchoStar has a regular and established place of business at 10303 E Bankhead Hwy # 100, Aledo, TX 76008. See, e.g., https://www.yellowpages.com/aledo-tx/mip/echostar-satellite-11408900. On information and belief, DISH has regular and established places of business in this District. For example, DISH advertises, "Get DISH TV Programming in Beaumont, Texas". See, e.g., https://www.DISH.com/availability/tx/beaumont. On information and belief, Arris maintains a place of business in this District at 101 E Park Blvd, Plano, TX 75074. See, e.g., http://www.buzzfile.com/business/Arris-Group,-Inc.-972-546-1700. On information and belief, Arris also maintains a regular and established place of business at 4516 Seton Center Pkwy, Suite 185, Austin, TX 78759. See, e.g.,

http://www.Arris.com/company/offices/.

ASSERTED PATENTS

12. The asserted patents are U.S. Patent Nos. 8,275,897 ("the '897 patent"), 8,867,610 ("the '610 Patent"), and 8,934,535 ("the '535 patent") (collectively, "Asserted Patents").

13. The Asserted Patents have been cited as prior art during the prosecution of at least 400 patent applications of Realtime and other companies. Those other companies include well-known technology companies such as: Quantum, Fujitsu, IBM, Seagate, STMicroelectronics, Cisco, LSI, Skyfire Labs, Chicago Mercantile Exchange, Thomson Reuters, OSR Open Systems Resources, Exegy, RIM, Renesas, Red Hat, Xerox, and Microsoft.

COUNT I

INFRINGEMENT OF U.S. PATENT NO. 8,275,897

14. Plaintiff realleges and incorporates by reference the foregoing paragraphs above, as if fully set forth herein.

15. Plaintiff Realtime is the owner by assignment of United States Patent No. 8,275,897 ("the '897 patent") entitled "System and methods for accelerated data storage and retrieval." The '897 patent was duly and legally issued by the United States Patent and Trademark Office on September 25, 2012. A true and correct copy of the '897 patent is included as Exhibit A.

16. On information and belief, DISH has made, used, offered for sale, sold and/or imported into the United States DISH products and services that infringe the '897 patent, and continues to do so. By way of illustrative example, these infringing products and services include, without limitation, DISH's streaming video products and services compliant with various versions of the H.264 video compression standard, such as, *e.g.,* the DISH TV service, Hopper with Sling, and all versions and variations thereof since the

issuance of the '897 patent ("Accused Instrumentalities"). *See, e.g.*, https://forum.DISH.com/viewtopic.php?t=9864&p=58341 ("[S]atellite services (e.g., DirecTV, XstreamHD and DISH Network) utilize the 1080p/24-30 format with MPEG-4 AVC/H.264 encoding for pay-per-view movies that are downloaded in advance via satellite or on-demand via broadband."); http://www.satelliteguys.us/xen/threads/hd-bitrate-is-under-5-mb-s-for-most-channels-is-this-correct.256211/ ("For HD video DN exclusively uses H.264 compression (sometimes ambiguously referred to here as MPEG-4, as there is more than one MPEG-4 video compression format). H.264 is about 2X more efficient than MPEG-2 for the same video quality."); http://www.laptopmag.com/reviews/wireless-networking/hopper-with-Sling; http://www.tivocommunity.com/community/index.php?threads/capturing-Slingbox-350-500-video.504853/ ("For the newer Slingboxes the video is H.264."); https://answers.Slingbox.com/thread/3940 ("I have the SlingBox Solo and by all accounts it streams h.264.").

17. On information and belief, Arris has made, used, offered for sale, sold and/or imported into the United States Arris products and services that infringe the '897 patent, and continues to do so. By way of illustrative example, these infringing products include, without limitation, Arris's streaming video products and services compliant with various versions of the H.264 video compression standard, such as, *e.g.,* Arris MS4000, and all versions and variations thereof since the issuance of the '897 patent ("Accused Instrumentalities"). *See, e.g.,* http://www.Arris.com/products/media-streamer-ms4000/ ("Transcode to H.264 with adaptive bitrate up to 4 Live/DVR streams").

18. On information and belief, each of DISH and Arris has directly infringed and continues to infringe the '897 patent, for example, through its own sale, offer for sale, importation, use and testing of the Accused Instrumentalities, which constitute devices claimed by Claim 46 of the '897 patent, namely, a device for accelerating data transmittal on an output to a data storage device, the output associated with an output transmission

rate, comprising: an input buffer capable of receiving a data stream comprising a plurality of data blocks, the data stream in a received form and temporarily storing the plurality of data blocks; a data accelerator capable of: (i) receiving a data parameter that indicates an amount of information loss permissible for the data stream; (ii) selecting, for a data block, a compression technique from a plurality of compression techniques based, at least in part, on the data parameter; (iii) compressing the data block using the compression technique to determine a compressed data block; and (iv) transmitting, on the output to the data storage device, the compressed data block in a compressed data stream to the data storage device, the compressing and the transmitting together occurring more quickly than a length of time to transmit the data block on the output in the received form. Upon information and belief, each of DISH and Arris sells, offers for sale, and imports the Accused Instrumentalities in the United States, and also uses the Accused Instrumentalities for its own internal non-testing business purposes, while testing the Accused Instrumentalities, and while providing technical support and repair services for the Accused Instrumentalities to their customers.

19. The Accused Instrumentalities are devices for accelerating data transmittal on an output to a data storage device, the output associated with an output transmission rate, comprising: an input buffer capable of receiving a data stream comprising a plurality of data blocks, the data stream in a received form and temporarily storing the plurality of data blocks. On information and belief, the input of the Accused Instrumentalities' compression system must contain at least one buffer to help normalize the I/O while throughput changes.

20. The Accused Instrumentalities comprise a data accelerator capable of: (i) receiving a data parameter that indicates an amount of information loss permissible for the data stream. For example, the Accused Instrumentalities determine a parameter of at least a portion of a video data block. As shown below, examples of such parameters include resolution, which reflects the amount of information loss permissible for the data

stream. Different parameters correspond to different end applications. The H.264 standard provides for multiple different ranges of such parameters, each included in the "profiles" and "levels" defined by the H.264 standard. *See* http://www.axis.com/files/whitepaper/wp_h264_31669_en_0803_lo.pdf at 5.

4. H.264 profiles and levels

The joint group involved in defining H.264 focused on creating a simple and clean solution, limiting 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.

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

Network cameras and video encoders will most likely use a profile called the baseline profile, which is 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 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.

H.264 has 11 levels or degree of capability to limit performance, bandwidth and memory requirements. 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.

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)
	Luma samples/s	Macroblocks/s	Luma samples	Macroblocks	Baseline, Extended and Main Profiles	High Profile	High 10 Profile	Toggle additional details
1	380,160	1,485	25,344	99	64	80	192	176×144@15.0 (4)
1b	380,160	1,485	25,344	99	128	160	384	176×144@15.0 (4)
1.1	768,000	3,000	101,376	396	192	240	576	352×288@7.5 (2)
1.2	1,536,000	6,000	101,376	396	384	480	1,152	352×288@15.2 (6)
1.3	3,041,280	11,880	101,376	396	768	960	2,304	352×288@30.0 (6)
2	3,041,280	11,880	101,376	396	2,000	2,500	6,000	352×288@30.0 (6)
2.1	5,068,800	19,800	202,752	792	4,000	5,000	12,000	352×576@25.0 (6)
2.2	5,184,000	20,250	414,720	1,620	4,000	5,000	12,000	720×576@12.5 (5)
3	10,368,000	40,500	414,720	1,620	10,000	12,500	30,000	720×576@25.0 (5)
3.1	27,648,000	108,000	921,600	3,600	14,000	17,500	42,000	1,280×720@30.0 (5)
3.2	55,296,000	216,000	1,310,720	5,120	20,000	25,000	60,000	1,280×1,024@42.2 (4)
4	62,914,560	245,760	2,097,152	8,192	20,000	25,000	60,000	2,048×1,024@30.0 (4)
4.1	62,914,560	245,760	2,097,152	8,192	50,000	62,500	150,000	2,048×1,024@30.0 (4)
4.2	133,693,440	522,240	2,228,224	8,704	50,000	62,500	150,000	2,048×1,080@60.0 (4)
5	150,994,944	589,824	5,652,480	22,080	135,000	168,750	405,000	3,672×1,536@26.7 (5)
5.1	251,658,240	983,040	9,437,184	36,864	240,000	300,000	720,000	4,096×2,304@26.7 (5)
5.2	530,841,600	2,073,600	9,437,184	36,864	240,000	300,000	720,000	4,096×2,304@56.3 (5)

21. The Accused Instrumentalities comprise a data accelerator capable of: (ii) selecting, for a data block, a compression technique from a plurality of compression techniques based at least in part, on the data parameter. Based on the bitrate and/or resolution parameter identified, any H.264-compliant system would determine the profile to which that parameter corresponds (e.g., "baseline," "extended," "main", "high"), then select between at least two compression techniques. If baseline or extended is the corresponding profile, then the system will select a Context-Adaptive Variable Length Coding entropy encoder. If main or high is the corresponding profile, then the system will select a Context-Adaptive Binary Arithmetic Coding ("CABAC") entropy encoder. See 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
8×8 vs. 4×4 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

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

at 7:

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

H.264 Entropy Coding – Comparison of Approaches

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

Moreover, the H.264 Standard requires a bit-flag descriptor, which is set to determine the correct decoder for the corresponding encoder. As shown below, if the flag = 0, then CAVLC must have been selected as the encoder; if the flag = 1, then CABAC must have been selected as the 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:

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

- 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).
- 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).

22. The Accused Instrumentalities comprise a data accelerator capable of: (iii) compressing the data block using the compression technique to determine a compressed data block. After being selected, the asymmetric compressors (CAVLC or CABAC) will

compress the video data to provide various compressed data blocks. 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://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.

23. The Accused Instrumentalities comprise a data accelerator capable of: (iv) transmitting, on the output to the data storage device, the compressed data block in a compressed data stream to the data storage device. Upon information and belief, the Accused Instrumentalities (in both on-demand and live streaming systems) will transmit the compressed data blocks and store the compressed data blocks in buffers, hard disk, and other forms of memory/storage.

24. The compressing and the transmitting performed by the Accused Instrumentalities together occur more quickly than a length of time to transmit the data block on the output in the received form. Upon information and belief, despite the time required to compress with either asymmetric encoder (CAVLC or CABAC), the compression ratios are so high—typically 60:1 or higher—that transmission and storage will be accelerated for at least some, if not all, the video data. 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

25. On information and belief, each of DISH and Arris also directly infringes and continues to infringe other claims of the '897 patent, for similar reasons as explained above with respect to Claim 46 of the '897 patent.

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

27. On information and belief, use of the Accused Instrumentalities in their ordinary and customary fashion results in infringement of the '897 patent.

28. On information and belief, each of DISH and Arris has had knowledge of

the '897 patent since at least since the filing of this Complaint or shortly thereafter, and on information and belief, each of DISH and Arris knew of the '897 patent and knew of its infringement, including by way of this lawsuit.

29. Upon information and belief, the affirmative acts of each of DISH and Arris of making, using, and selling the Accused Instrumentalities, and providing implementation services and technical support to users of the Accused Instrumentalities, have induced since the filing of this Amended Complaint and continue to induce users of the Accused Instrumentalities to use them in their normal and customary way to infringe Claim 46 of the '897 patent by using a device for accelerating data transmittal on an output to a data storage device, the output associated with an output transmission rate, comprising: an input buffer capable of receiving a data stream comprising a plurality of data blocks, the data stream in a received form and temporarily storing the plurality of data blocks; a data accelerator capable of: (i) receiving a data parameter that indicates an amount of information loss permissible for the data stream; (ii) selecting, for a data block, a compression technique from a plurality of compression techniques based, at least in part, on the data parameter; (iii) compressing the data block using the compression technique to determine a compressed data block; and (iv) transmitting, on the output to the data storage device, the compressed data block in a compressed data stream to the data storage device, the compressing and the transmitting together occurring more quickly than a length of time to transmit the data block on the output in the received form. For example, DISH instructs customers (e.g., of the Hopper with Sling) that they can, "Watch Live TV: Live sporting events, weather, news, and more – with a broadband-connected, Sling-enabled DVR and DISH Anywhere, you can watch all of your favorite channels anywhere you go! Watch Recorded TV: Access recorded shows from your broadband-connected, Sling-enabled DVR anywhere. You can even start watching on your TV and resume watching later on your computer or mobile device!". See, e.g., https://www.myDISH.com/DISH-anywhere. For example, Arris instructs its customers

that the MS4000 can "[t]ranscode to H.264 with adaptive bitrate up to 4 Live/DVR streams". See, e.g., https://www.Arris.com/globalassets/resources/data-sheets/365-095-24637_ms4000.pdf. For similar reasons, each of DISH and Arris also induces its customers to use the Accused Instrumentalities to infringe other claims of the '897 patent. Each of DISH and Arris specifically intended and was aware that these normal and customary activities would infringe the '897 patent. Each of DISH and Arris performed the acts that constitute induced infringement, since the filing of the Complaint, and would induce actual infringement, with the knowledge of the '897 patent and with the knowledge, or willful blindness to the probability, that the induced acts would constitute infringement. On information and belief, each of DISH and Arris engaged in such inducement to promote the sales of the Accused Instrumentalities. Accordingly, each of DISH and Arris has induced, since the filing of the Complaint, and continue to induce users of the Accused Instrumentalities to use the Accused Instrumentalities in their ordinary and customary way to infringe the '897 patent, knowing that such use constitutes infringement of the '897 patent.

30. By making, using, offering for sale, selling and/or importing into the United States the Accused Instrumentalities, and touting the benefits of using the Accused Instrumentalities' video compression features, each of DISH and Arris has injured Realtime and is liable to Realtime for infringement of the '897 patent pursuant to 35 U.S.C. § 271.

31. As a result the infringement of the '897 patent by each of DISH and Arris, Plaintiff Realtime is entitled to monetary damages in an amount adequate to compensate for their infringement, but in no event less than a reasonable royalty for the use made of the invention by each of DISH and Arris, together with interest and costs as fixed by the Court.

COUNT II

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

32. Plaintiff Realtime realleges and incorporates by reference the foregoing paragraphs above, as if fully set forth herein.

33. Plaintiff Realtime is the owner by assignment of United States Patent No. 8,867,610 ("the '610 Patent") entitled "System and methods for video and audio data distribution." The '610 Patent was duly and legally issued by the United States Patent and Trademark Office on October 21, 2014. A true and correct copy of the '610 Patent is included as Exhibit B.

34. On information and belief, DISH has made, used, offered for sale, sold and/or imported into the United States DISH products and services that infringe the '610 patent, and continues to do so. By way of illustrative example, these infringing products include, without limitation, DISH's streaming video products and services compliant with various versions of the H.264 video compression standard, such as, *e.g.,* the DISH TV service, and all versions and variations thereof since the issuance of the '610 patent ("DISH Accused Instrumentalities"). *See, e.g.*, https://forum.DISH.com/viewtopic.php?t=9864&p=58341 ("[S]atellite services (e.g., DirecTV, XstreamHD and DISH Network) utilize the 1080p/24-30 format with MPEG-4 AVC/H.264 encoding for pay-per-view movies that are downloaded in advance via satellite or on-demand via broadband."); http://www.satelliteguys.us/xen/threads/hd-bitrate-is-under-5-mb-s-for-most-channels-is-this-correct.256211/ ("For HD video DN exclusively uses H.264 compression (sometimes ambiguously referred to here as MPEG-4, as there is more than one MPEG-4 video compression format). H.264 is about 2X more efficient than MPEG-2 for the same video quality.").

35. On information and belief, Arris has made, used, offered for sale, sold and/or imported into the United States Arris products and services that infringe the '610 patent, and continues to do so. By way of illustrative example, these infringing products include, without limitation, Arris's streaming video products and services compliant with various versions of the H.264 video compression standard, such as, *e.g.,* Arris MS4000,

and all versions and variations thereof since the issuance of the '610 patent ("Accused Instrumentalities"). *See, e.g.,* http://www.Arris.com/products/media-streamer-ms4000/ ("Transcode to H.264 with adaptive bitrate up to 4 Live/DVR streams").

36. On information and belief, each of DISH and Arris has directly infringed and continues to infringe the '610 patent, for example, through its own use and testing of the Accused Instrumentalities, which when used, practice the method claimed by Claim 1 of the '610 patent, namely, a method, comprising: determining, a parameter or an attribute of at least a portion of a data block having video or audio data; selecting one or more compression algorithms from among a plurality of compression algorithms to apply to the at least the portion of the data block based upon the determined parameter or attribute and a throughput of a communication channel, at least one of the plurality of compression algorithms being asymmetric; and compressing the at least the portion of the data block with the selected compression algorithm after selecting the one or more compression algorithms.

37. The DISH Accused Instrumentalities determine a parameter of at least a portion of a video data block. Different parameters correspond with, for example, different moment to moment requirements, e.g., the degree of motion of a video data block at any given time. See, e.g., http://www.satelliteguys.us/xen/threads/hd-bitrate-is-under-5-mb-s-for-most-channels-is-this-correct.256211/ ("Subtracting out the audio data rates, most of the DN HD channels clock in less than 4 Mbit/s for the video stream. However these rates are averages only. DN multiplexes several HD channels per transponder, and **their compressors can dynamically allocate higher or lower rates for each channel based on moment to moment requirements. A static scene on one channel would require far less than a high action scene on another**. Still the data rates do not appear to change drastically and the average rate does appear to be a reasonable predictor of video quality. **Furthermore DN reduces the resolution of a number of their HD channels from 1920x1080 to 1440x1080**. This leads to a softer picture more

amenable to higher compression.").

38. The Sling TV Accused Instrumentalities determine a parameter of at least a portion of a video data block, e.g. based on different types of content. https://www.cuttingcords.com/home/2015/2/9/Sling-tv-technical-details ("First off, I found out that the streams were of differing quality depending on what channel you were watching. Sling has apparently **tailored different encoding profiles to different types of content** which is nice. … Below I have listed the encoding profile that each channel is using. As you are probably aware, **they are adaptive quality and jump between various qualities depending on how much bandwidth is available at any given time**.").

39. The Sling Media Accused Instrumentalities determine a parameter of at least a portion of a video data block. Different parameters are determined, for example, based on statistics observed by the Slingplayer client. See, e.g., https://answers.Slingbox.com/thread/3940 ("Sling Media believes their programming methodology choses the best encoding parameteres based on the statistics observed by the Slingplayer. You can see the statistics that it uses for the algorithim which dynamically choses the parameters by pressing [Alt]+[Shift]+[i] while connected to the Slingbox.").

40. The DISH Accused Instrumentalities select one or more compression algorithms to apply to the at least the portion of the data block based upon the determined parameter or attribute and a throughput of a communications channel, at least one of the plurality of compression algorithms being asymmetric. See, e.g., http://www.satelliteguys.us/xen/threads/hd-bitrate-is-under-5-mb-s-for-most-channels-is-this-correct.256211/ ("Subtracting out the audio data rates, most of the DN HD channels clock in less than 4 Mbit/s for the video stream. However these rates are averages only. DN multiplexes several HD channels per transponder, and **their compressors can dynamically allocate higher or lower rates for each channel based on moment to**

moment requirements. A static scene on one channel would require far less than a high action scene on another. Still the data rates do not appear to change drastically and the average rate does appear to be a reasonable predictor of video quality. Furthermore DN reduces the resolution of a number of their HD channels from 1920x1080 to 1440x1080. This leads to a softer picture more amenable to higher compression.").

41. The Sling TV Accused Instrumentalities select one or more compression algorithms to apply to the at least the portion of the data block based upon the determined parameter or attribute and a throughput of a communications channel, at least one of the plurality of compression algorithms being asymmetric. See, e.g., https://www.cuttingcords.com/home/2015/2/9/Sling-tv-technical-details ("First off, I found out that the streams were of differing quality depending on what channel you were watching. Sling has apparently **tailored different encoding profiles to different types of content** which is nice. … Below I have listed the encoding profile that each channel is using. As you are probably aware, **they are adaptive quality and jump between various qualities depending on how much bandwidth is available at any given time**.").

42. The Sling Media Accused Instrumentalities select one or more compression algorithms to apply to the at least the portion of the data block based upon the determined parameter or attribute and a throughput of a communications channel, at least one of the plurality of compression algorithms being asymmetric. See, e.g., https://answers.Slingbox.com/thread/3940 ("Sling Media believes their programming methodology choses the best encoding parameteres based on the statistics observed by the Slingplayer. You can see the statistics that it uses for the algorithim which dynamically choses the parameters by pressing [Alt]+[Shift]+[i] while connected to the Slingbox.").

43. Based on a throughput of the communications channel—reflected by the max video bitrate—and resolution parameter identified, any H.264-compliant system

such as the Accused Instrumentalities would determine which profile (e.g., "baseline," "extended," "main", or "high") and/or which "level" within a profile (which corresponds, e.g., to a maximum picture resolution, frame rate, and bit rate) corresponds with that parameter, then select between at least two asymmetric compressors. If, for example, baseline or extended is the corresponding profile, then the system will select a Context-Adaptive Variable Length Coding ("CAVLC") entropy encoder. If, for example, main or high is the corresponding profile, then the system will select a Context-Adaptive Binary Arithmetic Coding ("CABAC") entropy encoder. Both encoders are asymmetric compressors because it takes a longer period of time for them to compress data than to decompress data. See 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
8×8 vs. 4×4 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

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

at 7:

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

H.264 Entropy Coding – Comparison of Approaches

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

Moreover, the H.264 Standard requires a bit-flag descriptor, which is set to determine the correct decoder for the corresponding encoder. As shown below, if the flag = 0, then CAVLC must have been selected as the encoder; if the flag = 1, then CABAC must have been selected as the 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:

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

- 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).
- 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).

44. The Accused Instrumentalities compress the at least the portion of the data block with the selected compression algorithm after selecting the one or more,

compression algorithms. After its selection, the asymmetric compressor (CAVLC or CABAC) will compress the video data, in accordance with the specifications of the profile and level selected, to provide various compressed data blocks. 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

45. On information and belief, DISH and Arris also directly infringe and continue to infringe other claims of the '610 patent, for similar reasons as explained above with respect to Claim 1 of the '610 patent.

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

47. On information and belief, DISH and Arris have had knowledge of the '610 patent since at least the filing of this Complaint or shortly thereafter, and on information and belief, DISH and Arris knew of the '610 patent and knew of their infringement, including by way of this lawsuit.

48. Upon information and belief, the affirmative acts of each of DISH and Arris of making, using, and selling the Accused Instrumentalities, and providing

implementation services and technical support to users of the Accused Instrumentalities, have induced since the filing of this Amended Complaint and continue to induce users of the Accused Instrumentalities to use them in their normal and customary way to infringe the '610 patent by practicing a method, comprising: determining, a parameter or an attribute of at least a portion of a data block having video or audio data; selecting one or more compression algorithms from among a plurality of compression algorithms to apply to the at least the portion of the data block based upon the determined parameter or attribute and a throughput of a communication channel, at least one of the plurality of compression algorithms being asymmetric; and compressing the at least the portion of the data block with the selected compression algorithm after selecting the one or more, compression algorithms. For example, DISH instructs customers (e.g., of the Hopper with Sling) that they can, "Watch Live TV: Live sporting events, weather, news, and more – with a broadband-connected, Sling-enabled DVR and DISH Anywhere, you can watch all of your favorite channels anywhere you go! Watch Recorded TV: Access recorded shows from your broadband-connected, Sling-enabled DVR anywhere. You can even start watching on your TV and resume watching later on your computer or mobile device!". See, e.g., https://www.myDISH.com/DISH-anywhere. For example, Arris instructs its customers that the MS4000 can "[t]ranscode to H.264 with adaptive bitrate up to 4 Live/DVR streams". See, e.g., https://www.Arris.com/globalassets/resources/data-sheets/365-095-24637_ms4000.pdf.

For similar reasons, each of DISH and Arris also induces its customers to use the Accused Instrumentalities to infringe other claims of the '610 patent. Each of DISH and Arris specifically intended and was aware that these normal and customary activities would infringe the '610 patent. Each of DISH and Arris performed the acts that constitute induced infringement, since the filing of the Complaint, and would induce actual infringement, with the knowledge of the '610 patent and with the knowledge, or willful blindness to the probability, that the induced acts would constitute infringement.

On information and belief, each of DISH and Arris engaged in such inducement to promote the sales of the Accused Instrumentalities. Accordingly, each of DISH and Arris has induced, since the filing of the Complaint, and continue to induce users of the Accused Instrumentalities to use the Accused Instrumentalities in their ordinary and customary way to infringe the '610 patent, knowing that such use constitutes infringement of the '610 patent.

49. By making, using, offering for sale, selling and/or importing into the United States the Accused Instrumentalities, and touting the benefits of using the Accused Instrumentalities' compression features, each of DISH and Arris has injured Realtime and is liable to Realtime for infringement of the '610 patent pursuant to 35 U.S.C. § 271.

50. As a result of the infringement of the '610 patent by DISH and Arris, Plaintiff Realtime is entitled to monetary damages in an amount adequate to compensate for DISH and Arris's infringement, but in no event less than a reasonable royalty for the use made of the invention by DISH and Arris, together with interest and costs as fixed by the Court.

COUNT III

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

51. Plaintiff realleges and incorporates by reference the foregoing paragraphs above, as if fully set forth herein.

52. Plaintiff Realtime is the owner by assignment of United States Patent No. 8,934,535 ("the '535 patent") entitled "Systems and methods for video and audio data storage and distribution." The '535 patent was duly and legally issued by the United States Patent and Trademark Office on January 13, 2015. A true and correct copy of the '535 patent is included as Exhibit C.

53. On information and belief, DISH has made, used, offered for sale, sold

and/or imported into the United States DISH products and services that infringe the '535 patent, and continues to do so. By way of illustrative example, these infringing products include, without limitation, DISH's streaming video products and services compliant with various versions of the H.264 video compression standard, such as, *e.g.,* the DISH TV service, and all versions and variations thereof since the issuance of the '535 patent ("DISH Accused Instrumentalities"). *See, e.g.*, https://forum.DISH.com/viewtopic.php?t=9864&p=58341 ("[S]atellite services (e.g., DirecTV, XstreamHD and DISH Network) utilize the 1080p/24-30 format with MPEG-4 AVC/H.264 encoding for pay-per-view movies that are downloaded in advance via satellite or on-demand via broadband."); http://www.satelliteguys.us/xen/threads/hd-bitrate-is-under-5-mb-s-for-most-channels-is-this-correct.256211/ ("For HD video DN exclusively uses H.264 compression (sometimes ambiguously referred to here as MPEG-4, as there is more than one MPEG-4 video compression format). H.264 is about 2X more efficient than MPEG-2 for the same video quality.").

54. On information and belief, Arris has made, used, offered for sale, sold and/or imported into the United States Arris products and services that infringe the '535 patent, and continues to do so. By way of illustrative example, these infringing products include, without limitation, Arris's streaming video products and services compliant with various versions of the H.264 video compression standard, such as, *e.g.,* Arris MS4000, and all versions and variations thereof since the issuance of the '535 patent ("Accused Instrumentalities"). *See, e.g.,* http://www.Arris.com/products/media-streamer-ms4000/ ("Transcode to H.264 with adaptive bitrate up to 4 Live/DVR streams").

55. On information and belief, each of DISH and Arris has directly infringed and continues to infringe the '535 patent, for example, through its own use and testing of the Accused Instrumentalities, which when used, practices the methods claimed by at least Claim 15 of the '535 patent, including a method, comprising: determining a parameter of at least a portion of a data block; selecting one or more asymmetric

compressors from among a plurality of compressors based upon the determined parameter or attribute; compressing the at least the portion of the data block with the selected one or more asymmetric compressors to provide one or more compressed data blocks; and storing at least a portion of the one or more compressed data blocks. Upon information and belief, each of DISH and Arris uses the Accused Instrumentalities to practice infringing methods for their own internal non-testing business purposes, while testing the Accused Instrumentalities, and while providing technical support and repair services for the Accused Instrumentalities to each of DISH and Arris customers.

56. The DISH Accused Instrumentalities determine a parameter of at least a portion of a video data block. Different parameters correspond with, for example, different moment to moment requirements, e.g., the degree of motion of a video data block at any given time. See, e.g., http://www.satelliteguys.us/xen/threads/hd-bitrate-is-under-5-mb-s-for-most-channels-is-this-correct.256211/ ("Subtracting out the audio data rates, most of the DN HD channels clock in less than 4 Mbit/s for the video stream. However these rates are averages only. DN multiplexes several HD channels per transponder, and **their compressors can dynamically allocate higher or lower rates for each channel based on moment to moment requirements. A static scene on one channel would require far less than a high action scene on another**. Still the data rates do not appear to change drastically and the average rate does appear to be a reasonable predictor of video quality. **Furthermore DN reduces the resolution of a number of their HD channels from 1920x1080 to 1440x1080**. This leads to a softer picture more amenable to higher compression.").

57. The Sling TV Accused Instrumentalities determine a parameter of at least a portion of a video data block, e.g. based on different types of content. https://www.cuttingcords.com/home/2015/2/9/Sling-tv-technical-details ("First off, I found out that the streams were of differing quality depending on what channel you were watching. Sling has apparently **tailored different encoding profiles to different types**

of content which is nice. … Below I have listed the encoding profile that each channel is using. As you are probably aware, **they are adaptive quality and jump between various qualities depending on how much bandwidth is available at any given time**.").

58. The Sling Media Accused Instrumentalities determine a parameter of at least a portion of a video data block. Different parameters are determined, for example, based on statistics observed by the Slingplayer client. See, e.g., https://answers.Slingbox.com/thread/3940 ("Sling Media believes their programming methodology choses the best encoding parameteres based on the statistics observed by the Slingplayer. You can see the statistics that it uses for the algorithim which dynamically choses the parameters by pressing [Alt]+[Shift]+[i] while connected to the Slingbox.").

59. As, for example, explained above, the Accused Instrumentalities determine a parameter of at least a portion of a video data block. As shown below, examples of such parameters include bitrate (or max video bitrate) and resolution parameters. Different parameters correspond with different end applications. H.264 provides for multiple different ranges of such parameters, each included in the "profiles" and "levels" defined by the H.264 standard. *See* http://www.axis.com/files/whitepaper/wp_h264_31669_en_0803_lo.pdf at 5:

4. H.264 profiles and levels

The joint group involved in defining H.264 focused on creating a simple and clean solution, limiting 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.

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

Network cameras and video encoders will most likely use a profile called the baseline profile, which is 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 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.

H.264 has 11 levels or degree of capability to limit performance, bandwidth and memory requirements. 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.

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)
	Luma samples/s	Macroblocks/s	Luma samples	Macroblocks	Baseline, Extended and Main Profiles	High Profile	High 10 Profile	Toggle additional details
1	380,160	1,485	25,344	99	64	80	192	176×144@15.0 (4)
1b	380,160	1,485	25,344	99	128	160	384	176×144@15.0 (4)
1.1	768,000	3,000	101,376	396	192	240	576	352×288@7.5 (2)
1.2	1,536,000	6,000	101,376	396	384	480	1,152	352×288@15.2 (6)
1.3	3,041,280	11,880	101,376	396	768	960	2,304	352×288@30.0 (6)
2	3,041,280	11,880	101,376	396	2,000	2,500	6,000	352×288@30.0 (6)
2.1	5,068,800	19,800	202,752	792	4,000	5,000	12,000	352×576@25.0 (6)
2.2	5,184,000	20,250	414,720	1,620	4,000	5,000	12,000	720×576@12.5 (5)
3	10,368,000	40,500	414,720	1,620	10,000	12,500	30,000	720×576@25.0 (5)
3.1	27,648,000	108,000	921,600	3,600	14,000	17,500	42,000	1,280×720@30.0 (5)
3.2	55,296,000	216,000	1,310,720	5,120	20,000	25,000	60,000	1,280×1,024@42.2 (4)
4	62,914,560	245,760	2,097,152	8,192	20,000	25,000	60,000	2,048×1,024@30.0 (4)
4.1	62,914,560	245,760	2,097,152	8,192	50,000	62,500	150,000	2,048×1,024@30.0 (4)
4.2	133,693,440	522,240	2,228,224	8,704	50,000	62,500	150,000	2,048×1,080@60.0 (4)
5	150,994,944	589,824	5,652,480	22,080	135,000	168,750	405,000	3,672×1,536@26.7 (5)
5.1	251,658,240	983,040	9,437,184	36,864	240,000	300,000	720,000	4,096×2,304@26.7 (5)
5.2	530,841,600	2,073,600	9,437,184	36,864	240,000	300,000	720,000	4,096×2,304@56.3 (5)

60. The DISH Accused Instrumentalities select one or more compression algorithms to apply to the at least the portion of the data block based upon the determined parameter or attribute and a throughput of a communications channel, at least one of the plurality of compression algorithms being asymmetric. See, e.g., http://www.satelliteguys.us/xen/threads/hd-bitrate-is-under-5-mb-s-for-most-channels-is-

this-correct.256211/ ("Subtracting out the audio data rates, most of the DN HD channels clock in less than 4 Mbit/s for the video stream. However these rates are averages only. DN multiplexes several HD channels per transponder, and **their compressors can dynamically allocate higher or lower rates for each channel based on moment to moment requirements. A static scene on one channel would require far less than a high action scene on another**. Still the data rates do not appear to change drastically and the average rate does appear to be a reasonable predictor of video quality. Furthermore DN reduces the resolution of a number of their HD channels from 1920x1080 to 1440x1080. This leads to a softer picture more amenable to higher compression.").

61. The Sling TV Accused Instrumentalities select one or more compression algorithms to apply to the at least the portion of the data block based upon the determined parameter or attribute and a throughput of a communications channel, at least one of the plurality of compression algorithms being asymmetric. See, e.g., https://www.cuttingcords.com/home/2015/2/9/Sling-tv-technical-details ("First off, I found out that the streams were of differing quality depending on what channel you were watching. Sling has apparently **tailored different encoding profiles to different types of content** which is nice. … Below I have listed the encoding profile that each channel is using. As you are probably aware, **they are adaptive quality and jump between various qualities depending on how much bandwidth is available at any given time**.").

62. The Sling Media Accused Instrumentalities select one or more compression algorithms to apply to the at least the portion of the data block based upon the determined parameter or attribute and a throughput of a communications channel, at least one of the plurality of compression algorithms being asymmetric. See, e.g., https://answers.Slingbox.com/thread/3940 ("Sling Media believes their programming methodology choses the best encoding parameteres based on the statistics observed by the Slingplayer. You can see the statistics that it uses for the algorithim which

dynamically choses the parameters by pressing [Alt]+[Shift]+[i] while connected to the Slingbox.").

63. Based on a throughput of the communications channel—reflected by the max video bitrate—and resolution parameter identified, any H.264-compliant system such as the Accused Instrumentalities would determine which profile (e.g., "baseline," "extended," "main", or "high") corresponds with that parameter, then select between at least two asymmetric compressors. If baseline or extended is the corresponding profile, then the system will select a Context-Adaptive Variable Length Coding ("CAVLC") entropy encoder. If main or high is the corresponding profile, then the system will select a Context-Adaptive Binary Arithmetic Coding ("CABAC") entropy encoder. Both encoders are asymmetric compressors because it takes a longer period of time for them to compress data than to decompress data. See 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
8×8 vs. 4×4 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

See

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

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

H.264 Entropy Coding – Comparison of Approaches

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

Moreover, the H.264 Standard requires a bit-flag descriptor, which is set to determine the correct decoder for the corresponding encoder. As shown below, if the flag = 0, then CAVLC must have been selected as the encoder; if the flag = 1, then CABAC must have been selected as the 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:

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

- 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).
- 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).

64. The Accused Instrumentalities compress the at least the portion of the data block with the selected one or more asymmetric compressors to provide one or more compressed data blocks. After its selection, the asymmetric compressor (CAVLC or CABAC) will compress the video data to provide various compressed data blocks. 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.

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

66. On information and belief, DISH and Arris also directly infringe and continue to infringe other claims of the '535 patent, for similar reasons as explained above with respect to Claim 15 of the '535 patent.

67. On information and belief, use of the Accused Instrumentalities in their

ordinary and customary fashion results in infringement of the methods claimed by the '535 patent.

68. On information and belief, DISH and Arris have had knowledge of the '535 patent since at least the filing of this Complaint or shortly thereafter, and on information and belief, DISH and Arris knew of the '535 patent and knew of their infringement, including by way of this lawsuit.

69. Upon information and belief, the affirmative acts of each of DISH and Arris of making, using, and selling the Accused Instrumentalities, and providing implementation services and technical support to users of the Accused Instrumentalities, have induced since the filing of this Amended Complaint and continue to induce users of the Accused Instrumentalities to use them in their normal and customary way to infringe the '535 patent by practicing a method, comprising: determining a parameter of at least a portion of a data block; selecting one or more asymmetric compressors from among a plurality of compressors based upon the determined parameter or attribute; compressing the at least the portion of the data block with the selected one or more asymmetric compressors to provide one or more compressed data blocks; and storing at least a portion of the one or more compressed data blocks. For example, DISH instructs customers (e.g., of the Hopper with Sling) that they can, "Watch Live TV: Live sporting events, weather, news, and more – with a broadband-connected, Sling-enabled DVR and DISH Anywhere, you can watch all of your favorite channels anywhere you go! Watch Recorded TV: Access recorded shows from your broadband-connected, Sling-enabled DVR anywhere. You can even start watching on your TV and resume watching later on your computer or mobile device!". See, e.g., https://www.myDISH.com/DISH-anywhere. For example, Arris instructs its customers that the MS4000 can "[t]ranscode to H.264 with adaptive bitrate up to 4 Live/DVR streams". See, e.g., https://www.Arris.com/globalassets/resources/data-sheets/365-095-24637_ms4000.pdf. For similar reasons, each of DISH and Arris also induces its customers to use the

Accused Instrumentalities to infringe other claims of the '535 patent. Each of DISH and Arris specifically intended and was aware that these normal and customary activities would infringe the '535 patent. Each of DISH and Arris performed the acts that constitute induced infringement, since the filing of the Complaint, and would induce actual infringement, with the knowledge of the '535 patent and with the knowledge, or willful blindness to the probability, that the induced acts would constitute infringement. On information and belief, each of DISH and Arris engaged in such inducement to promote the sales of the Accused Instrumentalities. Accordingly, each of DISH and Arris has induced, since the filing of the Complaint, and continue to induce users of the Accused Instrumentalities to use the Accused Instrumentalities in their ordinary and customary way to infringe the '535 patent, knowing that such use constitutes infringement of the '535 patent.

70. By making, using, offering for sale, selling and/or importing into the United States the Accused Instrumentalities, and touting the benefits of using the Accused Instrumentalities' compression features, each of DISH and Arris has injured Realtime and is liable to Realtime for infringement of the '535 patent pursuant to 35 U.S.C. § 271.

71. As a result of the infringement of the '535 patent by DISH and Arris, Plaintiff Realtime is entitled to monetary damages in an amount adequate to compensate for DISH and Arris's infringement, but in no event less than a reasonable royalty for the use made of the invention by DISH and Arris, together with interest and costs as fixed by the Court.

PRAYER FOR RELIEF

WHEREFORE, Plaintiff Realtime respectfully requests that this Court enter:

a. A judgment in favor of Plaintiff that Defendants have directly infringed, either literally and/or under the doctrine of equivalents, the '897 patent, the '610 patent, and the '535 patent;

b. A judgment in favor of Plaintiff that Defendants have indirectly infringed, either literally and/or under the doctrine of equivalents, the '897 patent, the '610 patent, and the '535 patent, since the filing of the Complaint in this action;

b. A permanent injunction prohibiting Defendants from further acts of infringement of the '897 patent, the '610 patent, and the '535 patent;

c. A judgment and order requiring Defendants to pay Plaintiff its damages, costs, expenses, and prejudgment and post-judgment interest for Defendants' infringement of the '897 patent, the '610 patent, and the '535 patent, as provided under 35 U.S.C. § 284; and

d. A judgment and order requiring Defendants to provide an accounting and to pay supplemental damages to Realtime, including without limitation, prejudgment and post-judgment interest;

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

f. Any and all other relief as the Court may deem appropriate and just under the circumstances.

DEMAND FOR JURY TRIAL

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

Dated: August 31, 2017

Respectfully submitted,

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