IN THE UNITED STATES DISTRICT COURT
FOR THE WESTERN DISTRICT OF TEXAS
WACO DIVISION

REALTIME ADAPTIVE STREAMING LLC, Plaintiff, v. HAIVISION NETWORK VIDEO INC., Defendant.	Case No. 6:19-cv-00440 JURY TRIAL DEMANDED

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 Adaptive Streaming LLC ("Plaintiff" or "Realtime") makes the following allegations against Defendant Haivision Network Video Inc. ("Defendant" or "Haivision").

PARTIES

1. Realtime is a Texas limited liability company. Realtime has a place of business at 66 Palmer Avenue, Suite 27, Bronxville, NY 10708. 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 multiple United States patents and pending patent applications.

2. On information and belief, Defendant is a Delaware corporation with its principal place of business at 13975 W Polo Trail Drive, Lake Forest, Illinois 60045-5119. Defendant resides in this District because it is incorporated in Delaware. Defendant offers its products and/or services, including those accused herein of infringement, to customers

and potential customers located in Delaware and in this District. Defendant Haivision Network Video Inc. may be served with process through its registered agent for service at: Corporation Service Company, 251 Little Falls Dr., Wilmington, DE 19808.

JURISDICTION AND VENUE

3. 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).

4. This Court has personal jurisdiction over Defendant in this action because Defendant has committed acts within this District giving rise to this action and has established minimum contacts with this forum such that the exercise of jurisdiction over Defendant would not offend traditional notions of fair play and substantial justice. Defendant has also committed and continue 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.

5. Venue is proper in this district, *e.g.*, under 28 U.S.C. § 1400(b). Defendant has transacted business in this District and has committed acts of direct and indirect infringement in this District. Defendant has regular and established place of business in this District, including, e.g., at 4005 Banister Ln, Austin, TX 78704. *See* https://www.haivision.com/about/press-releases/haivision-moves-montreal-headquarters-to-accommodate-continued-growth-advanced-research-and-product-development/ ("Serving the global market, the company has recently expanded its headquarters in Chicago and offices in Hamburg, Germany, and also has regional offices in Portland, Austin, Washington D.C., and Atlanta.").

COUNT I

INFRINGEMENT OF U.S. PATENT NO. RE46,777

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

7. Plaintiff Realtime is the owner by assignment of United States Patent No. RE46,777 ("the '777 patent") entitled "Quantization for Hybrid Video Coding." The '777 patent was duly and legally issued by the United States Patent and Trademark Office on April 3, 2018. The '777 patent is a reissue of U.S. Pat. No. 8,634,462, which was issued on January 21, 2014. A true and correct copy of the '777 patent is included as **Exhibit A.**

8. On information and belief, Defendant has made, used, offered for sale, sold and/or imported into the United States products that infringe the '777 patent, and continues to do so. By way of illustrative example, these infringing products include, without limitation, Defendant's video encoding products, such as, *e.g.*, products that use Haivision Media Platform, the Makito X H.264, Makito X HEVC, Makito X with Storage, Makito Air, Makito XCR, and Makito X HARSH, KB Mini, KB Encoder/Transcoder Server, KB 4K Encoder/Transcoder, Kraken Series (S-KR-Base; S-KR-Base-KLV; S-KR-PREMIUM; S-KR-PREMIUM-KLV; S-KR-ULTRA; S-KR-ULTRA-KLV), Kraken CR, and streaming cloud services, such as, *e.g.*, the Haivision Video Cloud and Connect DVR services, and all versions and variations thereof since the issuance of the '777 patent ("Accused Instrumentalities").

9. On information and belief, Defendant has directly infringed and continue to infringe the '777 patent, for example, through their own use and testing of the Accused Instrumentalities, which when used, practices the method claimed by Claim 1 of the '777 patent, namely, a method for coding a video signal using hybrid coding, comprising: reducing temporal redundancy by block based motion compensated prediction in order to establish a prediction error signal; performing quantization on samples of the prediction error signal or on coefficients resulting from a transformation of the prediction error signal into the frequency domain to obtain quantized values, representing quantized samples or quantized coefficients respectively, wherein the prediction error signal includes a plurality of subblocks each including a plurality of quantized values; calculating a first quantization efficiency for the quantized values of at least one subblock of the plurality of subblocks; setting the quantized values of the at least one subblock to all zeroes; calculating a second quantization efficiency for the at least one subblock while all of the quantized values are zeroes; selecting which of the first and second quantization efficiencies is a higher efficiency; and selecting, for further proceeding, the at least one subblock with the quantized values prior to setting the quantized values of the at least one subblock to all zeroes if the first quantization efficiency is higher and selecting the at least one subblock with the quantized values set to zero, for further proceeding, if the second quantization efficiency is higher. Upon information and belief, Defendant use 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 their customers.

10. For example, a website maintained by Defendant advertising the "Makito X HEVC" product states that the "Makito X HEVC video encoder transports secure, high

quality, live HEVC/H.265 and AVC/H.264 video over any network at extremely low bit rates." *See* https://www.haivision.com/products/makito-series/makito-x-hevc/ (emphasis added):

11. Another website maintained by Defendant advertising the KB Series of "H.264 & **HEVC** Internet Media Encoders Transcoders" states that "With support for **HEVC,** the KB series uses up to 50% less bandwidth than H.264" and further stating that: "The KB Mini and KB 4K internet encoders/transcoders offer Intel-based hardware acceleration enabling real-time H.264 or **HEVC** encoding and adaptive bitrate (ABR) cascades up to 1080p for the KB Mini and 4K/UHD 2160p for the KB 4K. This maximizes stream quality for target devices while taking advantage of the bandwidth

savings offered by **HEVC**.” *See* https://www.haivision.com/products/kb-series/ (emphasis added):

BEST VIEWING EXPERIENCE

H.264 & HEVC Internet Media Encoders/Transcoders

Available as a small form factor portable appliance, HD server or 4K server, the KB Series of H.264 & HEVC Internet Media Encoders and Transcoders provides you with multiple options for live event streaming, helping you deliver the highest quality live video to your global internet audience. With the KB series, you have options to encode/transcode video in resolutions including SD, 720p, HD 1080p and up to 4K/UHD 2160p.

These resolutions can be distributed as a cascade of adaptive bitrate RTMP/HLS/MPEG-DASH streams across the world’s largest CDNs, giving you the highest quality per bit and giving your internet audience the best viewing experience regardless of their geographic location, network conditions or preferred device.

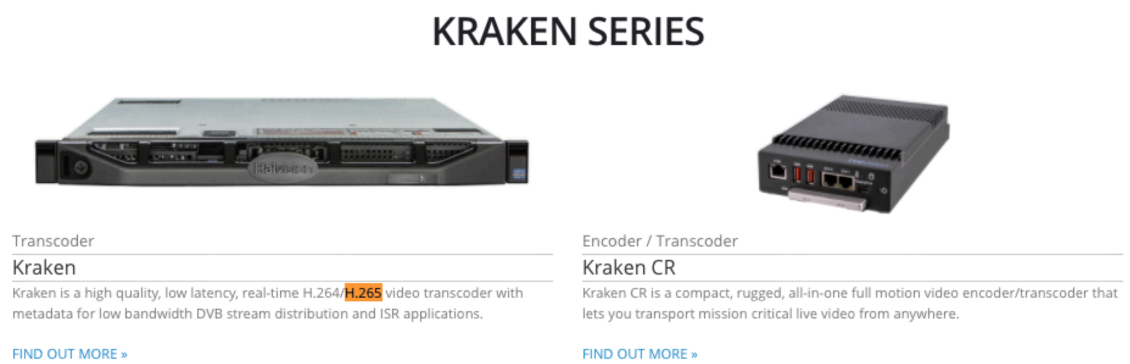
GET THE MOST OUT OF YOUR UPLINK CONNECTION TO THE CLOUD

When your internet connection at the source isn’t very reliable, and bandwidth is limited, simply send your video streams to a transcoder in the cloud to take care of adaptive bitrate (ABR) distribution.

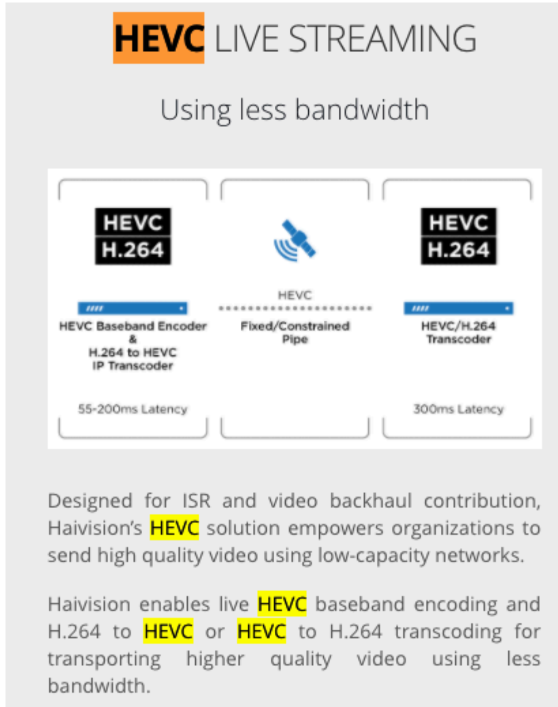
With support for HEVC, the KB Series uses up to 50% less bandwidth than H.264. Additionally Haivision’s SRT (Secure Reliable Transport) technology makes low-cost, readily available public internet connections secure and reliable for live video transport from the source to the cloud, getting the most out of your available uplink bandwidth.

12. Another website maintained by Defendant mentions that the Kraken transcoder product “is a high-quality, low latency, real-time H.264/**H.265** video transcoder with metadata for low bandwidth DVB stream distribution and ISR applications.” *See* *https://www.haivision.com/products/kraken-series/* (emphasis added) (image below). A website describing the Kraken transcoder product in more detail further states that “Kraken **HEVC** transcoding allows you to deliver substantially increased video quality over satellite and other constrained networks (typically in the 1 Mbps to 3 Mbps bandwidth range). Kraken receives high bitrate H.264 streams, which it then converts to **HEVC** for transport, and reconverts from **HEVC** to H.264 for onward distribution through less constrained ecosystems. Kraken **HEVC** transcoding reduces up

to 50% of bandwidth compared to H.264 while maintaining high picture quality.” *See* https://www.haivision.com/products/kraken-series/kraken/ (emphasis added).



13. Moreover, on the product website further describing the Kraken transcoder product, there is a section describing the feature of “HEVC Live Streaming” which states that “Designed for ISR and video backhaul contribution, Haivision’s **HEVC** solution empowers organizations to send high quality video using low-capacity networks. Haivision enables live **HEVC** baseband encoding and H.264 to **HEVC** or **HEVC** to H.264 transcoding for transporting higher quality video using less bandwidth.” *See* https://www.haivision.com/products/kraken-series/kraken/ (emphasis added):



14. A website further describing the Kraken CR encoder/transcoder product also states that "With Kraken CR **HEVC** encoding/transcoding, bandwidth is reduced by up to 50% over traditional H.264 solutions when transporting live video over constrained networks. **HEVC** streams can be played back directly on standards compliant players and decoders for monitoring or analysis purposes. Additionally, once the stream reaches its destination, a Haivision transcoder can be used to convert the stream from **HEVC** to H.264 for compatibility within existing distribution infrastructures." *See* https://www.haivision.com/products/kraken-series/kraken-cr/ (emphasis added).

15. The Accused Instrumentalities performs a method for coding a video signal using hybrid coding. For example, the aim of the coding process is the production of a bitstream, as defined in definition 3.12 of the ITU-T H.265 Series H: Audiovisual and Multimedia Systems, "Infrastructure of audiovisual services – Coding of moving video" High efficiency video coding ("HEVC Spec"): "bitstream: A sequence of bits, in

the form of a NAL unit stream or a byte stream, that forms the representation of coded pictures and associated data forming one or more coded video sequences (CVSs)." *See also, e.g.,* "Overview of the High Efficiency Video Coding (HEVC) Standard" by Gary J. Sullivan, Fellow, IEEE, Jens-Rainer Ohm, Member, IEEE, Woo-Jin Han, Member, IEEE, and Thomas Wiegand, Fellow, IEEE, published in IEEE TRANSACTIONS ON CIRCUITS AND SYSTEMS FOR VIDEO TECHNOLOGY, VOL. 22, NO. 12, DECEMBER 2012 ("IEEE HEVC) ("The video coding layer of HEVC employs the same hybrid approach (inter-/intrapicture prediction and 2-D transform coding) used in all video compression standards since H.261"). *See also, e.g.,* HEVC Spec at 0.7 "Overview of the design characteristics."

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

17. The Accused Instrumentalities perform quantization on samples of the prediction error signal or on coefficients resulting from a transformation of the prediction error signal into the frequency domain to obtain quantized values, representing quantized samples or quantized coefficients respectively. For example, the quantization parameter and the scaling (inverse quantization) are defined in definitions 3.112 (page 10) and 3.131 (page 11), respectively, the usage of the scaling process in the decoding being described in clause and 8.6 Scaling, transformation and array construction process prior to deblocking filter process of the HEVC Spec. *See also, e.g.,* IEEE HEVC at 1652 ("8) Quantization control: As in H.264/MPEG-4 AVC, uniform reconstruction quantization (URQ) is used in HEVC, with quantization scaling matrices supported for the various transform block sizes.").

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

19. The Accused Instrumentalities perform a method of calculating a first quantization efficiency for the quantized values of at least one subblock of the plurality of

subblocks; setting the quantized values of the at least one subblock to all zeroes; calculating a second quantization efficiency for the at least one subblock while all of the quantized values are zeroes; selecting which of the first and second quantization efficiencies is a higher efficiency; and selecting, for further proceeding, the at least one subblock with the quantized values prior to setting the quantized values of the at least one subblock to all zeroes if the first quantization efficiency is higher and selecting the at least one subblock with the quantized values set to zero, for further proceeding, if the second quantization efficiency is higher. For example, the bitstream resulting from the encoding as described in this last item of the claim contains all the relevant information as needed by the decoder for proper decoding. If the coefficients of the subblock are set to zero as a consequence of the efficiency calculation, the coded_sub_block_flag, as described in clause 7.4.9.11 Residual coding semantics, HEVC Spec, is set to 0, indicating that all the 16 coefficients of the coded sub block have been set to 0: "coded_sub_block_flag[xS][yS] specifies the following for the sub-block at location (xS, yS) within the current transform block, where a sub-block is a (4x4) array of 16 transform coefficient levels: – If coded_sub_block_flag[xS][yS] is equal to 0, the 16 transform coefficient levels of the sub-block at location (xS, yS) are inferred to be equal to 0."

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

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

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

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

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

– If one or more of the following conditions are true, coded_sub_block_flag[xS][yS] is inferred to be equal to 1:

– (xS, yS) is equal to (0, 0)

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

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

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

21. The infringement of the Accused Instrumentalities is also shown by way of considering the reference software (*see, e.g.,* https://hevc.hhi.fraunhofer.de/). Setting the flag RDOQ=true in the encoder configuration file enables rate-distortion-optimized quantization for transformed TUs. This feature is implemented in the HM reference software as function xRateDistOptQuant in file TComTrQuant.cpp. In the function xRateDistOptQuant, the efficiency for setting all quantized values to zero is calculated

and stored in the variable d64BestCost. In the variable iBestLastIdxP1, a 0 is stored indicating that all values starting from the 0th position are set to zero. Afterwards, the efficiency for keeping quantized values unequal to zero is calculated and stored in the variable totalCost. The variable iBestLastIdxP1 is adjusted correspondingly to values unequal to 0. The two efficiencies d64BestCost and totalCost are compared, and selecting for further proceeding either quantized values, which are all set to zero or quantized values, which are not all set to zero. All values starting from the position defined by the variable iBestLastIdxP1 are set to zero.

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

```
Double  d64BestCost         = 0;
Int     ui16CtxCbf          = 0;
Int     iBestLastIdxP1      = 0;
if( !pcCU->isIntra( uiAbsPartIdx ) && isLuma(compID) && pcCU->getTransformIdx( uiAbsPartIdx ) == 0 )
{
  ui16CtxCbf   = 0;
  d64BestCost  = d64BlockUncodedCost + xGetICost( m_pcEstBitsSbac->blockRootCbpBits[ ui16CtxCbf ][ 0 ] );
  d64BaseCost += xGetICost( m_pcEstBitsSbac->blockRootCbpBits[ ui16CtxCbf ][ 1 ] );
}
else
{
  ui16CtxCbf   = pcCU->getCtxQtCbf( rTu, channelType );
  ui16CtxCbf  += getCBFContextOffset(compID);
  d64BestCost  = d64BlockUncodedCost + xGetICost( m_pcEstBitsSbac->blockCbpBits[ ui16CtxCbf ][ 0 ] );
  d64BaseCost += xGetICost( m_pcEstBitsSbac->blockCbpBits[ ui16CtxCbf ][ 1 ] );
}
```

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

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

```
Bool bFoundLast = false;
for (Int iCGScanPos = iCGLastScanPos; iCGScanPos >= 0; iCGScanPos--)
{
  UInt uiCGBlkPos = codingParameters.scanCG[ iCGScanPos ];

  d64BaseCost -= pdCostCoeffGroupSig [ iCGScanPos ];
  if (uiSigCoeffGroupFlag[ uiCGBlkPos ])
  {
    for (Int iScanPosinCG = uiCGSize-1; iScanPosinCG >= 0; iScanPosinCG--)
    {
      iScanPos = iCGScanPos*uiCGSize + iScanPosinCG;

      if (iScanPos > iLastScanPos) continue;
      UInt   uiBlkPos     = codingParameters.scan[iScanPos];

      if( piDstCoeff[ uiBlkPos ] )
      {
        UInt   uiPosY       = uiBlkPos >> uiLog2BlockWidth;
        UInt   uiPosX       = uiBlkPos - ( uiPosY << uiLog2BlockWidth );

        Double d64CostLast= codingParameters.scanType == SCAN_VER ? xGetRateLast( uiPosY, uiPosX, compID ) :
                                                                    xGetRateLast( uiPosX, uiPosY, compID );
        Double totalCost = d64BaseCost + d64CostLast - pdCostSig[ iScanPos ];
```

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

24. Comparing the two efficiencies d64BestCost and totalCost:

```
if( totalCost < d64BestCost )
{
  iBestLastIdxP1  = iScanPos + 1;
  d64BestCost     = totalCost;
}
```

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

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

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

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

26. On information and belief, Defendant also directly infringe and continue to infringe other claims of the '777 patent, for similar reasons as explained above with respect to Claim 1 of the '777 patent.

27. 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 HEVC (or H.265) standard.

28. On information and belief, use of the Accused Instrumentalities in their ordinary and customary fashion results in infringement of the methods and/or systems claimed by the '777 patent.

29. On information and belief, Defendant has had knowledge of the '777 patent since at least the filing of this Complaint or shortly thereafter, and on information and belief, Defendant knew of the '777 patent and knew of its infringement, including by way of this lawsuit. By the time of trial, Defendant will have known and intended (since receiving such notice) that their continued actions would actively induce and contribute to the infringement of the claims of the '777 patent.

30. Upon information and belief, Defendant's affirmative acts of making, using, and selling the Accused Instrumentalities, and providing implementation services and technical support to users of the Accused Instrumentalities, including, e.g., through training, demonstrations, brochures, installation and user guides, have induced and continue to induce users of the Accused Instrumentalities to use them in their normal and customary way to infringe the '777 patent by practicing a method for coding a video signal using hybrid coding, comprising: reducing temporal redundancy by block based motion compensated prediction in order to establish a prediction error signal; performing quantization on samples of the prediction error signal or on coefficients resulting from a transformation of the prediction error signal into the frequency domain to obtain quantized values, representing quantized samples or quantized coefficients respectively,

wherein the prediction error signal includes a plurality of subblocks each including a plurality of quantized values; calculating a first quantization efficiency for the quantized values of at least one subblock of the plurality of subblocks; setting the quantized values of the at least one subblock to all zeroes; calculating a second quantization efficiency for the at least one subblock while all of the quantized values are zeroes; selecting which of the first and second quantization efficiencies is a higher efficiency; and selecting, for further proceeding, the at least one subblock with the quantized values prior to setting the quantized values of the at least one subblock to all zeroes if the first quantization efficiency is higher and selecting the at least one subblock with the quantized values set to zero, for further proceeding, if the second quantization efficiency is higher. For example, Defendant adopted HEVC (or H.265) as their video codec in their encoder devices, transcoder devices and streaming services. For similar reasons, Defendant also induce their customers to use the Accused Instrumentalities to infringe other claims of the ‘777 patent. Defendant specifically intended and were aware that these normal and customary activities would infringe the ‘777 patent. Defendant performed the acts that constitute induced infringement, and would induce actual infringement, with the knowledge of the ‘777 patent and with the knowledge, or willful blindness to the probability, that the induced acts would constitute infringement. On information and belief, Defendant engaged in such inducement to promote the sales of the Accused Instrumentalities. Accordingly, Defendant has induced and continue to induce users of the Accused Instrumentalities to use the Accused Instrumentalities in their ordinary and customary way to infringe the ‘777 patent, knowing that such use constitutes infringement of the ‘777 patent. Accordingly, Defendant has been, and currently are, inducing infringement of the ‘777 patent, in violation of 35 U.S.C. § 271(b).

31. Defendant has also infringed, and continue to infringe, claims of the ‘777 patent by offering to commercially distribute, commercially distributing, making, and/or importing the Accused Instrumentalities, which are used in practicing the process, or using the systems, of the ‘777 patent, and constitute a material part of the invention. Defendant know the components in the Accused Instrumentalities to be especially made or especially adapted for use in infringement of the ‘777 patent, not a staple article, and not a commodity of commerce suitable for substantial noninfringing use. Accordingly, Defendant has been, and currently are, contributorily infringing the ‘777 patent, in violation of 35 U.S.C. § 271(c).

32. 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, Defendant has injured Realtime and are liable to Realtime for infringement of the ‘777 patent pursuant to 35 U.S.C. § 271.

33. As a result of Defendant’s infringement of the ‘777 patent, Plaintiff Realtime is entitled to monetary damages in an amount adequate to compensate for Defendant’s infringement, but in no event less than a reasonable royalty for the use made of the invention by Defendant, together with interest and costs as fixed by the Court.

COUNT II

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

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

35. Plaintiff Realtime is the owner by assignment of United States Patent No. 9,578,298 ("the '298 patent") entitled "Method for Decoding 2D-Compatible Stereoscopic Video Flows." The '298 patent was duly and legally issued by the United States Patent and Trademark Office on February 21, 2017. A true and correct copy of the '298 patent is included as **Exhibit B**.

36. On information and belief, Defendant has made, used, offered for sale, sold and/or imported into the United States products that infringe the '298 patent, and continue to do so By way of illustrative example, these infringing products include, without limitation, Defendant's video encoding products, such as, *e.g.*, products that use Haivision Media Platform, the Makito X H.264, Makito X HEVC, Makito X with Storage, Makito Air, Makito XCR, and Makito X HARSH, KB Mini, KB Encoder/Transcoder Server, KB 4K Encoder/Transcoder, Kraken Series (S-KR-Base; S-KR-Base-KLV; S-KR-PREMIUM; S-KR-PREMIUM-KLV; S-KR-ULTRA; S-KR-ULTRA-KLV), Kraken CR, and streaming cloud services, such as, *e.g.*, the Haivision Video Cloud and Connect DVR services, and all versions and variations thereof since the issuance of the '298 patent ("Accused Instrumentalities").

37. On information and belief, Defendant has directly infringed and continue to infringe the '298 patent, for example, through its own use and testing of the Accused Instrumentalities, which when used, practices the method claimed by Claim 1 of the '298 patent, namely, a method for processing a video stream of digital images, the method comprising the steps of: receiving the video stream which comprises at least one

composite frame (FC), each composite frame containing a pair of stereoscopic digital images (L,R) according to a predetermined frame packing format; generating an output video stream which can be reproduced on a visualization apparatus, receiving metadata which determine an area occupied by one of the two images within said composite frame (FC), said metadata indicating either a geometry of the frame packing format or a frame packing type of said composite frame (FC); determining the area in the composite frame (FC) which is occupied by said one image of the stereoscopic pair within the composite frame based on said metadata; decoding only that part of the composite frame (FC) which contains said one image to be displayed, and generating an output frame containing said decoded image. Upon information and belief, Defendant use 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 their customers.

38. For example, a website maintained by Defendant advertising the "Makito X HEVC" product states that the "Makito X HEVC video encoder transports secure, high quality, live HEVC/H.265 and AVC/H.264 video over any network at extremely low bit

rates." *See* https://www.haivision.com/products/makito-series/makito-x-hevc/ (emphasis added):

39. Another website maintained by Defendant advertising the KB Series of "H.264 & **HEVC** Internet Media Encoders Transcoders" states that "With support for **HEVC,** the KB series uses up to 50% less bandwidth than H.264" and further stating that: "The KB Mini and KB 4K internet encoders/transcoders offer Intel-based hardware acceleration enabling real-time H.264 or **HEVC** encoding and adaptive bitrate (ABR) cascades up to 1080p for the KB Mini and 4K/UHD 2160p for the KB 4K. This maximizes stream quality for target devices while taking advantage of the bandwidth savings offered by **HEVC**." *See* https://www.haivision.com/products/kb-series/ (emphasis added):

BEST VIEWING EXPERIENCE

H.264 & HEVC Internet Media Encoders/Transcoders

Available as a small form factor portable appliance, HD server or 4K server, the KB Series of H.264 & HEVC Internet Media Encoders and Transcoders provides you with multiple options for live event streaming, helping you deliver the highest quality live video to your global internet audience. With the KB series, you have options to encode/transcode video in resolutions including SD, 720p, HD 1080p and up to 4K/UHD 2160p.

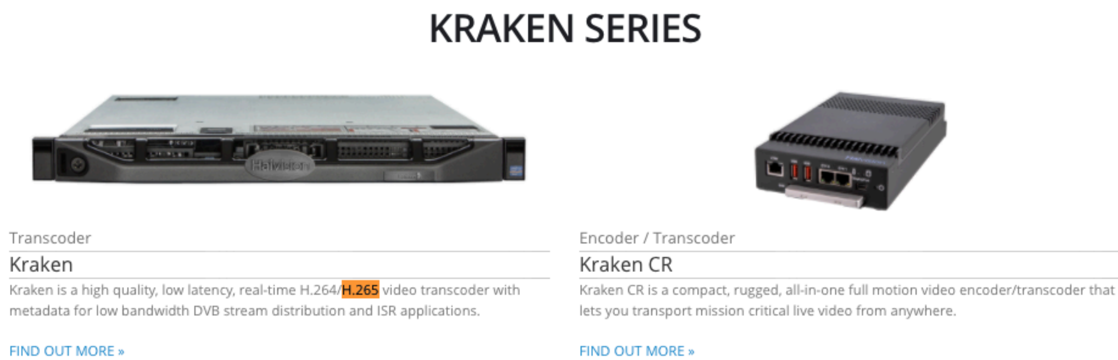
These resolutions can be distributed as a cascade of adaptive bitrate RTMP/HLS/MPEG-DASH streams across the world's largest CDNs, giving you the highest quality per bit and giving your internet audience the best viewing experience regardless of their geographic location, network conditions or preferred device.

GET THE MOST OUT OF YOUR UPLINK CONNECTION TO THE CLOUD

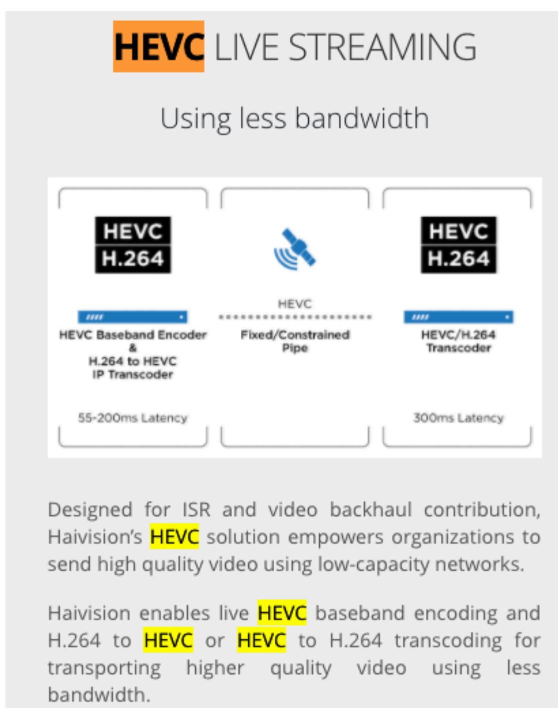
When your internet connection at the source isn't very reliable, and bandwidth is limited, simply send your video streams to a transcoder in the cloud to take care of adaptive bitrate (ABR) distribution.

With support for HEVC, the KB Series uses up to 50% less bandwidth than H.264. Additionally Haivision's SRT (Secure Reliable Transport) technology makes low-cost, readily available public internet connections secure and reliable for live video transport from the source to the cloud, getting the most out of your available uplink bandwidth.

40. Another website maintained by Defendant mentions that the Kraken transcoder product "is a high-quality, low latency, real-time H.264/**H.265** video transcoder with metadata for low bandwidth DVB stream distribution and ISR applications." *See https://www.haivision.com/products/kraken-series/* (emphasis added) (image below). A website describing the Kraken transcoder product in more detail further states that "Kraken **HEVC** transcoding allows you to deliver substantially increased video quality over satellite and other constrained networks (typically in the 1 Mbps to 3 Mbps bandwidth range). Kraken receives high bitrate H.264 streams, which it then converts to **HEVC** for transport, and reconverts from **HEVC** to H.264 for onward distribution through less constrained ecosystems. Kraken **HEVC** transcoding reduces up to 50% of bandwidth compared to H.264 while maintaining high picture quality." *See* https://www.haivision.com/products/kraken-series/kraken/ (emphasis added).



41. Moreover, on the product website further describing the Kraken transcoder product, there is a section describing the feature of "HEVC Live Streaming" which states that "Designed for ISR and video backhaul contribution, Haivision's **HEVC** solution empowers organizations to send high quality video using low-capacity networks. Haivision enables live **HEVC** baseband encoding and H.264 to **HEVC** or **HEVC** to H.264 transcoding for transporting higher quality video using less bandwidth." *See* https://www.haivision.com/products/kraken-series/kraken/ (emphasis added):



42. A website further describing the Kraken CR encoder/transcoder product also states that "With Kraken CR **HEVC** encoding/transcoding, bandwidth is reduced by up to 50% over traditional H.264 solutions when transporting live video over constrained networks. **HEVC** streams can be played back directly on standards compliant players and decoders for monitoring or analysis purposes. Additionally, once the stream reaches its destination, a Haivision transcoder can be used to convert the stream from **HEVC** to H.264 for compatibility within existing distribution infrastructures." *See* https://www.haivision.com/products/kraken-series/kraken-cr/ (emphasis added).

43. The Accused Instrumentalities receive the video stream which comprises at least one composite frame (FC), each composite frame containing a pair of stereoscopic digital images (L,R) according to a predetermined frame packing format. For example, the coded bitstream when it contains a stereoscopic video in one of the frame packing arrangements such as side-by-side or top-and-bottom or segmented rectangular frame packing format as defined in the following sections of the ITU-T H.265 Series H: Audiovisual and Multimedia Systems, "Infrastructure of audiovisual services – Coding of moving video" High efficiency video coding ("HEVC Spec"): D.2.16 Frame packing arrangement SEI message syntax, D.3.16 Frame packing arrangement SEI message semantics, D.2.29 Segmented rectangular frame packing arrangement SEI message syntax, D.3.29 Segmented rectangular frame packing arrangement SEI message semantics.

44. The Accused Instrumentalities generate an output video stream which can be reproduced on a visualization apparatus. For example, the output of the decoding process as defined above is a sequence of decoded pictures. *See, e.g.,* HEVC Spec at

3.39 ("3.39 decoded picture: A decoded picture is derived by decoding a coded picture"). Decoded pictures are the input of the display process. *Id.* at 3.47 ("3.47 display process: A process not specified in this Specification having, as its input, the cropped decoded pictures that are the output of the decoding process.").

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

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

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

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

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

– 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,
– 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,
– 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,
– 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,
– 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.

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.

The array MinTbAddrZs with elements MinTbAddrZs[x][y] for x ranging from 0 to (PicWidthInCtbsY << (CtbLog2SizeY − MinTbLog2SizeY)) − 1, inclusive, and y ranging from 0 to (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.

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

49. On information and belief, Defendant also directly infringe and continue to infringe other claims of the '298 patent, for similar reasons as explained above with respect to Claim 1 of the '298 patent.

50. 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 HEVC (or H.265) standard.

51. On information and belief, use of the Accused Instrumentalities in their ordinary and customary fashion results in infringement of the methods claimed by the ’298 patent.

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

53. Upon information and belief, Defendant’s affirmative acts of making, using, and selling the Accused Instrumentalities, and providing implementation services and technical support to users of the Accused Instrumentalities, including, e.g., through training, demonstrations, brochures, installation and user guides, have induced and continue to induce users of the Accused Instrumentalities to use them in their normal and customary way to infringe the ’298 by practicing a method for processing a video stream of digital images, the method comprising the steps of: receiving the video stream which comprises at least one composite frame (FC), each composite frame containing a pair of stereoscopic digital images (L,R) according to a predetermined frame packing format; generating an output video stream which can be reproduced on a visualization apparatus, receiving metadata which determine an area occupied by one of the two images within

said composite frame (FC), said metadata indicating either a geometry of the frame packing format or a frame packing type of said composite frame (FC); determining the area in the composite frame (FC) which is occupied by said one image of the stereoscopic pair within the composite frame based on said metadata; decoding only that part of the composite frame (FC) which contains said one image to be displayed, and generating an output frame containing said decoded image. For example, Defendant adopted HEVC (or H.265) as their video codec in their encoder devices, transcoder devices and streaming services. For similar reasons, Defendant also induce their customers to use the Accused Instrumentalities to infringe other claims of the '298 patent. Defendant specifically intended and were aware that these normal and customary activities would infringe the '298 patent. Defendant performed the acts that constitute induced infringement, and would induce actual infringement, with the knowledge of the '298 patent and with the knowledge, or willful blindness to the probability, that the induced acts would constitute infringement. On information and belief, Defendant engaged in such inducement to promote the sales of the Accused Instrumentalities. Accordingly, Defendant has induced and continue to induce users of the Accused Instrumentalities to use the Accused Instrumentalities in their ordinary and customary way to infringe the '298 patent, knowing that such use constitutes infringement of the '298 patent. Accordingly, Defendant has been, and currently are, inducing infringement of the '298 patent, in violation of 35 U.S.C. § 271(b).

54. Defendant has also infringed, and continue to infringe, claims of the '298 patent by offering to commercially distribute, commercially distributing, making, and/or importing the Accused Instrumentalities, which are used in practicing the process, or

using the systems, of the ’298 patent, and constitute a material part of the invention. Defendant know the components in the Accused Instrumentalities to be especially made or especially adapted for use in infringement of the ’298 patent, not a staple article, and not a commodity of commerce suitable for substantial noninfringing use. Accordingly, Defendant has been, and currently are, contributorily infringing the ’298 patent, in violation of 35 U.S.C. § 271(c).

55. 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, Defendant has injured Realtime and are liable to Realtime for infringement of the ’298 patent pursuant to 35 U.S.C. § 271.

56. As a result of Defendant’s infringement of the ’298 patent, Plaintiff Realtime is entitled to monetary damages in an amount adequate to compensate for Defendant’s infringement, but in no event less than a reasonable royalty for the use made of the invention by Defendant, 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 Defendant has infringed, literally and/or under the doctrine of equivalents, the ‘777 and ’298 patents (the “Asserted Patents”);

b. A judgment and order requiring Defendant to pay Plaintiff its damages, costs, expenses, and prejudgment and post-judgment interest for its infringement of the Asserted Patents, as provided under 35 U.S.C. § 284;

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

d. A permanent injunction prohibiting Defendant from further acts of infringement of the Asserted Patents;

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 Defendant; 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.

July 23, 2019

/s/ Reza Mirzaie

Marc A. Fenster
Reza Mirzaie
Brian D. Ledahl
C. Jay Chung
Philip X. Wang
RUSS, AUGUST & KABAT
12424 Wilshire Boulevard, 12th Floor
(310) 826-7474
Los Angeles, CA 90025-1031
mfenster@raklaw.com
rmirzaie@raklaw.com
bledahl@raklaw.com
jchung@raklaw.com
pwang@raklaw.com

Attorneys for Plaintiff
Realtime Adaptive Streaming LLC