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UNITED STATES DISTRICT COURT

CENTRAL DISTRICT OF CALIFORNIA

UNILOC 2017 LLC,

Plaintiff,

v.

ROKU, INC.,

Defendant.

LEAD CONSOLIDATED: 8:18-2055-GW-DFM

CASE NO. 8:19-cv-00295-GW-DFM

SECOND AMENDED COMPLAINT FOR PATENT INFRINGEMENT

DEMAND FOR JURY TRIAL

SECOND AMENDED COMPLAINT FOR PATENT INFRINGEMENT

Plaintiff Uniloc 2017 LLC ("Uniloc"), by and through the undersigned counsel, hereby files this Second Amended Complaint and makes the following allegations of patent infringement relating to U.S. Patent Nos. 6,519,005 and 8,407,609 against Defendant Roku, Inc. ("Roku") and alleges as follows upon actual knowledge with respect to itself and its own acts and upon information and belief as to all other matters:

NATURE OF THE ACTION

1. This is an action for patent infringement. Uniloc alleges that Roku infringes U.S. Patent Nos. 6,519,005 (the "'005 patent") and 8,407,609 (the "'609 patent") copies of which are attached hereto as Exhibits A-B (collectively, "the Asserted Patents").

2. Uniloc alleges that Roku directly infringes the Asserted Patents by making, using, offering for sale, selling and importing products that (1) perform a method for motion coding an uncompressed (pixel level) digital video data stream, such as Roku Channel, and (2) perform a method of coding a digital image comprising macroblocks in a binary data stream, such as Roku Channel. Uniloc seeks damages and other relief for Roku's infringement of the Asserted Patents.

THE PARTIES

3. Uniloc 2017 LLC is a Delaware corporation having places of business at 1209 Orange Street, Wilmington, Delaware 19801, 620 Newport Center Drive, Newport Beach, California 92660 and 102 N. College Avenue, Suite 303, Tyler, TX 75702.

4. Uniloc holds all substantial rights, title and interest in and to the Asserted Patents.

5. Upon information and belief, Defendant Roku, Inc. is a Delaware corporation and is authorized to do business in California. Roku has a regular and

established place of business at 2450 Colorado Avenue, Suite 260E, Santa Monica, California 90404. Roku may be served through its agent for service of process, CSC-Lawyers Incorporating Service, 2710 Gateway Oaks Drive, Suite 150N, Sacramento, California. 95833.

JURISDICTION AND VENUE

6. This action for patent infringement arises under the Patent Laws of the United States, 35 U.S.C. § 1 et. seq. This Court has original jurisdiction under 28 U.S.C. §§ 1331 and 1338.

7. Venue in the Central District of California is proper pursuant to 28 U.S.C. §§ 139l (b), (c) and l400(b) because Roku has a regular and established place of business in this District, 2450 Colorado Avenue, Suite 260E, Santa Monica, California 90404, has committed acts within this judicial district giving rise to this action, and Roku continues to conduct business in this judicial district, including one or more acts of selling, using, importing and/or offering for sale infringing products or providing support service to Roku's customers in this District.

COUNT I – INFRINGEMENT OF U.S. PATENT NO. 6,519,005

8. The allegations of paragraphs 1-7 of this First Amended Complaint are incorporated by reference as though fully set forth herein.

9. The '005 patent, titled "Method of Concurrent Multiple-Mode Motion Estimation For Digital Video," issued on February 11, 2003. A copy of the '005 patent is attached as Exhibit A. The priority date for '005 patent is April 30, 1999. The inventions of the '005 patent were developed by inventors at Koninklijke Philips Electronics N.V.

10. Pursuant to 35 U.S.C. § 282, the '005 patent is presumed valid.

11. Claim 1 of the '005 patent addresses a technological problem indigenous to motion coding in uncompressed digital video streams.

12. Claim 1 of the '005 patent reads as follows.

> 1. A method for motion coding an uncompressed digital video data stream, including the steps of:
>
> comparing pixels of a first pixel array in a picture currently being coded with pixels of a plurality of second pixel arrays in at least one reference picture and concurrently performing motion estimation for each of a plurality of different prediction modes in order to determine which of the prediction modes is an optimum prediction mode;
>
> determining which of the second pixel arrays constitutes a best match with respect to the first pixel array for the optimum prediction mode; and,
>
> generating a motion vector for the first pixel array in response to the determining step.

13. The invention of claim 1 of the '005 patent concerns "digital video compression" and, more particularly, "a motion estimation method and search engine for a digital video encoder that is simpler, faster, and less expensive than the presently available technology permits, and that permits concurrent motion estimation using multiple prediction modes." '005 patent at 1:6-11.

14. Data compression is the encoding of data using fewer "bits" than the original representation. Data compression is useful because it reduces the resources required to store and transmit data, and allows for faster retrieval and transmission of video data.

15. In the context of digital video with which the '005 patent is concerned, a video codec is electronic circuitry or software that compresses and/or decompresses digital video for storage and/or transmission. Video codecs refer to video encoders and decoders.

16. Prior to digital video, video was typically stored as an analog signal on magnetic tape. Then, around the time of the development of compact discs (CDs), it became more feasible to store and convey video in digital form. However, a large

amount of storage and communications bandwidth was needed to record and convey raw video. Thus, what was needed was a method to reduce the amount of data used to represent the raw video. Accordingly, numerous engineers and many companies worked to develop solutions for compressing digital video data.

17. "Practical digital video compression started with the ITU H.261 standard in 1990." *A Brief History of Video Coding*, ARC International, Marco Jacobs and Jonah Probell (2007). Numerous other video compression standards thereafter were created and evolved. The innovation in digital video compression continues to this day.

18. In April 1999, at the time of the invention of claim 1 of the '005 patent, "different compression algorithms ha[d] been developed for digitally encoding video and audio information (hereinafter referred to generically as the 'digital video data stream') in order to minimize the bandwidth required to transmit this digital video data stream for a given picture quality." '005 patent at 1:11-17.

19. At the time of the invention of claim 1 of the '005 patent, the "most widely accepted international standards [for compression of digital video for motion pictures and television were] proposed by the Moving Pictures Expert Group (MPEG)." '005 patent at 1:20-24. Two such standards that existed at the time of the invention were MPEG-1 and MPEG-2.

20. In accordance with MPEG-1 and MPEG-2—and other compression standards for digital video—the video stream is "encoded/compressed . . . using a compression technique generally known as 'motion coding.'" '005 patent at 1:40-44. More particularly, rather than transmitting each video frame in its entirety, the standards at the time used motion estimation for only those parts of sequential pictures that varied due to motion, where possible. '005 patent at 1:45-48.

21. In general, the picture elements or "pixels" within a block of a picture are specified relative to those of a previously transmitted reference or "anchor"

picture using differential or "residual" video, as well as so-called "motion vectors" that specify the location of an array (e.g., 16-by-16) of pixels or "macroblock" within the current picture relative to its original location within the anchor picture. '005 patent at 1:48-55. A macroblock is a unit in image and video compression that typically consists of 16x16 samples of pixels. A motion vector is used to represent a macroblock in a picture based on the position of that same or similar macroblock in another picture (known as the reference picture).

22. At the time of the invention, there were various "prediction modes" that could be used for each macroblock that was to be encoded. '005 patent at 3:7-11. Prediction modes are techniques for predicting image pixels or groups of pixels, and examples of prediction modes in MPEG include frame and field prediction modes. '005 patent at 4:64-67. Moreover, at that time, motion coding allowed for the use of different prediction modes within the same frame, but required one prediction mode to be specified for a macroblock in advance of performing the motion estimation that results in a motion vector. '005 patent at 3:12-15. Given that there are multiple prediction modes, the optimum prediction mode could not be known prior to encoding unless multiple motion estimations were performed on each macroblock sequentially. '005 patent at 3:15-20. Then, after determining the optimum prediction mode based on multiple and sequential motion estimations, the optimal prediction mode would be selected and only then would the motion estimation that results in the generation of a motion vector occur.

23. In this prior art method, numerous and sequential motion estimations would have to run to find the optimal prediction mode. Only after these sequential motion estimations have been run and the optimal prediction mode selected could the motion estimation that results in the motion vector for the macroblock be carried out. Because "motion estimation usually consists of an exhaustive search procedure in which all 256 pixels of the two corresponding macroblocks are

compared, and which is repeated for a large number of macroblocks," having to sequentially run numerous motion estimations to find the optimal prediction mode and only then performing the motion estimation using the optimal prediction mode to generate the motion vector is very computationally intensive, complex, inefficient, lengthy and cost ineffective. '005 patent at 3:20-43.

24. As demonstrated below, the claimed invention of claim 1 of the '005 patent provides a technological solution to the problem faced by the inventors, namely concurrently determining the optimal prediction mode while performing motion estimation along with generating the motion vector more simply, faster and in a less expensive way.

25. As detailed in the specification, the invention of claim 1 of the '005 patent provides a technological solution to the problems faced by the inventors:

> Based on the above and foregoing, it can be appreciated that there presently exists a need in the art that overcomes the disadvantages and shortcomings of the presently available technology. The present invention fulfills this need in the art by performing motion coding of an uncompressed digital video sequence in such a manner that the prediction mode for each individual macroblock is determined as part of the motion estimation process, along with the actual motion vector(s), and need not be specified in advance; only the type of picture currently being coded need be known. Since the latter must be determined at a higher level of video coding than the macroblock layer, this method makes possible a much more efficient, as well as optimal, degree of video compression than would otherwise be possible using conventional methods of motion estimation. Further, the present invention provides a novel scheme for concurrently searching for the optimum macroblock match within the appropriate anchor picture according to each of a plurality of motion prediction modes during the same search operation for the given macroblock, without the need for a separate search to be performed on the same macroblock for each such mode. Since this search procedure is the single most complex and expensive aspect of motion estimation, in both time and hardware, such a method as the present invention will clearly result in a more efficient video image coding and compression than would otherwise be possible given the

aforementioned practical limitations of the presently available technology.

'005 patent at 3:40-67 (emphasis added).

26. The technological solution of claim 1 of the '005 patent is further shown in Figure 3 which visually depicts a motion estimation process for concurrently performing motion estimation for frame prediction mode and field prediction modes for frame pictures:

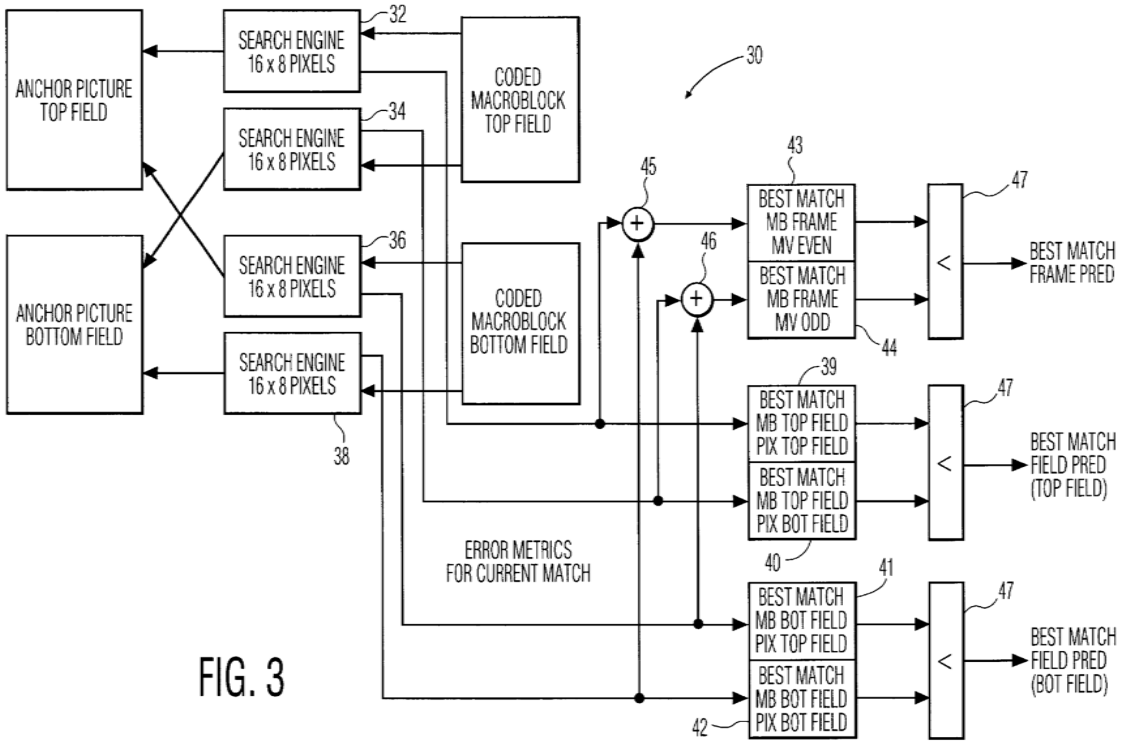


FIG. 3

27. Claim 1 of the '005 patent improves the functionality of motion coding in video compression by performing the concurrent determination of the optimal prediction mode while performing motion estimation along with generating the motion vector. The claimed invention of claim 1 of '005 patent also was not well-understood, routine or conventional at the time of the invention. Rather, as set forth below, the claimed invention was a departure from the conventional ways of performing motion coding in video compression.

28. That the '005 patent improves the functioning of motion coding in video compression and was a departure from conventional ways of carrying out this functionality cannot be disputed:

> Based on the above and foregoing, it can be appreciated that there presently exists a need in the art that overcomes the disadvantages and shortcomings of the presently available technology. The present invention fulfills this need in the art by performing motion coding of an uncompressed digital video sequence in such a manner that the prediction mode for each individual macroblock is determined as part of the motion estimation process, along with the actual motion vector(s), and need not be specified in advance; only the type of picture currently being coded need be known. Since the latter must be determined at a higher level of video coding than the macroblock layer, this method makes possible a much more efficient, as well as optimal, degree of video compression than would otherwise be possible using conventional methods of motion estimation. Further, the present invention provides a novel scheme for concurrently searching for the optimum macroblock match within the appropriate anchor picture according to each of a plurality of motion prediction modes during the same search operation for the given macroblock, without the need for a separate search to be performed on the same macroblock for each such mode. Since this search procedure is the single most complex and expensive aspect of motion estimation, in both time and hardware, such a method as the present invention will clearly result in a more efficient video image coding and compression than would otherwise be possible given the aforementioned practical limitations of the presently available technology.

'005 patent at 3:40-67 (emphasis added).

> The present invention relates generally to digital video compression, and, more particularly, to a motion estimation method and search engine for a digital video encoder that is simpler, faster, and less expensive than the presently available technology permits, and that permits concurrent motion estimation using multiple prediction modes.

'005 patent at 1:7-11 (emphasis added).

> In either case, the methods and architectures of the present invention result in a means of significantly improving the video compression efficiency and, hence, the resulting picture quality, without the need for either greater hardware costs or higher computational complexity.

'005 patent at 14:62-67 (emphasis added).

> In all known motion estimation methods, the prediction mode must be specified for every macroblock before the motion estimation, with its constituent search, is performed. However, in accordance with the present invention, in one of its aspects, the motion estimation may be performed, in a frame picture, forth both frame and field prediction modes simultaneously, during the same search for the anchor picture.

'005 patent at 8:6-13 (emphasis added).

29. In light of the foregoing, and the general knowledge of a person of ordinary skill in the art, a person of ordinary skill in the art reading the '005 patent and its claims would understand that the patent's disclosure and claims are drawn to solving a specific, technical problem arising in the field of digital video compression. Moreover, a person of ordinary skill in the art would understand that the claimed subject matter of the '005 patent presents advancements in the field of digital video compression, and more particularly to a motion estimation method and search engine for a digital video encoder that is simpler, faster, and less expensive than prior art technology, and that permits concurrent motion estimation using multiple prediction modes. A person of ordinary skill in the art would understand that claim 1 of the '005 patent is directed to a method for motion coding an uncompressed digital video data stream, which provides concurrent motion estimation using multiple prediction modes along with the generation of motion vectors. Moreover, a person of ordinary skill in the art would understand that claim 1 of the '005 patent contains that corresponding inventive concept.

30. The patent of one of the streaming services used on Roku devices (Netflix) claims subject matter in the field of video coding and, in particular,

concurrent encoding processes. For example, on December 10, 2010, over a decade after the priority date for the '005 patent, Netflix filed an application entitled, "Parallel Video Encoding based on Complexity Analysis," which matured into US Patent No. 8,837,601 on September 16, 2014 (the "'601 patent"). Similar to the '005 patent, the '601 patent, concerns concurrent video encoding processes.

31. The patent of another one of the streaming services used on Roku devices (Hulu) claims subject matter in the field of video coding and, in particular, using concurrent or parallel processing in the field of video coding. For example, on August 13, 2012, more than 13 years after the priority date for the '005 patent, Hulu filed an application titled, "Splicing of Video for Parallel Encoding," which matured into U.S. Patent No. 9,307,261 on April 5, 2016 (the "'261 patent"). During prosecution of this application, Hulu successfully argued that this subject matter was patent eligible because it provided a "specialized encoding process." File History of '261 Patent, Amendment of 9-11-2015 at p. 13.

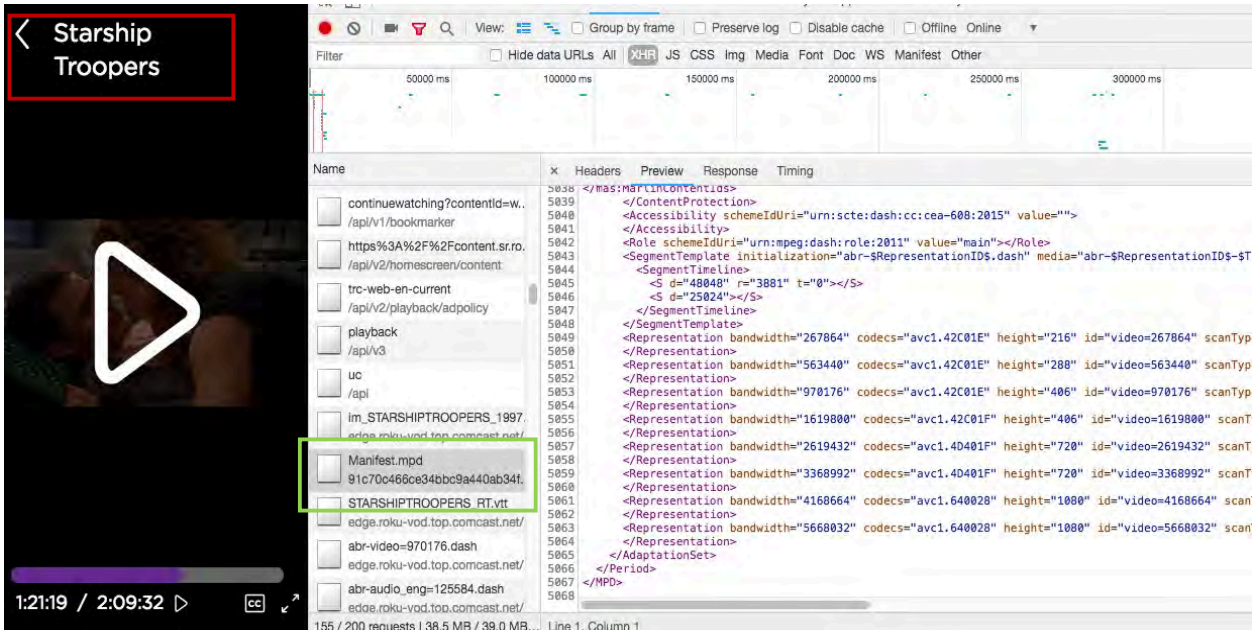
32. Upon information and belief, Roku makes, uses, offers for sale, and/or sells in the United States and/or imports into the United States products and services such as H.264 encoders that practice a method for motion coding an uncompressed (pixel level) digital video data stream, such as Roku Channel (collectively "the Accused Infringing Devices").

33. Upon information and belief, the Accused Infringing Devices infringe at least claim 1 of the '005 patent in the exemplary manner described below.

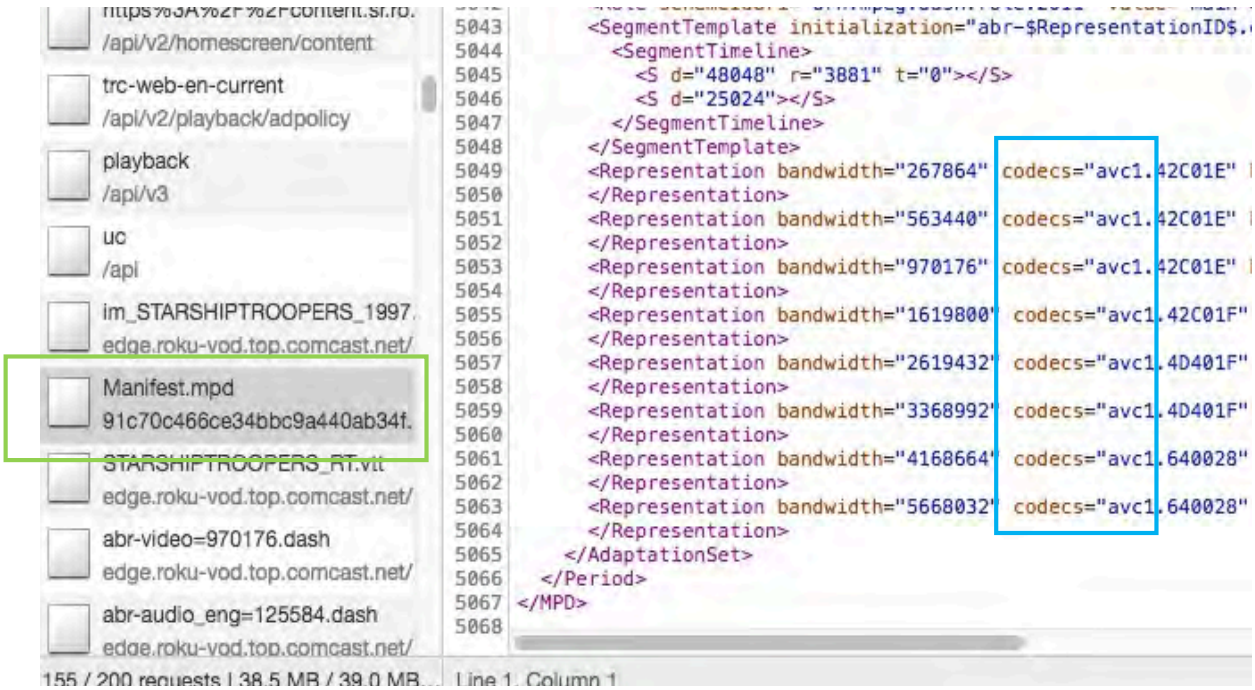
34. The Accused Infringing Devices provide a method for motion coding an uncompressed (pixel level) digital video data stream. The Accused Infringing Devices receive input video streams which are then encoded using at least the H.264 (AVC1) standard. This is a widely used video compression format with decoder support on web browsers, TVs and other consumer devices. Moreover, H.264 uses motion compressor and estimator for motion coding video streams.

35. The Accused Infringing Devices stream content using the DASH format, such as the example frame from the movie "Starship Trooper" shown below. The DASH movie delivery mechanism includes a manifest that provides a description of the video format present in the movie stream. This is illustrated by the file Manifest.mpd sample below. The manifest file includes references to the video codec AVC1 (H.264). The AVC1 designator is the IETF identifier for H.264.

Source:
https://therokuchannel.roku.com/details/w.W105qGbbNVi7pZ7MW4Jyu1VrZVMVdvf1639q6a0BS9A8xq8ArWuALjW5z3gGFxa8meqMektGjJ6jx0r7CNmYyZdv9mtP7qPQx



Source: https://therokuchannel.roku.com/details/w.W105qGbbNVi7pZ7MW4Jyu1VrZVMVdvf1639q6a0BS9A8xq8ArWuALjW5z3gGFxa8meqMektGjJ6jx0r7CNmYyZdv9mtP7qPQx



Source: https://therokuchannel.roku.com/details/w.W105qGbbNVi7pZ7MW4Jyu1VrZVMVdvf1639q6a0BS9A8xq8ArWuALjW5z3gGFxa8meqMektGjJ6jx0r7CNmYyZdv9mtP7qPQx

When the first element of a value is a code indicating a codec from the Advanced Video Coding specification [AVC], specifically one of the sample entries defined in [AVC-Formats] (such as 'avc1', 'avc2', 'svc1', 'mvc1', and 'mvc2') -- indicating AVC (H.264), Scalable Video Coding (SVC), or Multiview Video Coding (MVC), the second element (referred to as 'avcoti' in the formal syntax) is the hexadecimal representation of the following three bytes in the (subset) sequence parameter set Network Abstraction Layer (NAL) unit specified in [AVC]:

(1) profile_idc,

(2) the byte containing the constraint_set flags (currently constraint_set0_flag through constraint_set5_flag, and the reserved_zero_2bits), and

(3) level_idc.

Source: https://tools.ietf.org/html/rfc6381

0.6 Overview of the design characteristics

This subclause does not form an integral part of this Recommendation | International Standard.

The coded representation specified in the syntax is designed to enable a high compression capability for a desired image quality. With the exception of the transform bypass mode of operation for lossless coding in the High 4:4:4 Intra, CAVLC 4:4:4 Intra, and High 4:4:4 Predictive profiles, and the I_PCM mode of operation in all profiles, the algorithm is typically not lossless, as the exact source sample values are typically not preserved through the encoding and decoding processes. A number of techniques may be used to achieve highly efficient compression. Encoding algorithms (not specified in this Recommendation | International Standard) may select between inter and intra coding for block-shaped regions of each picture. Inter coding uses motion vectors for block-based inter prediction to exploit temporal statistical dependencies between different pictures. Intra coding uses various spatial prediction modes to exploit spatial statistical dependencies in the source signal for a single picture. Motion vectors and intra prediction modes may be specified for a variety of block sizes in the picture. The prediction residual is then further compressed using a transform to remove spatial correlation inside the transform block before it is quantised, producing an irreversible process that typically discards less important visual information while forming a close approximation to the source samples. Finally, the motion vectors or intra prediction modes are combined with the quantised transform coefficient information and encoded using either variable length coding or arithmetic coding.

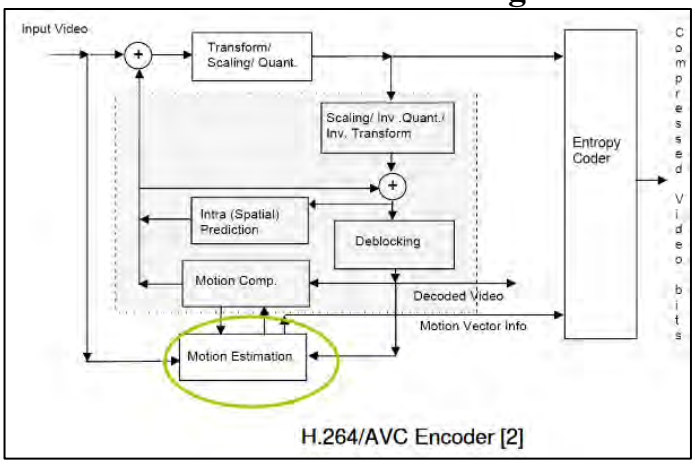
0.6.1 Predictive coding

This subclause does not form an integral part of this Recommendation | International Standard.

Because of the conflicting requirements of random access and highly efficient compression, two main coding types are specified. Intra coding is done without reference to other pictures. Intra coding may provide access points to the coded sequence where decoding can begin and continue correctly, but typically also shows only moderate compression efficiency. Inter coding (predictive or bi-predictive) is more efficient using inter prediction of each block of sample values from some previously decoded picture selected by the encoder. In contrast to some other video coding standards, pictures coded using bi-predictive inter prediction may also be used as references for inter coding of other pictures.

The application of the three coding types to pictures in a sequence is flexible, and the order of the decoding process is generally not the same as the order of the source picture capture process in the encoder or the output order from the decoder for display. The choice is left to the encoder and will depend on the requirements of the application. The decoding order is specified such that the decoding of pictures that use inter-picture prediction follows later in decoding order than other pictures that are referenced in the decoding process.

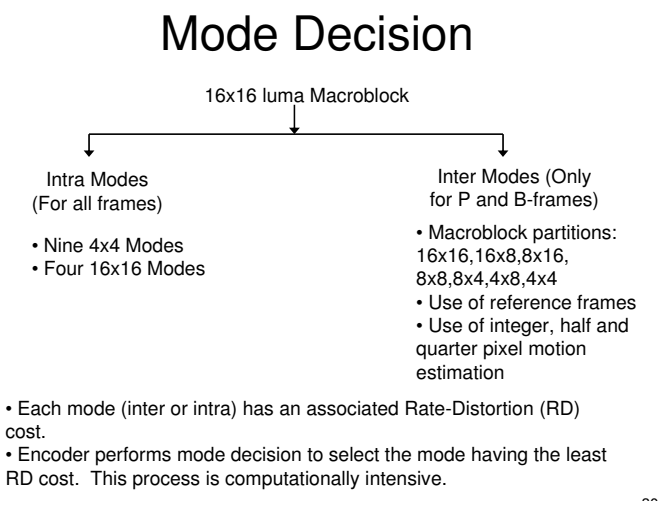
H.264 Encoder Block Diagram



Source:
https://courses.cs.washington.edu/courses/csep590a/07au/lectures/rahullarge.pdf

36. The Accused Infringing Devices provide a method for comparing pixels of a first pixel array (e.g., a macroblock) in a picture currently being coded with pixels of a plurality of second pixel arrays in at least one reference picture and concurrently performing motion estimation for each of a plurality of different prediction modes in order to determine which of the prediction modes is an optimum prediction mode.

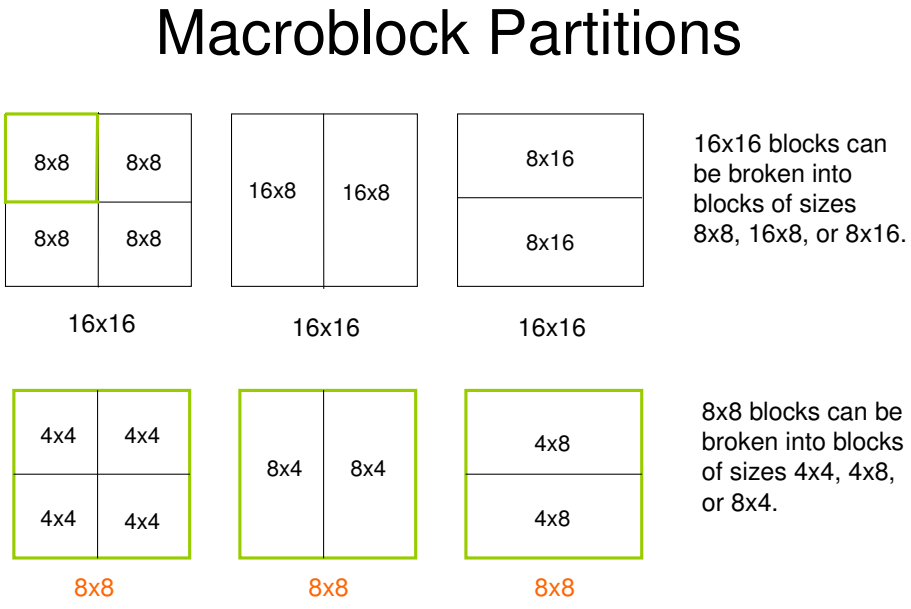
37. H.264 uses different motion estimation modes in inter-frame prediction. These modes are commonly referred to as inter-frame prediction modes, or inter modes. Each inter mode involves partitioning the current macroblock into a different combination of sub blocks, and selecting the optimum motion vector for the current macroblock based on the partition. The inter-frame prediction modes, or inter modes, can be further categorized by the number and position of the reference frames, as well as the choice of integer pixel, half pixel and quarter pixel values in motion estimation. The Roku H.264 encoders concurrently perform motion estimation of a macroblock for all inter-modes and select the most optimum prediction mode with least rate distortion cost.



Source:
https://courses.cs.washington.edu/courses/csep590a/07au/lectures/rahullarge.pdf, p. 30.

38. H.264 provides a hierarchical way to partition a macroblock, with the available partitions shown in the following two figures. An exemplary inter-frame prediction mode, or inter mode, can be for a macroblock to be partitioned to encompass a 16x8 sub block on the left, and two 8x8 sub blocks on the right.

Macroblock partitions for inter-frame prediction modes



Source: https://courses.cs.washington.edu/courses/csep590a/07au/lectures/rahullarge.pdf, p. 4

H.264 provides macroblock partitions for inter-frame prediction modes

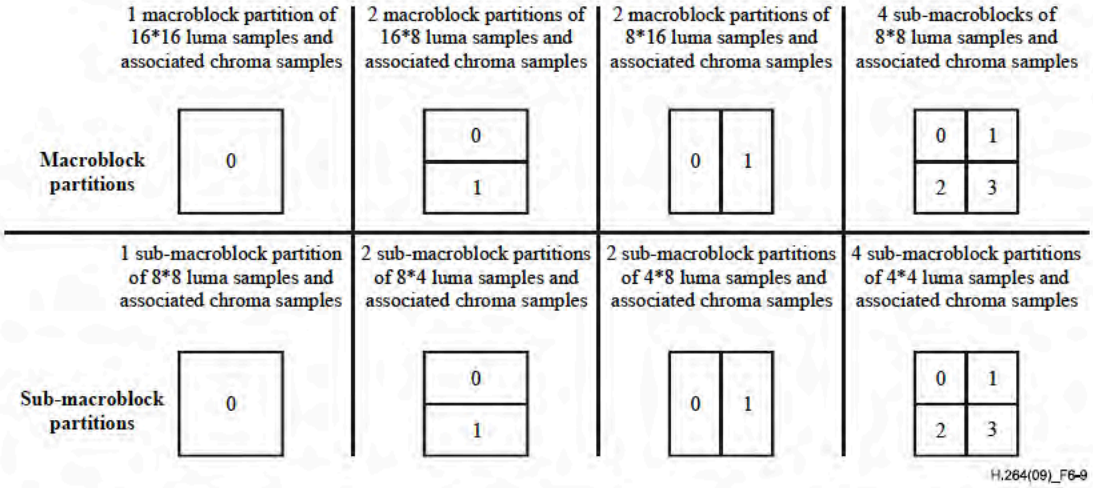


Figure 6-9 – Macroblock partitions, sub-macroblock partitions, macroblock partition scans, and sub-macroblock partition scans

Source: H.264 Standard (03-2010) at p. 26

39. The optimum prediction mode as chosen for the current macroblock is embedded in the compressed bit stream of H.264, as shown in the following two syntaxes.

Macroblock prediction syntax in H.264

7.3.5.1 Macroblock prediction syntax

mb_pred(mb_type) {	C	Descriptor
if(MbPartPredMode(mb_type, 0) == Intra_4x4 || MbPartPredMode(mb_type, 0) == Intra_16x16) {		
if(MbPartPredMode(mb_type, 0) == Intra_4x4)		
for(luma4x4BlkIdx=0; luma4x4BlkIdx<16; luma4x4BlkIdx++) {		
prev_intra4x4_pred_mode_flag[luma4x4BlkIdx **]**	2	u(1) | ae(v)
if(!prev_intra4x4_pred_mode_flag[luma4x4BlkIdx])		
rem_intra4x4_pred_mode[luma4x4BlkIdx **]**	2	u(3) | ae(v)
}		
intra_chroma_pred_mode	2	ue(v) | ae(v)
} else if(MbPartPredMode(mb_type, 0) != Direct) {		
for(mbPartIdx = 0; mbPartIdx < NumMbPart(mb_type); mbPartIdx++)		
if((num_ref_idx_l0_active_minus1 > 0 || mb_field_decoding_flag) && MbPartPredMode(mb_type, mbPartIdx) != Pred_L1)		
ref_idx_l0[mbPartIdx **]**	2	te(v) | ae(v)
for(mbPartIdx = 0; mbPartIdx < NumMbPart(mb_type); mbPartIdx++)		
if((num_ref_idx_l1_active_minus1 > 0 || mb_field_decoding_flag) && MbPartPredMode(mb_type, mbPartIdx) != Pred_L0)		
ref_idx_l1[mbPartIdx **]**	2	te(v) | ae(v)
for(mbPartIdx = 0; mbPartIdx < NumMbPart(mb_type); mbPartIdx++)		
if(MbPartPredMode (mb_type, mbPartIdx) != Pred_L1)		
for(compIdx = 0; compIdx < 2; compIdx++)		
mvd_l0[mbPartIdx **][** 0 **][** compIdx **]**	2	se(v) | ae(v)
for(mbPartIdx = 0; mbPartIdx < NumMbPart(mb_type); mbPartIdx++)		
if(MbPartPredMode(mb_type, mbPartIdx) != Pred_L0)		
for(compIdx = 0; compIdx < 2; compIdx++)		
mvd_l1[mbPartIdx **][** 0 **][** compIdx **]**	2	se(v) | ae(v)
}		
}		

Source: H.264 Standard (03-2010) at p. 57

Sub-macroblock prediction syntax in H.264

7.3.5.2 Sub-macroblock prediction syntax

sub_mb_pred(mb_type) {	C	Descriptor
for(mbPartIdx = 0; mbPartIdx < 4; mbPartIdx++)		
sub_mb_type[mbPartIdx]	2	ue(v) | ae(v)
for(mbPartIdx = 0; mbPartIdx < 4; mbPartIdx++)		
if((num_ref_idx_l0_active_minus1 > 0 || mb_field_decoding_flag) && mb_type != P_8x8ref0 && sub_mb_type[mbPartIdx] != B_Direct_8x8 && SubMbPredMode(sub_mb_type[mbPartIdx]) != Pred_L1)		
ref_idx_l0[mbPartIdx]	2	te(v) | ae(v)
for(mbPartIdx = 0; mbPartIdx < 4; mbPartIdx++)		
if((num_ref_idx_l1_active_minus1 > 0 || mb_field_decoding_flag) && sub_mb_type[mbPartIdx] != B_Direct_8x8 && SubMbPredMode(sub_mb_type[mbPartIdx]) != Pred_L0)		
ref_idx_l1[mbPartIdx]	2	te(v) | ae(v)
for(mbPartIdx = 0; mbPartIdx < 4; mbPartIdx++)		
if(sub_mb_type[mbPartIdx] != B_Direct_8x8 && SubMbPredMode(sub_mb_type[mbPartIdx]) != Pred_L1)		
for(subMbPartIdx = 0; subMbPartIdx < NumSubMbPart(sub_mb_type[mbPartIdx]); subMbPartIdx++)		
for(compIdx = 0; compIdx < 2; compIdx++)		
mvd_l0[mbPartIdx][subMbPartIdx][compIdx]	2	se(v) | ae(v)
for(mbPartIdx = 0; mbPartIdx < 4; mbPartIdx++)		
if(sub_mb_type[mbPartIdx] != B_Direct_8x8 && SubMbPredMode(sub_mb_type[mbPartIdx]) != Pred_L0)		
for(subMbPartIdx = 0; subMbPartIdx < NumSubMbPart(sub_mb_type[mbPartIdx]); subMbPartIdx++)		
for(compIdx = 0; compIdx < 2; compIdx++)		
mvd_l1[mbPartIdx][subMbPartIdx][compIdx]	2	se(v) | ae(v)
}		

Source: H.264 Standard (03-2010) at p. 58

40. The Accused Infringing Devices provide a method for determining which of the second pixel arrays (e.g., macroblock) constitutes a best match with respect to the first pixel array (e.g., macroblock) for the optimum prediction mode.

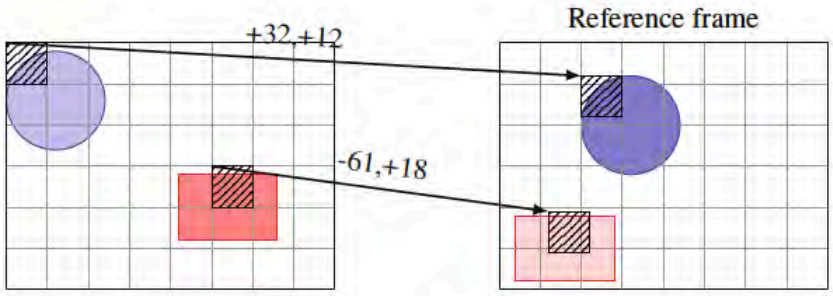


Fig. 2.4: Motion estimation. For each MB the best matching block in the reference frame is found. The encoder codes the differences (errors) between the MBs and their best matching blocks. Arrows indicate motion vectors and are labeled by the vector coordinates. In this example the shapes are identical but their colors are slightly larger/darker.

Source: B. Juurlink et al., Scalable Parallel Programming Applied to H.264, Chapter 2: Understanding the Application: An Overview of the H.264 Standard, p. 12

41. For example, the encoder performs mode decision to select the most optimum prediction mode with least rate distortion cost.

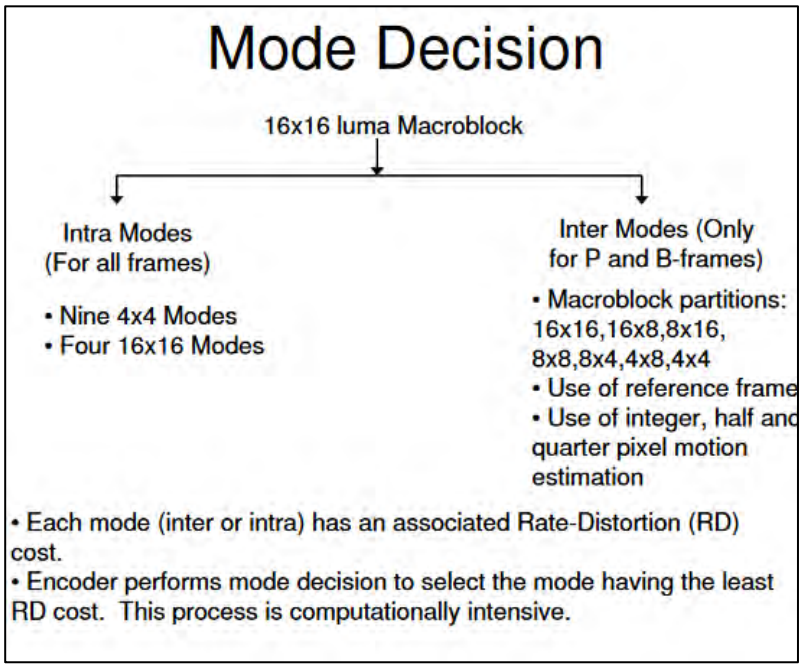
Macroblock layer semantics

The following semantics are assigned to the macroblock types in Table 7-13:

- P_L0_16x16: the samples of the macroblock are predicted with one luma macroblock partition of size 16x16 luma samples and associated chroma samples.
- P_L0_L0_MxN, with MxN being replaced by 16x8 or 8x16: the samples of the macroblock are predicted using two luma partitions of size MxN equal to 16x8, or two luma partitions of size MxN equal to 8x16, and associated chroma samples, respectively.
- P_8x8: for each sub-macroblock an additional syntax element (sub_mb_type[mbPartIdx] with mbPartIdx being the macroblock partition index for the corresponding sub-macroblock) is present in the bitstream that specifies the type of the corresponding sub-macroblock (see subclause 7.4.5.2).
- P_8x8ref0: has the same semantics as P_8x8 but no syntax element for the reference index (ref_idx_l0[mbPartIdx] with mbPartIdx = 0..3) is present in the bitstream and ref_idx_l0[mbPartIdx] shall be inferred to be equal to 0 for all sub-macroblocks of the macroblock (with indices mbPartIdx = 0..3).
- P_Skip: no further data is present for the macroblock in the bitstream.

Source: H.264 Standard (03-2010), p. 100

Mode Decision



Source:
https://courses.cs.washington.edu/courses/csep590a/07au/lectures/rahullarge.pdf, p. 30

42. The Accused Infringing Devices provide a method for generating a motion vector for the first pixel array in response to the determining step. The encoder calculates the appropriate motion vectors and other data elements represented in the video data stream.

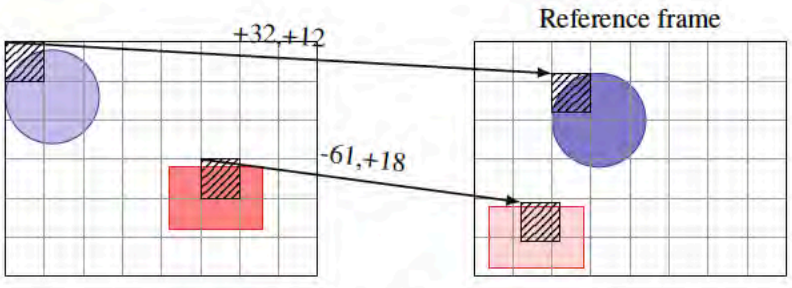


Fig. 2.4: Motion estimation. For each MB the best matching block in the reference frame is found. The encoder codes the differences (errors) between the MBs and their best matching blocks. Arrows indicate motion vectors and are labeled by the vector coordinates. In this example the shapes are identical but their colors are slightly larger/darker.

Source: B. Juurlink et al., Scalable Parallel Programming Applied to H.264, Chapter 2: Understanding the Application: An Overview of the H.264 Standard, p. 12

Motion Vector Derivation is described below

1. The derivation process for motion vector components and reference indices as specified in subclause 8.4.1 is invoked.

   Inputs to this process are:

   – a macroblock partition mbPartIdx,

   – a sub-macroblock partition subMbPartIdx.

   Outputs of this process are:

   – luma motion vectors mvL0 and mvL1 and when ChromaArrayType is not equal to 0, the chroma motion vectors mvCL0 and mvCL1

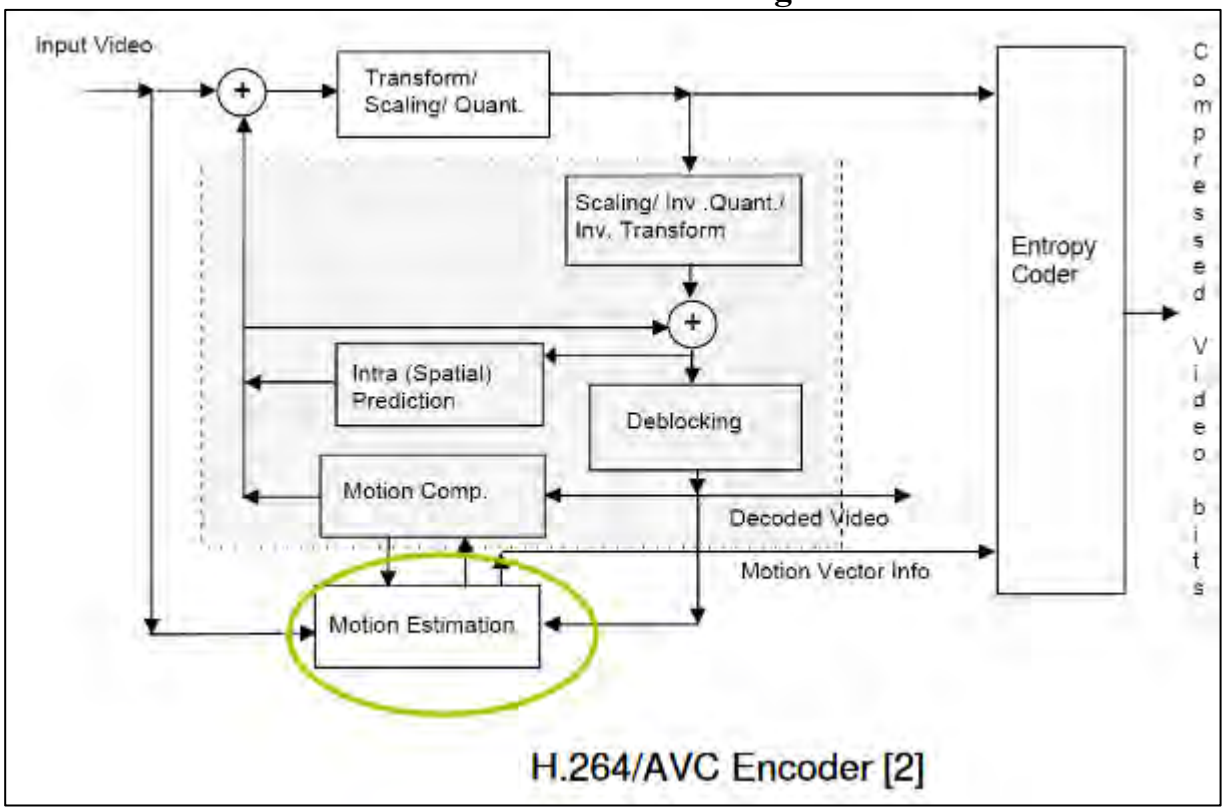
   – reference indices refIdxL0 and refIdxL1

   – prediction list utilization flags predFlagL0 and predFlagL1

   – the sub-macroblock partition motion vector count subMvCnt.

Source: H.264 Standard (03-2010), p. 151

H.264 Encoder Block Diagram



Source: https://courses.cs.washington.edu/courses/csep590a/07au/lectures/rahullarge.pdf, p. 2

43. Roku has infringed, and continues to infringe, at least claim 1 of the '005 patent in the United States, by making, using, offering for sale, selling and/or importing the Accused Infringing Devices in violation of 35 U.S.C. § 271(a).

44. Upon information and belief, Roku may have infringed and continues to infringe the '005 patent through other software and devices utilizing the same or reasonably similar functionality, including other versions of the Accused Infringing Devices.

45. Roku's acts of direct infringement have caused and continue to cause damage to Uniloc and Uniloc is entitled to recover damages sustained as a result of Roku's wrongful acts in an amount subject to proof at trial.

COUNT II – INFRINGEMENT OF U.S. PATENT NO. 8,407,609

46. The allegations of paragraphs 1-7 of this First Amended Complaint are incorporated by reference as though fully set forth herein.

47. The '609 patent, titled "System and Method For Providing And Tracking The Provision of Audio and Visual Presentations Via A Computer Network," issued on March 26, 2013. A copy of the '609 patent is attached as Exhibit C. The priority date for the '609 patent is August 21, 2008. The inventions of the '609 patent were developed by an inventor at LINQware, Inc.

48. Pursuant to 35 U.S.C. § 282, the '609 patent is presumed valid.

49. Claim 1 of the '609 patent addresses a technological problem indigenous to webpages and the Internet—tracking digital media presentations that are streamed via the Internet and webpages.

50. Claim 1 of the '609 patent reads as follows:

> 1. A method for tracking digital media presentations delivered from a first computer system to a user's computer via a network comprising:

providing a corresponding web page to the user's computer for each digital media presentation to be delivered using the first computer system;

providing identifier data to the user's computer using the first computer system;

providing an applet to the user's computer for each digital media presentation to be delivered using the first computer system, wherein the applet is operative by the user's computer as a timer;

receiving at least a portion of the identifier data from the user's computer responsively to the timer applet each time a predetermined temporal period elapses using the first computer system; and

storing data indicative of the received at least portion of the identifier data using the first computer system;

wherein each provided webpage causes corresponding digital media presentation data to be streamed from a second computer system distinct from the first computer system directly to the user's computer independent of the first computer system;

wherein the stored data is indicative of an amount of time the digital media presentation data is streamed from the second computer system to the user's computer; and

wherein each stored data is together indicative of a cumulative time the corresponding web page was displayed by the user's computer.

51. At the time of invention of the ’609 patent, given the vastness of content on the Internet, it proved “difficult for a user of an Internet enabled computer to identify and locate content of a particular type and relating to a particular subject.” ’609 patent at 1:40-55. One way to find relevant content was to use a search engine for specified keywords to return a list of documents where those words are found. ’609 patent at 1:56-59.

52. Some of the available search engines at the time of the invention included Yahoo!, Google and search.com. ’609 patent at 2:2-5. These are search

engines created in the mid to late 1990s that rose to prominence by the early 2000s just prior to the priority date for the '609 patent. The known search engines at the time suffered from drawbacks, however. The search engines at the time typically utilized a webcrawler to provide documents. '609 patent at 1:58-62. An indexer then typically reads the webcrawler provided documents and creates an index based on the words contained in each document. '609 patent at 1:69-62. Each search engine typically uses its own methodology to create indices such that, ideally, only meaningful results are returned for each query. '609 patent at 1:62-64. This is not always true though due to the complex nature and nuances of human language and efforts by document authors or providers to fool or trick the indexer into ranking its documents above those of others. '609 patent at 1:64-2:2.

53. These search engines did not, however, perform tracking of digital media presentations that are streamed from one computer to another and in particular tracking where within the digital media presentation a user may have left off in viewing a presentation. The search engine would only identify the same content as before.

54. In light of the foregoing, there existed a need for webpage and Internet technology for the provision and tracking of digital media presentations to responsively stream the presentation from the same point no matter where the user left off.

55. The claimed invention of claim 1 of the '609 patent provides a technological solution to the problem faced by the inventor, namely to create a system for providing and tracking digital media presentations using a web page, identifier data and a timer applet originating at a first computer to track and responsively stream a digital media presentation from a second computer that can be viewed by a user at the user's computer.

56. The technological solution is detailed in the specification and claim 1 and provides a method whereby digital media presentations are delivered and tracked from in a manner that departs from convention. First, from the perspective of the provider of digital media presentations, a webpage is provided with digital media presentations that are to be delivered to a user's computer using a first computer system. Identifier data—such as data used for tracking the user's viewing history of the digital media presentations—is also provided to the user's computer. Further, an applet that is operative as a timer is provided to the user's computer for each digital media presentation. Then the provider of the digital media presentation receives a portion of the identifier data responsively to the timer applet each time a predetermined temporal period elapses. The portion of the identifier data is then stored. Each webpage with the digital media presentations causes a digital media presentation data to be streamed to a user's computer using a second computer system and independent of the first computer system. Finally, the stored data is indicative of the amount of time the digital media presentation has been streamed and the cumulative time the webpage for the individual digital media presentations have been displayed. '609 patent at 3:65-14:8, Figs. 1-10, claim 1.

> By way of further non-limiting example, at each expiration of temporal period as determined by the timer applet, such as every 15 seconds, a table entry may be made of the user, the page the user is on, and, to the extent the user is on the same page as was the user upon the last expiration of the timer, the user's total time, to the current time, spent on that same page using database server 32. The user may be identified by, for example, any of a number of known methodologies, such as the information the user used to login, the user's IP address, the user's response to an identifying query, or the like.
> In certain embodiments of the present invention, the timer applet may cause data indicative of the total time spent on the web page presenting the presentation that has elapsed. In certain embodiments of the present invention, the timer applet may cause data indicative of another temporal cycle having passed while the web page presents the

> presentation. In the latter, a value indicative of the number of cycles that have passed in database 32 may be incremented each time the data is received, for example.
>
> Thus, certain embodiments of the present invention provide the capability to know that a viewer began viewing a particular show at a certain time, and to know when a user began viewing a different page, or show, thereby providing knowledge of how long a particular viewer spent on a particular page. Such knowledge is not conventionally available, and the provision of such knowledge by certain embodiments of the present invention allows for an increasing scale of payments for advertising displayed on a given page correspondent to how long a viewer or viewers remain, or typically remain, on that particular page or like pages. Thus, the tabular tracking of the present invention allows for the knowledge of how long viewer spends on a page, what the viewer was viewing or listening to on the given page, the ads shown while the viewer was viewing or listening, how long the ads were shown, and what ads were shown to the view correspondent to that viewer's identification and/or login.

'609 patent at 13:24-14:8 (emphasis added).

57. Claim 1 of the '609 patent improves the functionality of webpage and Internet technology by creating a system for the provision and tracking of digital media presentations via webpages and responsively streaming the presentations via a second computer system from the same point no matter where the user left off. The claimed invention of claim 1 of '609 patent also was not well-understood, routine or conventional at the time of the invention. Rather, as demonstrated above, the claimed invention was a departure from the conventional ways of providing presentations on the Internet at the time.

58. In light of the foregoing, and the general knowledge of a person of ordinary skill in the art, a person of ordinary skill in the art reading the '609 patent and its claims would understand that the patent's disclosure and claims are drawn to solving a specific, technical problem arising in webpage and Internet technology. Moreover, a person of ordinary skill in the art would understand that the claimed subject matter of the '609 patent presents advancements in the field of webpage and

Internet technology by creating a system for the provision and tracking of digital media presentations via webpages using a first computer system and responsively streaming the presentations via a second computer system from the same point no matter where the user left off. A person of ordinary skill in the art would understand that claim 1 of the '609 patent is directed to a method for providing and tracking digital media presentations using a web page, identifier data and a timer applet originating at a first computer system to track and responsively stream a digital media presentation from a second computer system that can be viewed by a user at the user's computer. Moreover, a person of ordinary skill in the art would understand that claim 1 of the '609 patent contains that corresponding inventive concept.

59. The patent of one of the streaming services used on Roku devices (Netflix) claims subject matter in the field. For example, on September 26, 2014, more than 6 years after the priority date for the '609 patent, Netflix filed an application entitled "Systems and Methods for Suspended Playback," which matured into U.S. Patent No. 9,917,791 on March 13, 2018 (the "'791 patent"). The '791 patent "suspended playback for efficient resumption [of] media content in digital streaming media playback systems." '791 patent at 1:8-10.

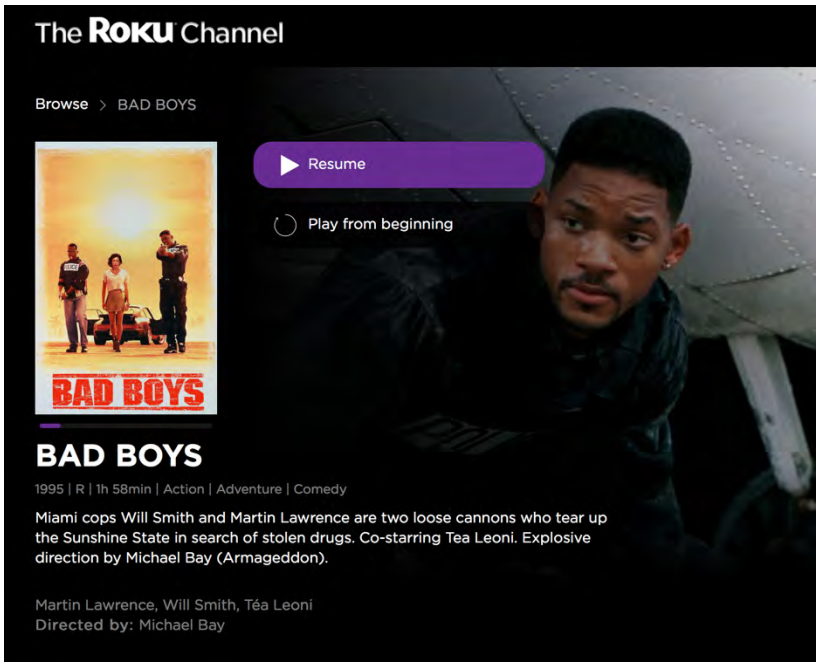
60. Upon information and belief, Roku makes, uses, offers for sale, and/or sells in the United States and/or imports into the United States products and services that perform a method for tracking digital media presentations delivered from a first computer system to a user's computer via a network, such as the Roku Channel (collectively the "Accused Infringing Devices").

61. Upon information and belief, the Accused Infringing Devices infringe at least claim 1 in the exemplary manner described below.

62. The Accused Infringing Devices track digital media presentations delivered from a first computer system to a user's computer via a network. In

particular, among other things, the Accused Infringing Devices identify the TV shows that the user is currently watching and tracks the user's viewing progress.

63. The Accused Infringing Devices provide a corresponding web page to the user's computer for each digital media presentation to be delivered using the first computer system. In particular, the webpage located at https://therokuchannel.roku.com/details/w.K1Zal7ggzkiLjvLR3x8PTBqldq6q9RuRwM6pK8GpCbmzzYLv2bcpMJNyZryvfM0lBQR78liqlY5kGWMgTvb3KRa6r corresponds to the "Bad Boys" movie.



64. The Accused Infringing Devices provide identifier data to the user's computer using the first computer system. The Accused Infringing Devices allow users to create an account, which in turn, allows Roku to track the user's viewing history across devices.

When The Roku Channel loads, you can browse titles immediately, but before you can watch a movie or TV show, you will be asked to sign in or create a free Roku account. Once you sign in, movies you start watching on your smartphone, tablet, or computer can be resumed on other devices signed in to the same Roku account, like a Roku streaming device or Samsung Smart TV.

Source: https://support.roku.com/article/360007223934

65. The Accused Infringing Devices provide an applet to the user's computer for each digital media presentation to be delivered using the first computer system. In particular, the Accused Infringing Devices provide a script that keeps track of how much of the presentation the user has watched, thus reflecting the operation of a timer running in the background.

Source: Screenshot of Bad Boys webpage showing the current position as 14:05.

66. The Accused Infringing Devices receive at least a portion of the identifier data from the user's computer responsively to the timer applet each time a predetermined temporal period elapses using the first computer system. The Accused Infringing Devices maintain a viewing history for each user. The viewing history is updated continuously, even the absence of user input such as pressing a pause button or exit button. For example, if the user closes and reopens the webpage to view "Bad Boys," the movie will resume just prior to the point where the user closed the webpage. This indicates that the user's computer sends periodic updates at regular intervals to inform Roku of the user's current position, thus reflecting the use of a timer.

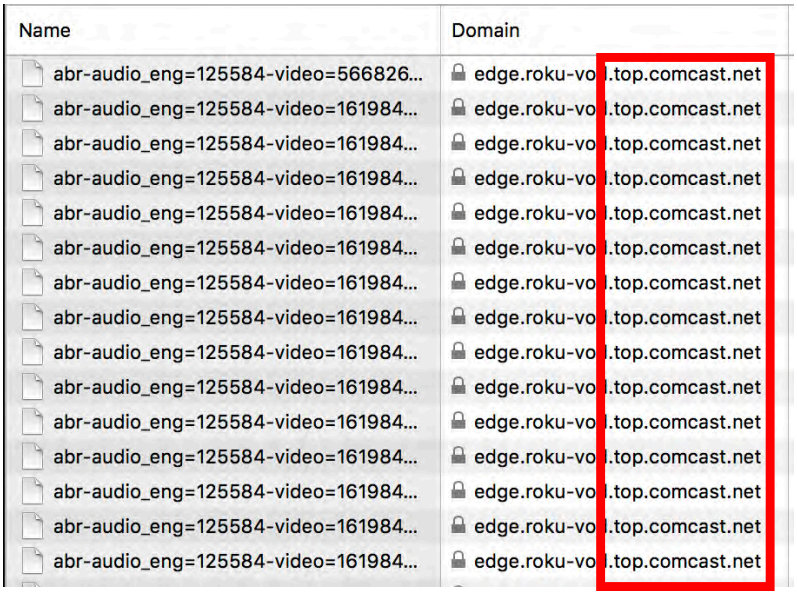
Source: Screenshot prior to closing the browser tab, showing the current position as 10:22.

Source: Screenshot after reopening the webpage, showing the current position as 09:58.

67. The Accused Infringing Devices store data indicative of the received at least portion of the identifier data using the first computer system. The user's viewing history, updated every time a heartbeat is sent, is stored by the Accused Infringing Devices. In particular, the listing for "Bad Boys" includes a progress bar that is updated as the user watches more of the movie.

Source:
https://therokuchannel.roku.com/details/w.K1Zal7ggzkiLjvLR3x8PTBqldq6q9RuRwM6pK8GpCbmzzYLv2bcpMJNyZryvfM0lBQR78liqlY5kGWMgTvb3KRa6r

68. Each provided webpage causes corresponding digital media presentation data to be streamed from a second computer system (e.g., the content delivery network, e.g., Comcast CDN), distinct from the user's computer independent of the first computer system (e.g., the Roku Channel website).



Source: Screenshot of Safari Developer Tools showing the network requests and responses for webpage above.

69. The stored data is indicative of an amount of time the digital media presentation is streamed from the second computer system to the user's computer. The stored data indicates the duration and position of the user's current position, which indicates the amount of time the presentation has been streamed to the user's computer by the CDN.

70. Each stored data is together indicative of a cumulative time the corresponding web page was displayed by the user's computer. The amount of time the user spends watching a movie or TV show is tracked by Roku and also reflects the amount of time the Roku Channel webpage was displayed by the user's computer.

71. Roku has infringed, and continues to infringe, at least claim 1 of the '609 patent in the United States, by making, using, offering for sale, selling and/or importing the Accused Infringing Devices in violation of 35 U.S.C. § 271(a).

72. Upon information and belief, Roku may have infringed and continues to infringe the '609 patent through other software and devices utilizing the same or

reasonably similar functionality, including other versions of the Accused Infringing Devices.

73. Roku's acts of direct infringement have caused and continue to cause damage to Uniloc and Uniloc is entitled to recover damages sustained as a result of Roku's wrongful acts in an amount subject to proof at trial.

PRAYER FOR RELIEF

WHEREFORE, plaintiff Uniloc 2017 LLC respectfully prays that the Court enter judgment in its favor and against Roku as follows:

a. A judgment that Roku has infringed one or more claims of the '005 patent literally and/or under the doctrine of equivalents;

b. A judgment that Roku has infringed one or more claims of the ' '609 patent literally and/or under the doctrine of equivalents;

c. That for each Asserted Patent this Court judges infringed by Roku this Court award Uniloc its damages pursuant to 35 U.S.C. § 284 and any royalties determined to be appropriate;

d. That this be determined to be an exceptional case under 35 U.S.C. § 285;

e. That this Court award Uniloc prejudgment and post-judgment interest on its damages;

f. That Uniloc be granted its reasonable attorneys' fees in this action;

g. That this Court award Uniloc its costs; and

h. That this Court award Uniloc such other and further relief as the Court deems proper.

DEMAND FOR JURY TRIAL

Pursuant to Rule 38(b) of the Federal Rules of Civil Procedure, Uniloc demands a trial by jury for all issues so triable.

Dated: October 21 2019

FEINBERG DAY KRAMER ALBERTI LIM TONKOVICH & BELLOLI LLP

By: */s/ M. Elizabeth Day*
M. Elizabeth Day

Attorneys for Plaintiff
Uniloc 2017 LLC