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

UNILOC 2017 LLC, Plaintiff, v. ROKU, INC., Defendant.	§	Case No. 1:18-cv-1126 JURY TRIAL DEMANDED

COMPLAINT FOR PATENT INFRINGEMENT

Plaintiff Uniloc 2017 LLC ("Uniloc"), by and through the undersigned counsel, hereby files this Complaint and makes the following allegations of patent infringement relating to U.S. Patent Nos. 8,407,609, 6,519,005 and 6,895,118 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. 8,407,609 (the "'609 patent"), 6,519,005 (the "'005 patent") and 6,895,118 (the "'118 patent") copies of which are attached hereto as Exhibits A-C (collectively, "the Asserted Patents").

2. Uniloc alleges that Roku directly infringes the Asserted Patents by making, using, offering for sale, selling and importing (1) products that perform a method for tracking digital media presentations delivered from a first computer system to a user's computer via a network, including Roku Channel, (2) perform a method for motion coding an uncompressed (pixel level) digital video data stream, such as Roku Channel and (3) 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 Texas. Roku may be served through its agent for service of process, Corporation Service Company, 211 E. 7th St, Suite 620, Austin Texas 78701. Roku has a regular and established place of business at 9606 N. Mopac Expressway, Suite 400, Austin, Texas 78759.

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 Western District of Texas 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, including at 9606 N. Mopac Expressway, Suite 400, Austin, Texas 78759, 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. 8,407,609

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

9. 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 A.

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

11. Invented by LINQware, Inc., the inventions of the '609 patent were not well-understood, routine or conventional at the time of the invention. At the time of invention of the '609 patent, it was very difficult for a user of an Internet enabled computer to find content of a particular type and relating to a particular subject because the amount of content available via the Internet was virtually unlimited. '609 patent at 1:50-54. A popular solution to finding desired content was to use a publicly available search engine. *Id.* at 1:55-56. Each search engine typically used its own methodology to create indices such that, ideally, only meaningful results are returned for each query. *Id.* at 1:62-64. This was 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. *Id.* at 1:64-2:1. Examples of conventional search engines include those made available via www.yahoo.com, www.google.com and www.search.com. *Id.* at 2:1-3.

12. The inventive solution of the claimed inventions of the '609 patent provides a method whereby digital media presentations are delivered and tracked from a first computer system to a user's computer via a network in a manner that departs from convention. *Id.* at 2:13-15. In accordance with one aspect of the invention, a web page, identifier data and an applet are provided to the user's computer for each digital media presentation to be delivered using the first computer system. *Id.* at 2:15-21. The applet is operative by the user's computer as a timer. *Id.* at 2:21-22. The first computer system receives 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 and stores data indicative of the received at least portion of the identifier data. *Id.* at 2:22-27. 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. *Id.* at 2:27-31. 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. *Id.* at 2:31-34.

13. 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 delivering and tracking digital media presentations via a network. 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 the provision of informational, entertainment, educational, business and other audio and/or audio/visual presentations via a computer network. And, as detailed by the specification, the prior search engines suffered drawbacks such that a new and novel communications system was required.

14. In light of the foregoing, a person of ordinary skill in the art would understand that claim 1 of the '609 patent is directed to a specific method 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. *Id.* at 14:17-45. Moreover, a person of ordinary skill in the art would understand that claim 1 of the '609 patent contains the inventive concept of 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.

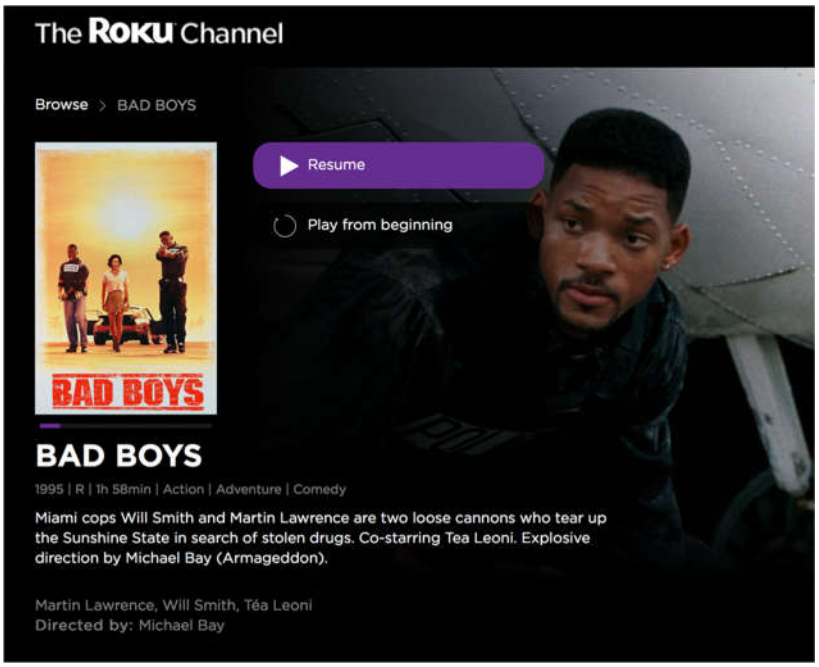
15. Upon information and belief, Roku makes, uses, offers for sale, and/or sells in the United States and/or imports into the United States products and services that perform a method for tracking digital media presentations delivered from a first computer system to a user's computer via a network, such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

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

17. 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.

18. 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.



19. 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

20. 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.

21. 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.

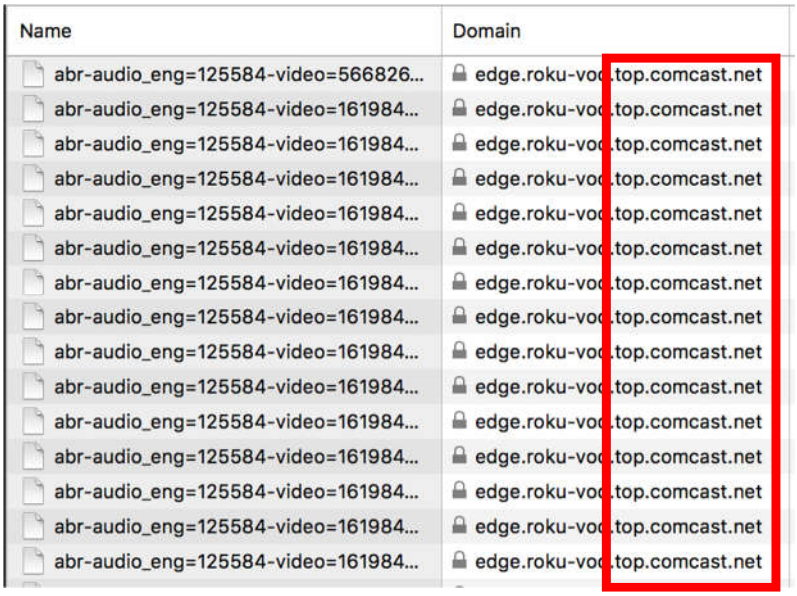
Source: Screenshot after reopening the webpage, showing the current position as 09:58.

22. 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

23. 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.

24. 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.

25. 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.

26. 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).

27. 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.

28. 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. 6,591,005

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

30. 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 B.

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

32. Invented by Koninklijke Philips Electronics N.V., the inventions of the '005 patent were not well-understood, routine or conventional at the time of the invention. At the time of invention of the '005 patent, different compression algorithms had been developed for digitally encoding video and audio information (hereinafter referred to generically as "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 1:12-17. Several multimedia specification committees established and proposed standards for encoding/compressing and decoding/decompressing audio and video information. The most widely accepted international standards have been proposed by the Moving Pictures Expert Group (MPEG). *Id*. at 1:17-22 Video coding, such as MPEG coding, involves a number of steps. In general, in accordance with the MPEG standards, the audio and video data comprising a multimedia data stream (or "bit stream") are encoded/compressed in an intelligent manner using a compression technique generally known as "motion coding." *Id*. at 1:41-45. More particularly, rather than transmitting each video frame in its entirety, MPEG uses motion estimation for only those parts of sequential pictures that vary due to motion, where possible. *Id*. at 1:45-48. In general, the picture elements or "pixels" 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 a 16-by-16 array of pixels or "macroblock" within the current picture relative to its original location within the anchor picture. *Id*. at 1:48-55. Computation of the

motion vector(s) for a given macroblock involves an exhaustive search procedure that is very computationally intensive. *Id*. at 3:25-39. It was desirable at the time of the invention to improve this process. *Id*. at 3:40-67.

33. The inventive solution of the claimed inventions of the ’005 patent provides a system and method for 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. *Id*. at 1:6-11.

34. 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. *Id*. 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. *Id*.

35. In light of the foregoing, 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. Moreover, a person of ordinary skill in the art would understand that claim 1 of the ’005 patent contains that corresponding inventive concept.

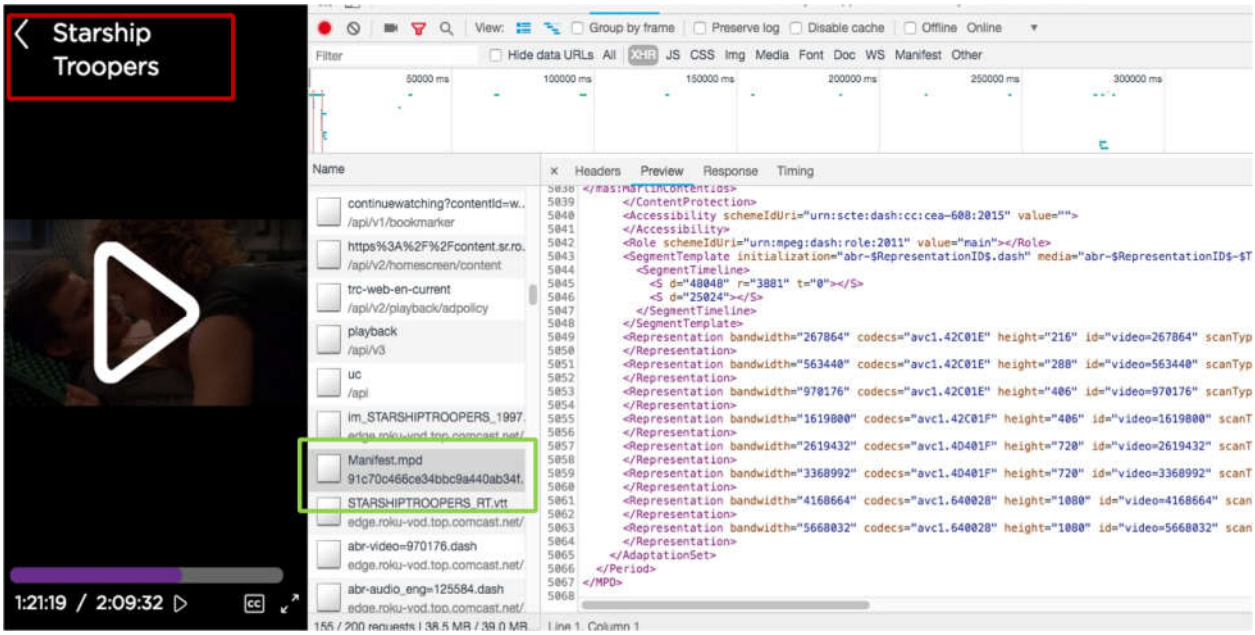
36. Upon information and belief, Roku makes, uses, offers for sale, and/or sells in the United States and/or imports into the United States products and services such as H.264 encoders that practice a method for motion coding an uncompressed (pixel level) digital video data stream, such as Roku Channel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

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

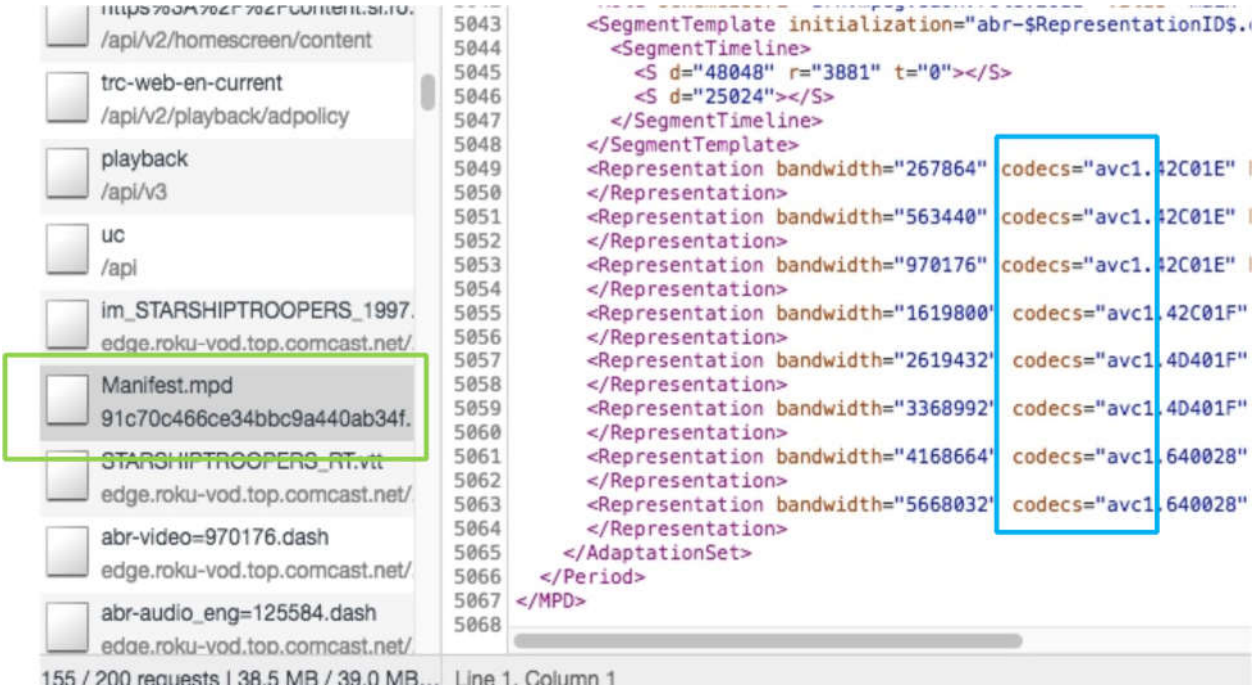
38. The Accused Infringing Devices provide a method for motion coding an uncompressed (pixel level) digital video data stream. The Accused Infringing Devices receive input video streams which are then encoded using at least the H.264 (AVC1) standard. This is a widely used video compression format with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

39. 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

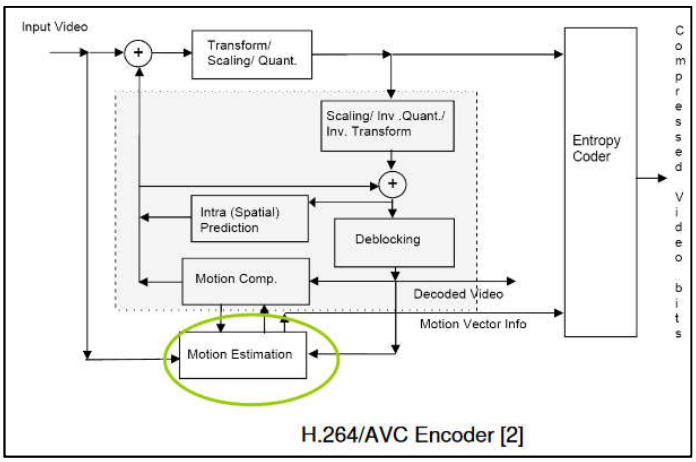
This subclause does not form an integral part of this Recommendation | International Standard.

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.

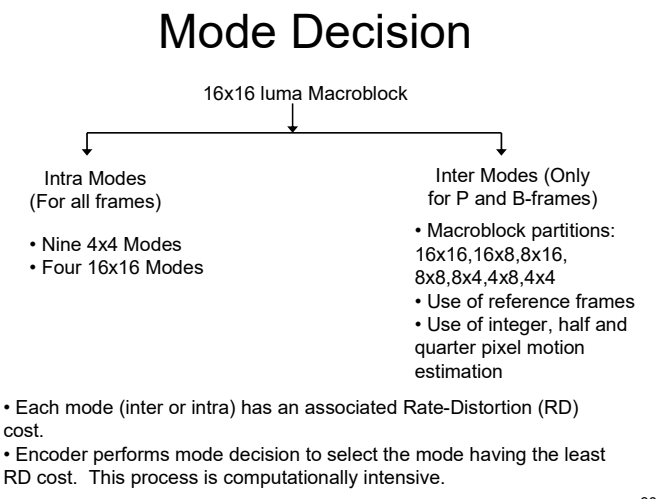
H.264 Encoder Block Diagram



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

40. 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.

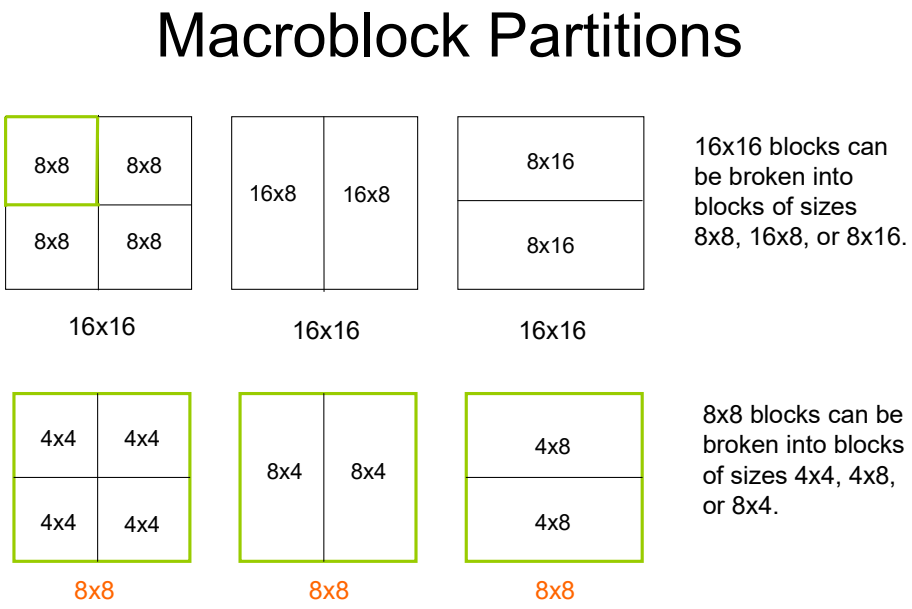
41. H.264 uses different motion estimation modes in inter-frame prediction. These modes are commonly referred to as inter-frame prediction modes, or inter modes. Each inter mode involves partitioning the current macroblock into a different combination of sub blocks, and selecting the optimum motion vector 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

42. 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

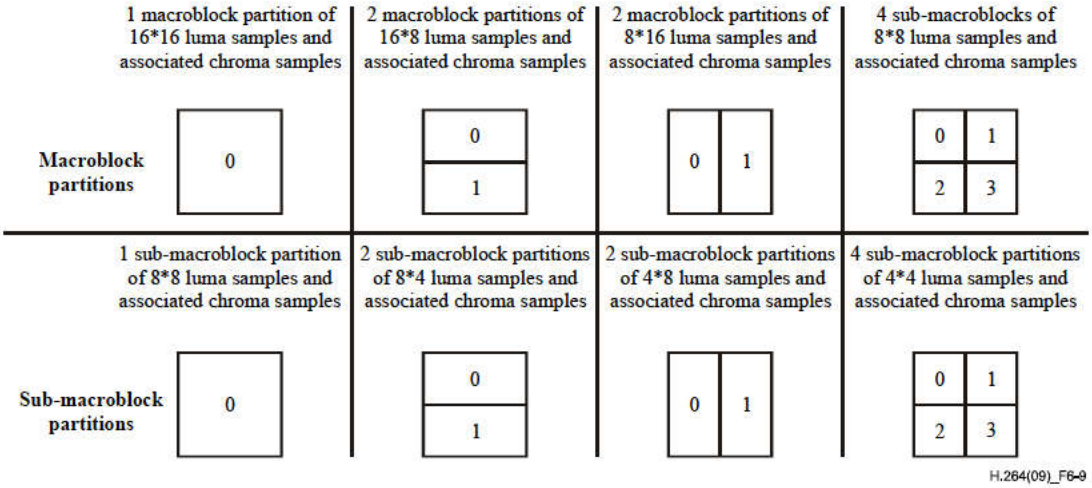


Figure 6-9 – Macroblock partitions, sub-macroblock partitions, macroblock partition scans, and sub-macroblock partition scans

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

43. 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

44. 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

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

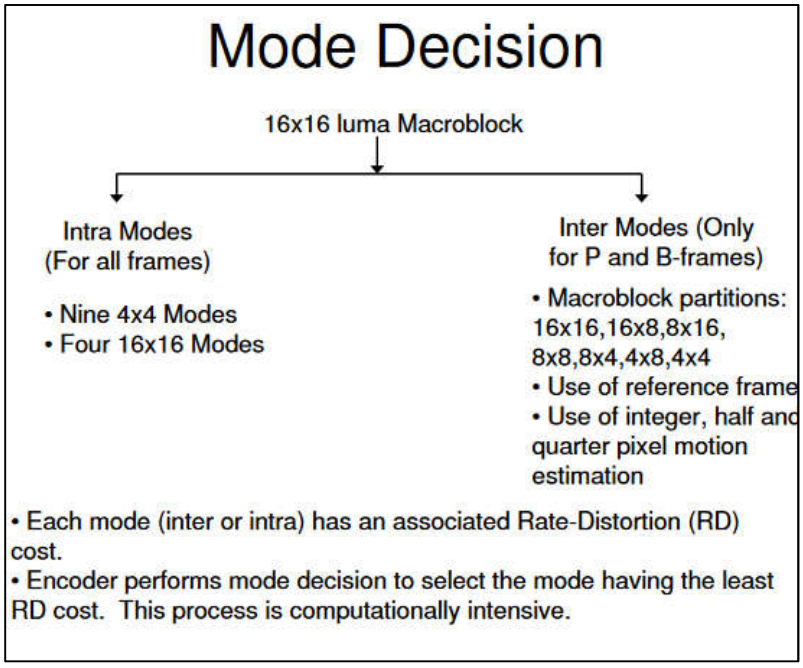
Macroblock layer semantics

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

46. 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.

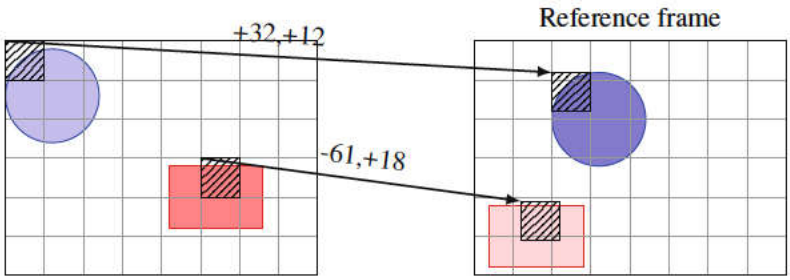


Fig. 2.4: Motion estimation. For each MB the best matching block in the reference frame is found. The encoder codes the differences (errors) between the MBs and their best matching blocks. Arrows indicate motion vectors and are labeled by the vector coordinates. In this example the shapes are identical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

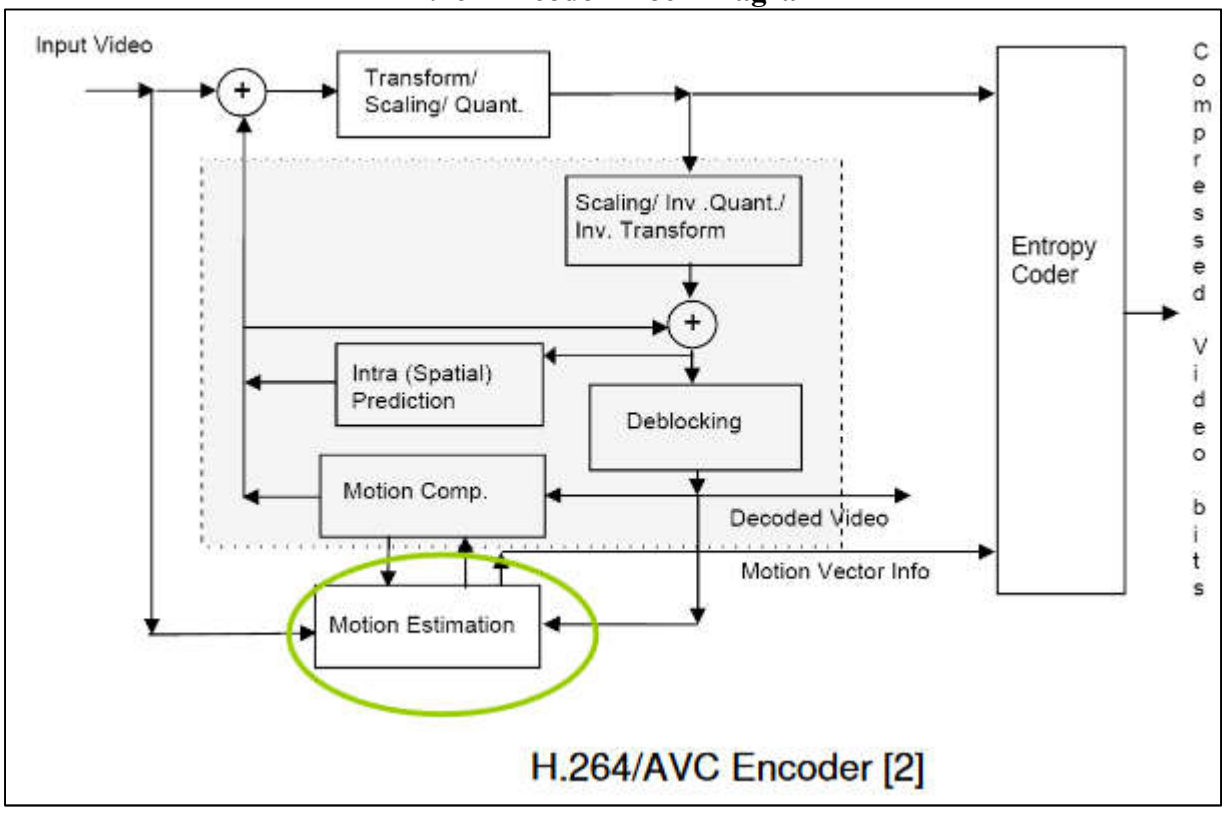
   – reference indices refIdxL0 and refIdxL1

   – 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

47. 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).

48. 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.

49. 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 III – INFRINGEMENT OF U.S. PATENT NO. 6,895,118

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

51. The ’118 patent, titled “Method Of Coding Digital Image Based on Error Concealment,” issued on May 17, 2005. A copy of the ’118 patent is attached as Exhibit C.

52. Pursuant to 35 U.S.C. § 282, the ’118 patent is presumed valid.

53. Invented by Koninklijke Philips Electronics N.V., the inventions of the ’118 patent were not well-understood, routine or conventional at the time of the invention. The specification discloses previous work done to reduce the amount of data required to send a video stream by intentionally dropping certain image blocks, and then concealing the lost blocks through the use of spatial interpolation. ’118 patent at 1:14-32. The publication referenced in the specification describes how a JPEG coder can be modified to intentionally drop image blocks that can be reasonably reconstructed from neighboring transmitted blocks. The schemes described therein achieved data reduction by replacing dropped blocks with constant value blocks, or by modifying block addressing information to communicate the addresses of the dropped blocks. *Id.* at 1:21-32.

54. The inventors observed that block information could be dropped altogether, simulating lost data in the video stream, but for the synchronization issues such data dropping can cause at the decoder. MPEG-4, a more modern coding standard than JPEG or MPEG-1,

contained a new mechanism to recover from lost data through periodically inserted resynchronization markers. *Id.*at 1:35-42. One aspect of the invention was to selectively combine block dropping with resynchronization markers to enable more efficient compression. The inventors include a step in their invention to evaluate the potential data savings of dropping a block or blocks relative to the overhead of the resynchronization markers. *Id.* At 2:11-27. In addition to spatial reconstruction of dropped blocks, the inventors furthermore incorporated the additional mechanism of temporal interpolation to support reconstruction of dropped blocks, using motion vector information from neighboring blocks. *Id.* at 3:19-28.

55. A person of ordinary skill in the art reading the '118 patent and its claims would understand that the patent's disclosure and claims are drawn to solving a specific, technical problem arising in achieving more efficient video compression. Moreover, a person of ordinary skill in the art would understand that the claimed subject matter of the '118 patent presents advancements in the field of digital image coding. And, as detailed by the specification, the prior tools for reducing compressed video data rates was such that a new and novel approach was required.

56. In light of the foregoing, a person of ordinary skill in the art would understand that claim 1 of the '118 patent is directed to a method of coding a digital image comprising macroblocks in a binary data stream. *Id.* at 8:2-3. Moreover, a person of ordinary skill in the art would understand that claim 1 of the '118 patent contains the inventive concept of (1) an estimation step, for macroblocks, of a capacity to be reconstructed via an error concealment method, (2) a decision step for macroblocks to be excluded from the coding, a decision to exclude a macroblock from coding being made on the basis of the capacity of such macroblock to be reconstructed, and (3) a step of inserting a resynchronization marker into the binary data stream after the exclusion of one or more macroblocks. *Id.* at 8:4-12.

57. 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 practice a method for coding a digital image comprising macroblocks in a binary data stream, including Roku

Channel (collectively the "Accused Infringing Devices").

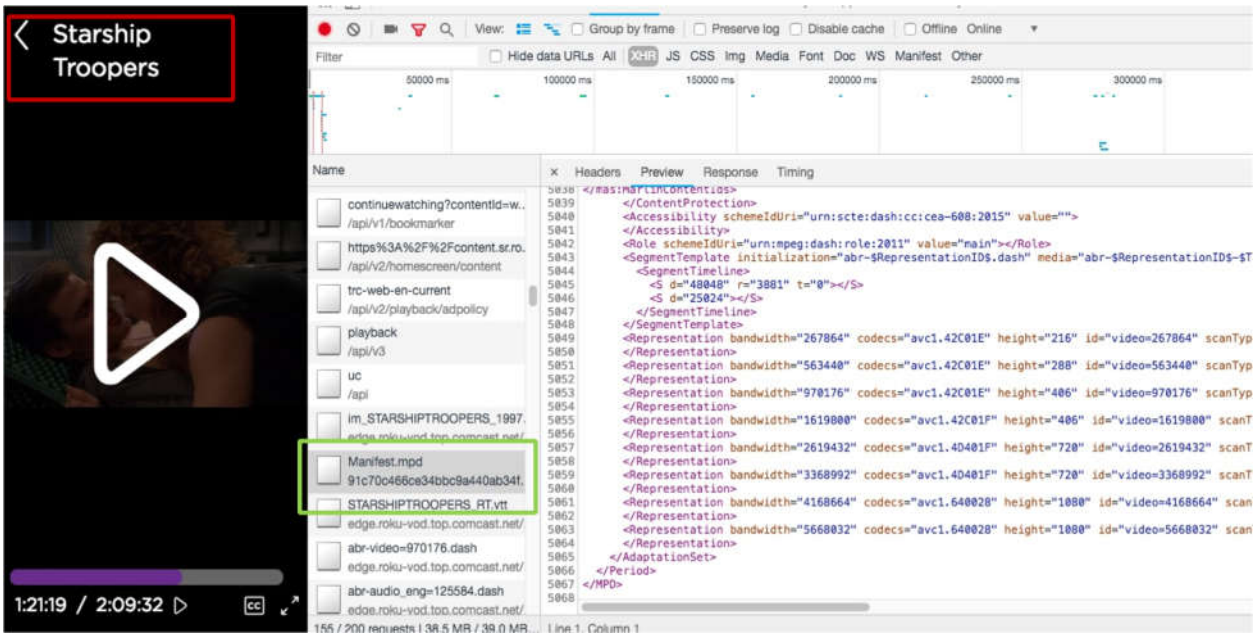
58. Upon information and belief, the Accused Infringing Devices infringe at least claim 1 in the exemplary manner described below.

59. The Accused Infringing Devices use H.264 (AVC) streams for coding video data (digital images) including macroblocks embedded in a binary stream.

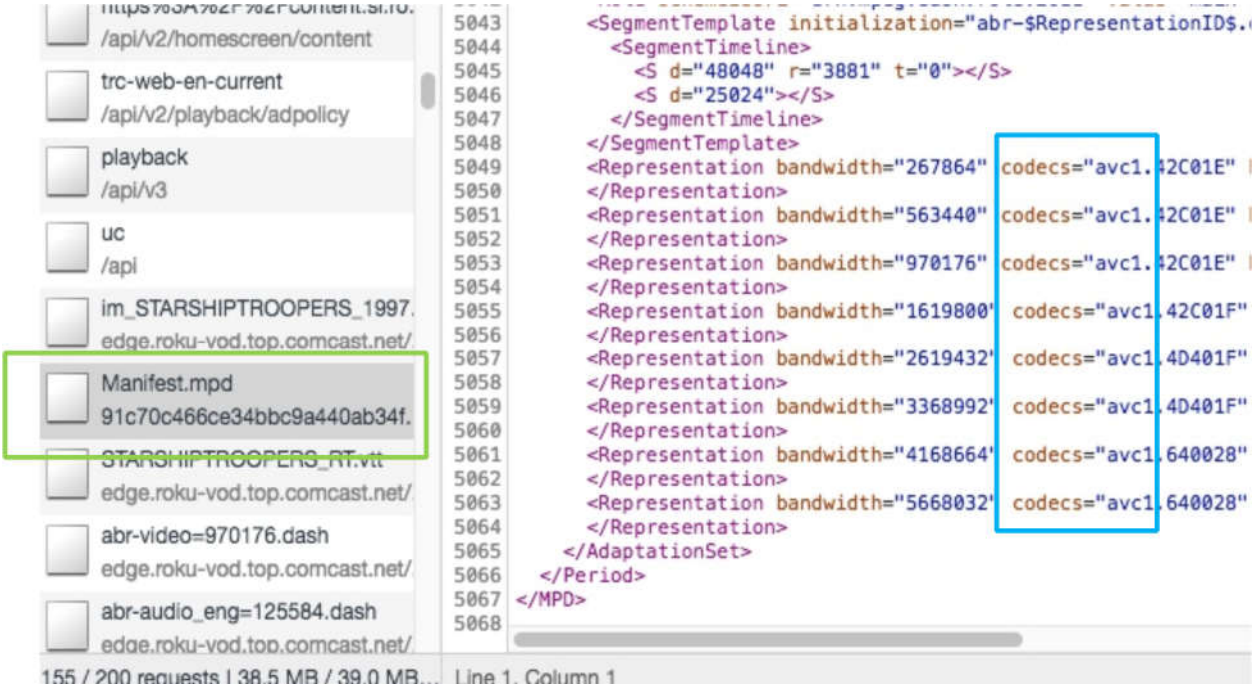
60. H.264 is a widely used video compression format with decoder support on web browsers, TVs and other consumer devices. Moreover, H.264 codes digital images comprising macroblocks streams.

61. 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. The binary (byte stream) format is specified in Annex B of the H.264 specification.

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

> This Recommendation | International Standard was developed in response to the growing need for higher compression of moving pictures for various applications such as videoconferencing, digital storage media, television broadcasting, internet streaming, and communication. It is also designed to enable the use of the coded video representation in a flexible manner for a wide variety of network environments. The use of this Recommendation | International Standard allows motion video to be manipulated as a form of computer data and to be stored on various storage media, transmitted and received over existing and future networks and distributed on existing and future broadcasting channels.

Source: https://www.itu.int/rec/T-REC-H.264-201704-I/en , p. i

As in previous video coding Recommendations and International Standards, a macroblock, consisting of a 16x16 block of luma samples and two corresponding blocks of chroma samples, is used as the basic processing unit of the video decoding process.

A macroblock can be further partitioned for inter prediction. The selection of the size of inter prediction partitions is a result of a trade-off between the coding gain provided by using motion compensation with smaller blocks and the quantity

Source: https://www.itu.int/rec/T-REC-H.264-201704-I/en, section 0.6.3

Annex B

Byte stream format

(This annex forms an integral part of this Recommendation | International Standard.)

This annex specifies syntax and semantics of a byte stream format specified for use by applications that deliver some or all of the NAL unit stream as an ordered stream of bytes or bits within which the locations of NAL unit boundaries need to be identifiable from patterns in the data, such as Rec. ITU-T H.222.0 | ISO/IEC 13818-1 systems or Rec. ITU-T H.320 systems. For bit-oriented delivery, the bit order for the byte stream format is specified to start with the MSB of the first byte, proceed to the LSB of the first byte, followed by the MSB of the second byte, etc.

Source: https://www.itu.int/rec/T-REC-H.264-201704-I/en, Annex B

62. The Accused Infringing Devices' H.264 coding supports skipped macroblocks. Before a macroblock is coded, an estimation is made of whether that macroblock can be reconstructed with an error concealment method by examining its motion characteristics, and checking to see that the resulting prediction contains no non-zero (i.e. all zero) quantized transform coefficients. This estimation provides an indication of the capacity for the macroblock to be reconstructed from properties of neighboring macroblocks, allowing the missing block to be concealed by inferring its properties.

> Skipped Mode:
> In addition to the macroblock modes described above, a P-slice macroblock can also be coded in the so-called skip mode. If a macroblock has motion characteristics that allow its motion to be effectively predicted from the motion of neighboring macroblocks, and it contains no non-zero quantized transform coefficients, then it is flagged as skipped. For this mode, neither a quantized prediction error signal nor a motion vector or reference index parameter are transmitted. The reconstructed signal is computed in a manner similar to the prediction of a macroblock with partition size 16 × 16 and fixed reference picture index equal to 0. In contrast to previous video coding standards, the motion vector used for reconstructing a skipped macroblock is inferred from motion properties of neighboring macroblocks rather than being inferred as zero (i.e., no motion).

Source: http://mrutyunjayahiremath.blogspot.com/2010/09/h264-inter-predn.html

63. The Accused Infringing Devices' H.264 encoders perform a decision step to determine if a macroblock should be excluded from coding (skipped), with the decision to exclude made on the basis of its capacity to be reconstructing by inferring its motion properties from neighboring macroblocks, and based on all zero quantized transform coefficients.

> Skipped Mode:
> In addition to the macroblock modes described above, a P-slice macroblock can also be coded in the so-called skip mode. If a macroblock has motion characteristics that allow its motion to be effectively predicted from the motion of neighboring macroblocks, and it contains no non-zero quantized transform coefficients, then it is flagged as skipped. For this mode, neither a quantized prediction error signal nor a motion vector or reference index parameter are transmitted. The reconstructed signal is computed in a manner similar to the prediction of a macroblock with partition size 16 × 16 and fixed reference picture index equal to 0. In contrast to previous video coding standards, the motion vector used for reconstructing a skipped macroblock is inferred from motion properties of neighboring macroblocks rather than being inferred as zero (i.e., no motion).

Source: http://mrutyunjayahiremath.blogspot.com/2010/09/h264-inter-predn.html

> **3.139** **skipped macroblock**: A *macroblock* for which no data is coded other than an indication that the *macroblock* is to be decoded as "skipped". This indication may be common to several *macroblocks*.

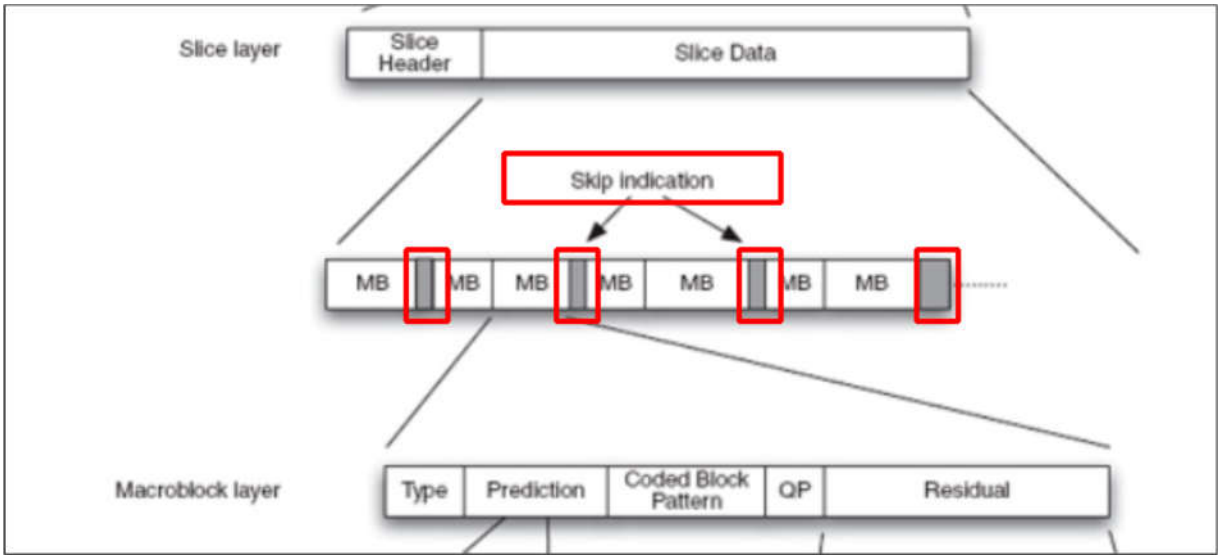
Source: https://www.itu.int/rec/T-REC-H.264-201704-I/en, p13

64. Skipped macroblocks are communicated with a mb_skip_flag = 1 (resynchronization marker at the point where the macroblocks are not coded (skipped)) in the

binary data stream.

> **3.139** **skipped macroblock**: A *macroblock* for which no data is coded other than an indication that the *macroblock* is to be decoded as "skipped". This indication may be common to several *macroblocks*.

Source: https://www.itu.int/rec/T-REC-H.264-201704-I/en, p13



Source: https://www.safaribooksonline.com/library/view/the-h264-advanced/9780470516928/ch05.html#macroblock_layer

65. Roku has infringed, and continues to infringe, at least claim 1 of the ’118 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).

66. Upon information and belief, Roku may have infringed and continues to infringe the ’118 patent through other software and devices utilizing the same or reasonably similar functionality, including other versions of the Accused Infringing Devices.

67. 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 their favor and against Roku as follows:

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

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

c. A judgment that Roku has infringed one or more claims of the '118 patent literally and/or under the doctrine of equivalents;

d. 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;

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.

Date: December 27, 2018

/s/ James L. Etheridge
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