IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE

UNILOC 2017 LLC, Plaintiff, v. VUDU, INC., Defendant.	C.A. No. 19-cv-183-CFC JURY TRIAL DEMANDED

FIRST AMENDED COMPLAINT FOR PATENT INFRINGEMENT

Plaintiff Uniloc 2017 LLC ("Uniloc"), by and through the undersigned counsel, hereby files this First Amended Complaint and makes the following allegations of patent infringement relating to U.S. Patent Nos. 8,407,609 (the "'609 patent"), 6,895,118 (the "'118 patent"), and 6,519,005 (the "'005 patent") (collectively "the Asserted Patents") against Defendant Vudu, Inc. ("Vudu") 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 Vudu has infringed and/or is infringing one or more of the '609 patent, the '118 patent and the '005 patent, copies of which are attached as Exhibits A-C, respectively.

2. Uniloc alleges that Vudu directly infringes and/or has infringed the Asserted Patents by making, using, offering for sale, selling, and/or importing various products and services that: (1) products that perform a method for tracking digital media presentations, (2) perform a method of coding a digital image comprising macroblocks in a binary data stream and

(3) perform a method for motion coding an uncompressed (pixel level) digital video data stream. Uniloc seeks damages and other relief for Vudu'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 and 620 Newport Center Drive, Newport Beach, California 92660.

4. Upon information and belief, Vudu is a Delaware corporation with a place of business at 600 W. California Avenue, Sunnyvale, California 94086. Vudu may be served through its registered agent at The Corporation Trust Company, Corporation Trust Center, 1209 Orange Street, Wilmington, Delaware 19801.

JURISDICTION AND VENUE

5. 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.

6. This Court has both general and specific personal jurisdiction over Vudu because Vudu is a Delaware corporation that has committed acts within this District giving rise to this action and has established minimum contacts with this forum such that the exercise of jurisdiction over Vudu would not offend traditional notions of fair play and substantial justice. Vudu directly and through subsidiaries and intermediaries (including distributors, retailers, franchisees and others), has committed and continues to commit acts of infringement in this District by, among other things, making, using, testing, selling, importing, and/or offering for sale products that infringe the Asserted Patents.

7. Venue is proper in this District and division under 28 U.S.C. §§1391(b)-(d) and 1400(b) because Vudu is incorporated in this District, transacts business in this District and has committed and continues to commit acts of direct infringement in this District.

COUNT I: INFRINGEMENT OF THE ’609 PATENT

8. The allegations of paragraphs 1-7 of this First Amended 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. 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.

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

11. 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.

12. 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.

13. 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. 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.

14. At the time of invention of the ’609 patent, server log file analysis applications were available to gather information, such as webpage views and website visits. ’609 patent, 11:37-46. The ’609 patent sought to track more detailed information, such as “how long a user actually watched, and/or listened, to a presented program, after selection . . . the number of visitors to the platform of the present invention, and additionally the number of visitors per content via the platform of the present invention, and additionally information regarding how long presentations were watched and/or listened.” *Id.*, 11:47-58. In addition, the ’609 patent recognized that it was not straightforward to track “content [] not uploaded to an operator’s system . . . and is instead remotely stored from yet aggregated by [the operator’s] system.” *Id.*, 12:36-40. In particular, the ’609 patent understood that “[a]s an operator of system 30 does not necessarily exercise control over the content data storage resource, the operator may not be able to directly operate the storage resource in a manner to directly track how long content is streamed therefrom to a particular user.” *Id.*, 12:40-45. 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 or the source of the presentation being streamed.

15. The claimed invention of claim 1 of the ’609 patent provides a technological solution to the problem faced by the inventor by bridging the gap between the operator system and the third party system in an innovative and minimally burdensome way. In particular, the claimed invention creates a system for providing and tracking digital media presentations using a web page, identifier data and a timer ap plet 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.

16. 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. '609 patent, 1:40-2:5, 13:24-14:8, claim 1. 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 13:65-14:8, 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, <u>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</u>.

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

17. 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 the ’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. The detailed tracking of viewing history using an applet and tracking viewing history across independent computer systems of the ’609 patent are not routine or conventional. When viewed as an ordered combination, claim 1 of the ’609 patent enables tracking of viewing history across independent computer systems through the deployment of an applet that periodically monitors viewing progress. ’609 patent at 12:56-

13:42.

18. The ’609 patent represents an advancement in the field of 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. Prior to the ’609 patent, playback of content hosted on third-party systems could not be tracked. At the time, there was no mechanism for the third-party system to provide tracking information to the operator system, and indeed doing so would require tremendous overhead depending on the number of operator systems used to access the third-party system, the size of the content catalog, and number of users. The ’609 patent provides an elegant, self-contained system to independently track content streamed from a third-party computer system. Indeed, this technology sustains Vudu’s business model to this day because (1) offloading hosting responsibilities onto third-parties lowers overhead and enables its rapid expansion and (2) tracking viewing preferences leads to higher revenue from improved subscriber retention.

19. 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

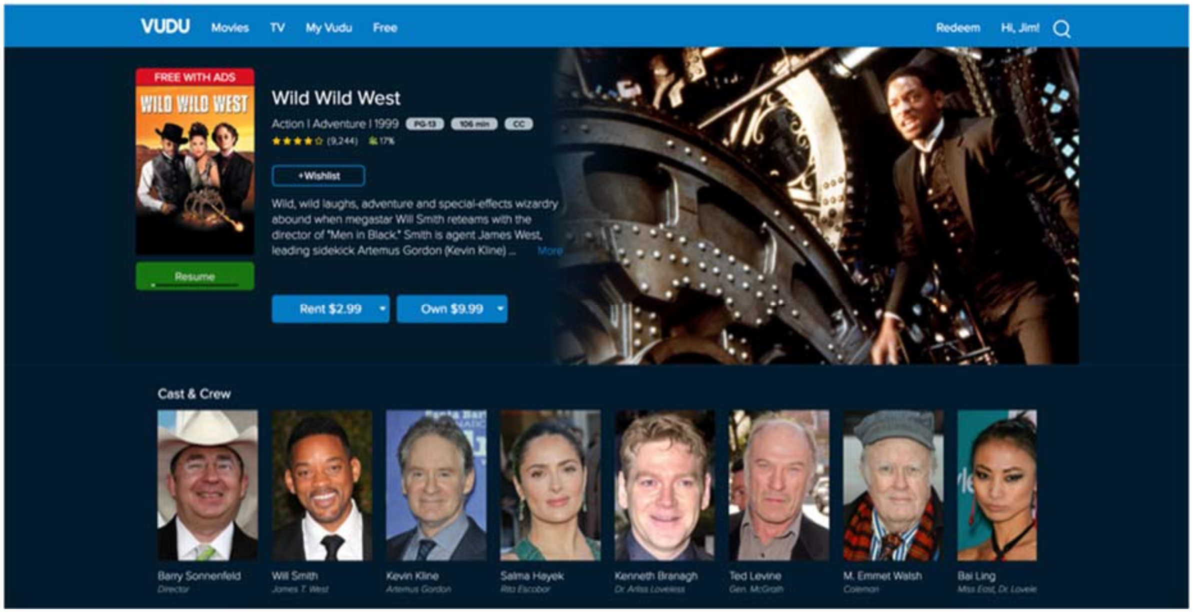
page, identifier data and a timer applet originating at a first computer system to track and responsively stream a digital media presentation from a second computer system that can be viewed by a user at the user's computer. Moreover, a person of ordinary skill in the art would understand that claim 1 of the '609 patent contains that corresponding inventive concept.

20. Upon information and belief, Vudu 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 (collectively the "'609 Accused Infringing Devices").

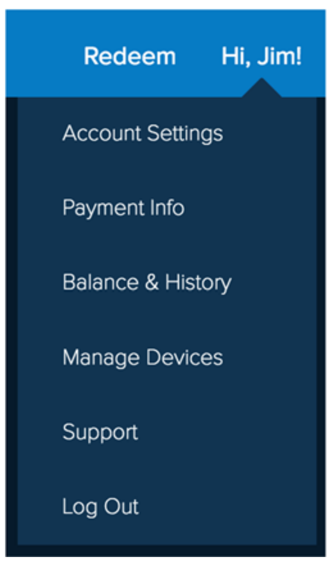
21. Upon information and belief, the '609 Accused Infringing Devices infringe at least claim 1 in the exemplary manner described below.

22. The '609 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 '609 Accused Infringing Devices identify the media content that the user is currently watching and tracks the user's viewing progress. The Vudu website is hosted on the first computer and is delivered to a user's computer over the Internet.

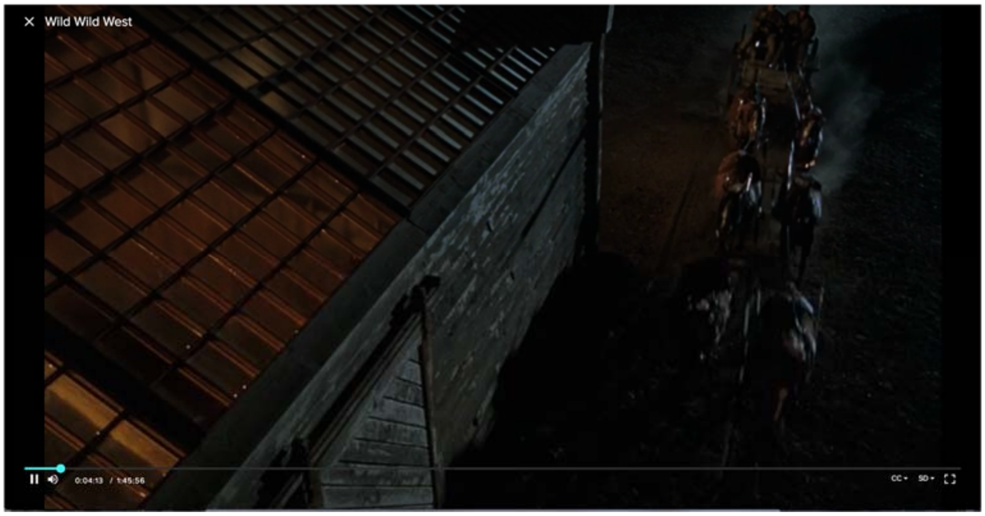
23. The '609 Accused Infringing Devices provide a corresponding web page to the user's computer for each digital media presentation to be delivered using the first computer system. For example, the webpage located at https://www.vudu.com/content/movies/details/Wild-Wild-West/9277 corresponds to the "Wild Wild West" movie.



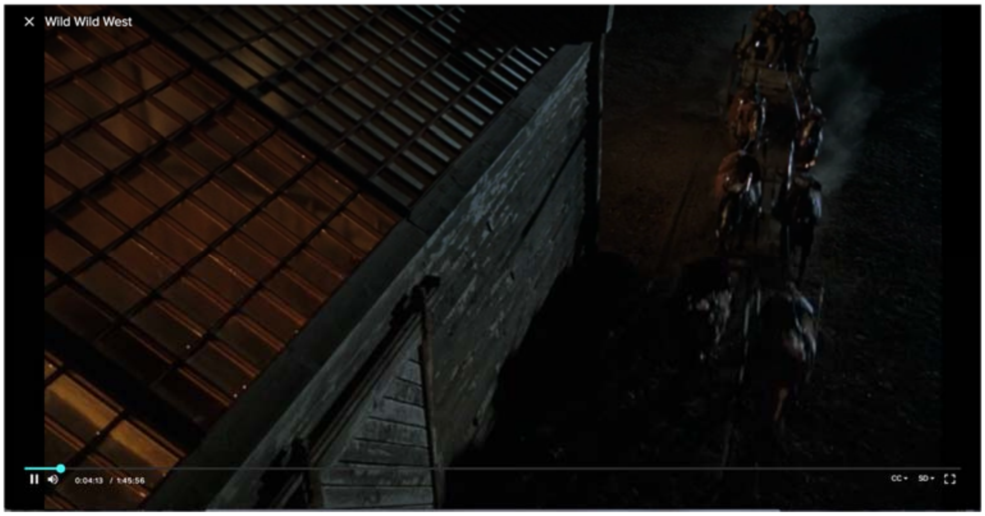
24. The ’609 Accused Infringing Devices provide identifier data to the user’s computer using the first computer system. The ’609 Accused Infringing Devices require users to log in to access the service, including watching video-on-demand programs.

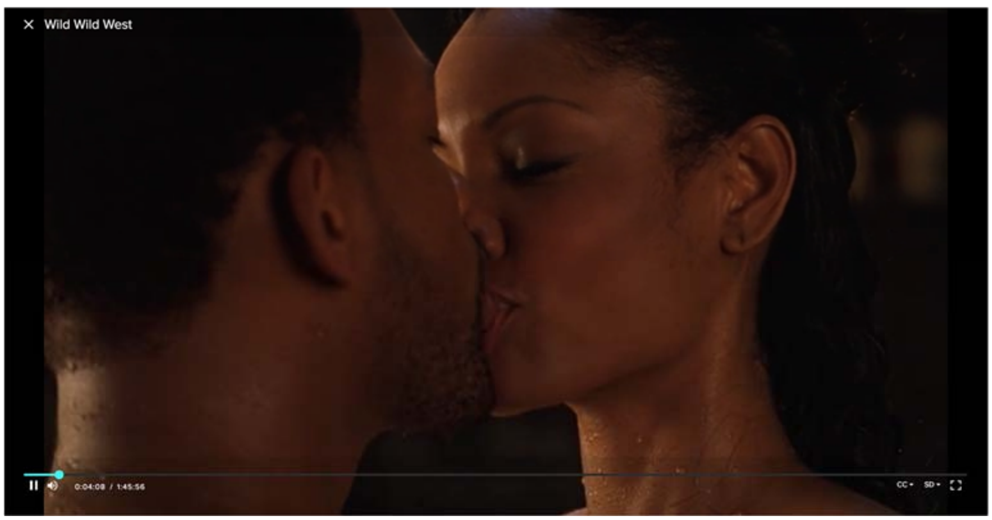


25. The ’609 Accused Infringing Devices provide an applet to the user’s computer for each digital media presentation to be delivered using the first computer system. The Vudu website provides a media player that keeps track of the user’s progress using a timer.



26. The ’609 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 ’609 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 website, the program will resume just prior to the point where the user closed the webpage. It also displays a message that the program is resuming where the user left off. This indicates that the user’s computer sends periodic updates at regular intervals to inform the ’609 Accused Infringing Devices of the user’s current position, thus reflecting the use of a timer.

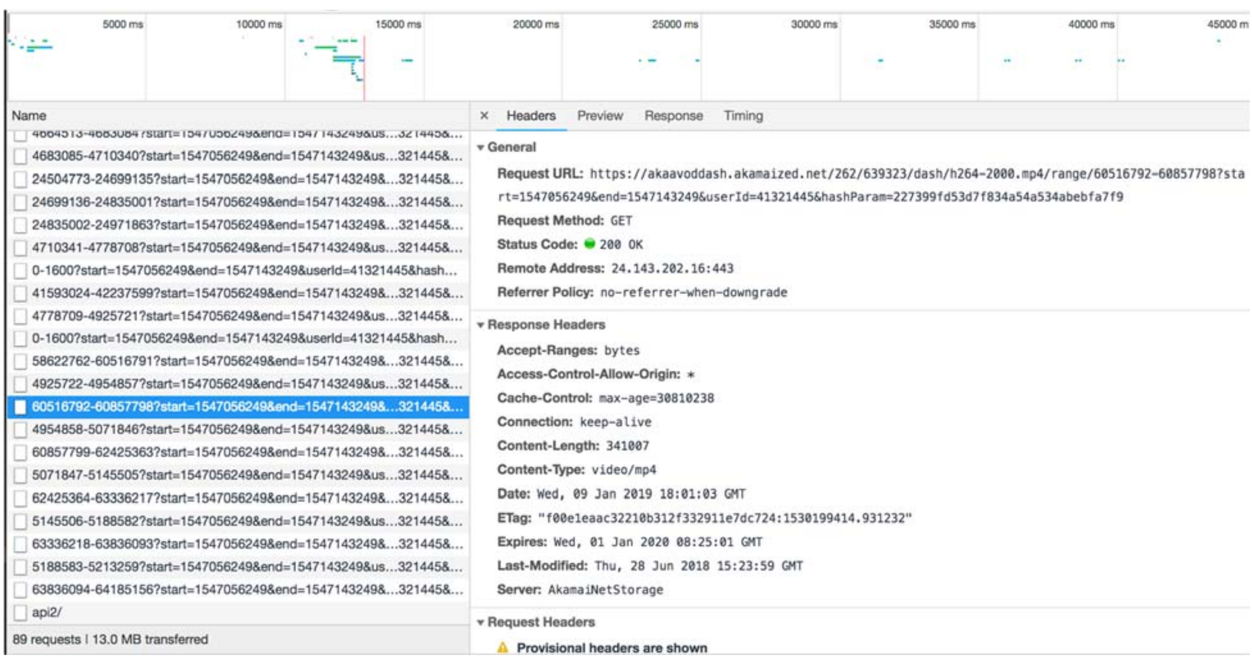




27. The ’609 Accused Infringing Devices store data indicative of the received at least a portion of the identifier data using the first computer system. The user’s viewing history, updated every time an updated position is sent, is stored by Vudu. For example, the “Wild Wild West” page displays a progress bar that is updated as the user watches more of the program.

28. 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.*, Akamai), distinct from the user's computer independent of the first computer system (*e.g.*, the Vudu website).

29. This screenshot from Chrome Developer tools shows the requests to and responses from an Akamai server for a particular segment of the "Wild Wild West" movie.



30. 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.

31. 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 is tracked by Vudu and also reflects the amount of time the corresponding Vudu webpage was displayed by the user's computer.

32. Vudu has thus infringed at least claim 1 of the '609 patent by making, using, testing, selling, offering for sale, importing and/or licensing the '609 Accused Infringing Devices, and operating them such that all steps of at least claim 1 are performed.

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

COUNT II: INFRINGEMENT OF THE '118 PATENT

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

35. 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 B. The priority date for the '118 patent is March 6, 2001. The inventions of the '118 patent were developed by inventors at Koninklijke Philips Electronics N.V.

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

37. Claim 1 of the '118 patent addresses a technological problem indigenous to coding macroblocks in a binary digital stream where certain macroblocks have been excluded.

38. Claim 1 of the '118 patent reads as follows:

> 1. A method of coding a digital image comprising macroblocks in a binary data stream, the method comprising:
>
> an estimation step, for macroblocks, of a capacity to be reconstructed via an error concealment method,
>
> 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,
>
> characterized in that it also includes a step of inserting a resynchronization marker into the binary data stream after the exclusion of one or more macroblocks.

39. The invention of claim 1 of the '118 patent concerns a novel method for digital coding of macroblocks within a data stream.

40. Just prior to the invention of the '118 patent, in June 1999, a then novel method for coding involved the exclusion of certain macroblocks in a digital image based upon the capacity of the macroblocks to be reconstructed via error concealment ("the June 1999 Method"). '118 patent at 1:14-21. In the June 1999 Method, the excluded macroblocks were replaced with "uncoded blocks with constant blocks, black blocks for example, subsequently detected by the receiver." '118 patent at 1:21-25. Alternatively, the June 1999 Method provided for allocating bits to communicate the address of the excluded blocks in interceded macroblocks that were not excluded. '118 patent at 1:26-32.

41. Both means of replacing the excluded blocks in the June 1999 Method suffered from significant drawbacks. For example, if constant blocks or black blocks were used as replacements for the excluded macroblocks there would be "graphical errors on most receivers." '118 patent at 1:62-67. Likewise, allocating bits to communicate the address of excluded blocks gave "rise to graphical 'lag' errors of image elements if macroblocks have been excluded." '118 patent at 1:56-62.

42. As demonstrated below, the claimed invention of claim 1 of the '118 patent provides a technological solution to the problem faced by the inventors—using resynchronization markers after the exclusion of a macroblock rather than replacing macroblocks with constant blocks, black blocks or bits allocated to communicate the address of the excluded blocks. This technological solution resulted in reduction in lag and graphical errors and improved bandwidth because of a reduction in the binary data stream.

43. As detailed in the specification, the invention of claim 1 of the '118 patent provides a technological solution to the specific technological problems faced by the inventors that existed at the time of the invention. First, the specification describes the June 1999 Method and the drawbacks associated with that method:

> A coding method of such type is known from the document "Geometric-Structure-Based Error Concealment with Novel Applications in Block-Based Low-Bit-Rate Coding" by W. Zeng and B. Liu in IEEE Transactions on Circuits and Systems For Video Technology, Vol. 9, No. 4, Jun. 1999. That document describes exclusions of blocks belonging to macroblocks, block combination, said macroblocks being capable of being intercoded or intracoded. That document proposes harmonizing this block exclusion with video coding standards, either, in a **first solution**, by replacing uncoded blocks with constant blocks, black blocks for example, subsequently detected by the receiver, or, in a **second solution**, by modifying the word that defines which blocks are coded within a macroblock, such modification taking place at the same time as a modification of the address words of the macroblocks when all the blocks in a macroblock are excluded. A certain number of bits are allocated to communicate the address of the excluded blocks in the interceded macroblocks.

'118 patent at 1:14-31 (emphasis added).

44. Both of these means of dealing with the excluded macroblocks in the June 1999 Method were disadvantageous and suffered from serious drawbacks that thwarted the purpose of excluding macroblocks (i.e., to further compress the data stream):

> In this case it is therefore impossible to change the addresses of the macroblocks or indicate which blocks are not coded, according to the

> **second solution** proposed in the document cited in the foregoing. All macroblocks are thus decoded and placed sequentially, giving rise to graphical "lag" errors of image elements if macroblocks have been excluded. The **first solution** proposed in the document cited involves detection by the decoder of the constant blocks replacing the excluded blocks. No provision for such detection is made in the MPEG-4 syntax, and this will cause graphical errors on most receivers.

'118 patent at 1:56-67 (emphasis added).

45. In light of the drawbacks with the June 1999 Method, the inventors of the '118 patent claimed a new method where resynchronization markers included in header elements were used instead of constant blocks, black blocks and bits allocated to communicate the address of the excluded blocks:

> It is an object of the present invention to suggest a coding method that includes an exclusion of macroblocks having a certain capacity to be reconstructed from the coding compatible with coding standards which include point resynchronization means.
>
> Indeed, a coding method as defined in the introductory paragraph is characterized according to the invention in that it also includes a step of inserting a resynchronization marker into the binary data stream after the exclusion of one or more macroblocks.
>
> The resynchronization marker represents a certain number of bits in the data stream (at least between 17 and 23 bits). It is a further object of the present invention to reduce the binary data stream associated with the transmission of digital images by excluding macroblocks.

'118 patent at 2:1-15 (emphasis added).

46. The reduction in the data stream using the claimed method—as opposed to the June 1999 Method which added constant blocks, black blocks and other bits for excluded macroblocks—is depicted in Figure 2 and described in the specification:

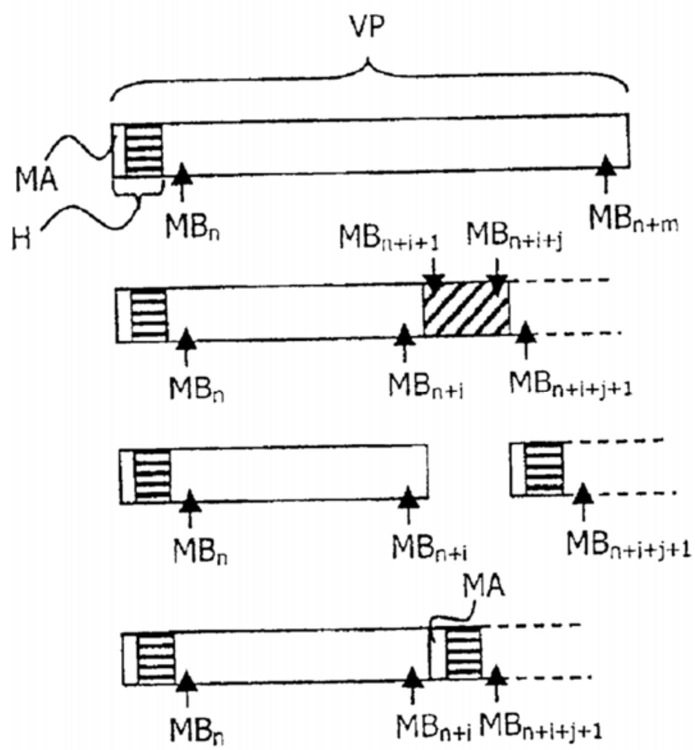


FIG.2a
FIG.2b
FIG.2c
FIG.2d

> The resulting binary data stream in such case is shown in FIG. 2*d*. A resynchronization marker MA and the associated header element have been inserted in the stream at the point where the first one of the excluded macroblocks should have been, and before macroblock $MB_{n+i+j+1}$. Here, the reduction in the size of the binary data stream caused by the insertion of resynchronization marker MA and the associated header element is not zero according to FIG. **2**: the bloc representing excluded macroblocks MB_{n+i+1} to MB_{n+i+j} is larger than the size of the inserted header element.
>
> * * *
>
> Since the binary data stream includes coded data of a digital image comprising macroblocks, said binary data stream being such that macroblocks MB_{n+i+1} to MB_{n+i+j} are not coded in the binary data stream for at least one point in the binary data stream and since such uncoded macroblocks are capable of being reconstructed by an error concealment method, said binary data stream is thus characterized according to the invention in that a resynchronization marker MA is present in the binary data stream at the location in the binary data stream where the macroblocks are not coded.

’118 patent at 5:37-46.

47. The claimed invention of claim 1 of the ’118 patent improves the functionality of coding macroblocks in a binary digital stream where certain macroblocks have been excluded.

The claimed invention of claim 1 of the ’118 patent also was not well-understood, routine or conventional at the time of invention. Rather, the claimed invention was a departure from the conventional way of performing coding macroblocks in a binary digital stream where certain macroblocks have been excluded.

48. A person of ordinary skill in the art reading claim 1 of the ’118 patent and the corresponding specification would understand that claim 1 improves the functionality of coding macroblocks in a binary digital stream where certain macroblocks have been excluded. This is because, as noted above, the June 1999 Method suffered from drawbacks including (1) lag errors; (2) graphical errors; and (3) no reduction in the size of the data stream because of the use of constant blocks, black blocks and allocating bits to communicate the address of the excluded blocks. A person of ordinary skill in the art would further understand that the claimed invention of claim 1 of the ’118 patent resolved these problems by using resynchronization markers in a way they had not been used before—as replacements for excluded blocks.

49. A person of ordinary skill in the art reading claim 1 of the ’118 patent and the corresponding specification would further understand that claim 1 of the ’118 patent represents a departure from convention by (1) coding a data stream with excluded macroblocks in a way that is different from the recent June 1999 Method and (2) using resynchronization markers in a manner that had not been used before—as replacements for excluded macroblocks.

50. In light of the foregoing, 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.

51. 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 macroblocks in a binary digital stream where certain macroblocks have been excluded. Moreover, a person of ordinary skill in the art would understand that claim 1 of the ’118 patent contains the inventive concept of using resynchronization markers after the exclusion of a macroblock rather than replacing macroblocks with constant blocks, black blocks or bits allocated to communicate the address of the excluded blocks.

52. Upon information and belief, Vudu 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 coding a digital image comprising macroblocks in a binary data stream (collectively the "’118 Accused Infringing Devices").

53. Upon information and belief, the ’118 Accused Infringing Devices infringe at least claim 1 in the exemplary manner described below.

54. The ’118 Accused Infringing Devices use H.264 (AVC) streams for coding video data (digital images) including macroblocks embedded in a binary stream.

55. 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 macroblock streams.

56. The ’118 Accused Infringing Devices receive input video streams which are then encoded and/or transcoded using at least the H.264 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.

Today, VUDU uses both Limelight and Akamai to deliver their videos to third party devices and encodes all of their content in H.264 for SD, HD and VUDU's proprietary HDX quality. For each quality classification, VUDU is doing multiple encodes which takes advantage of their own in-house adaptive streaming technology for the delivery. SD quality videos are encoded at 1Mbps, 1.5Mbps and 2Mbps. 720p HD content is encoded at 2.25Mbps, 3.75mbps and 4.5Mbps. 1080p HDX videos are encoded at 4.5Mbps, 6.75Mbps and 9Mbps. While VUDU encodes using the H.264 standard, they spend a lot of time to optimize their videos by using an open-source video encoding platform that they have made a lot of modifications to. This is one of the reasons why people who use VUDU, including myself, think they have the best looking videos today. To me, VUDU's 1.5Mbps stream looks much better quality wise, than Netflix's 1.5Mbps stream and has some of the fastest start times I have seen, outside of 1080p streaming on the Xbox 360.

Source: https://www.businessinsider.com/everything-you-need-to-know-about-vudu-2010-3

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

57. H.264 coding in the ’118 Accused Infringing Devices 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

58. H.264 encoders in the ’118 Accused Infringing Devices 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

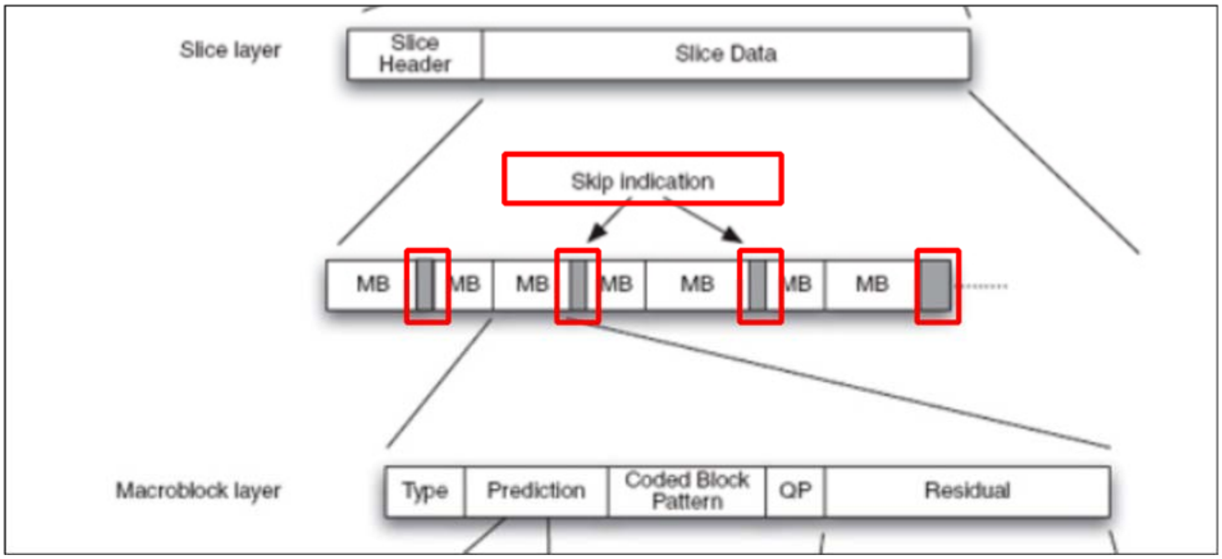
59. Skipped macroblocks are communicated with a mb_skip_flag = 1 (resynchronization marker at the point where the macroblocks are not coded (skipped)) in the binary data stream.

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

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

60. Vudu has thus infringed at least claim 1 of the '118 patent by making, using, testing, selling, offering for sale, importing and/or licensing the '118 Accused Infringing Devices, and operating them such that all steps of at least claim 1 are performed.

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

COUNT III: INFRINGEMENT OF THE ’005 PATENT

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

63. 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 C. 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.

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

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

66. 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.

67. 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.

68. 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.

69. 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.

70. 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.

71. "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.

72. 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.

73. 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.

74. 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.

75. 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).

76. 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.

77. 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.

78. 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.

79. 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).

80. 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:

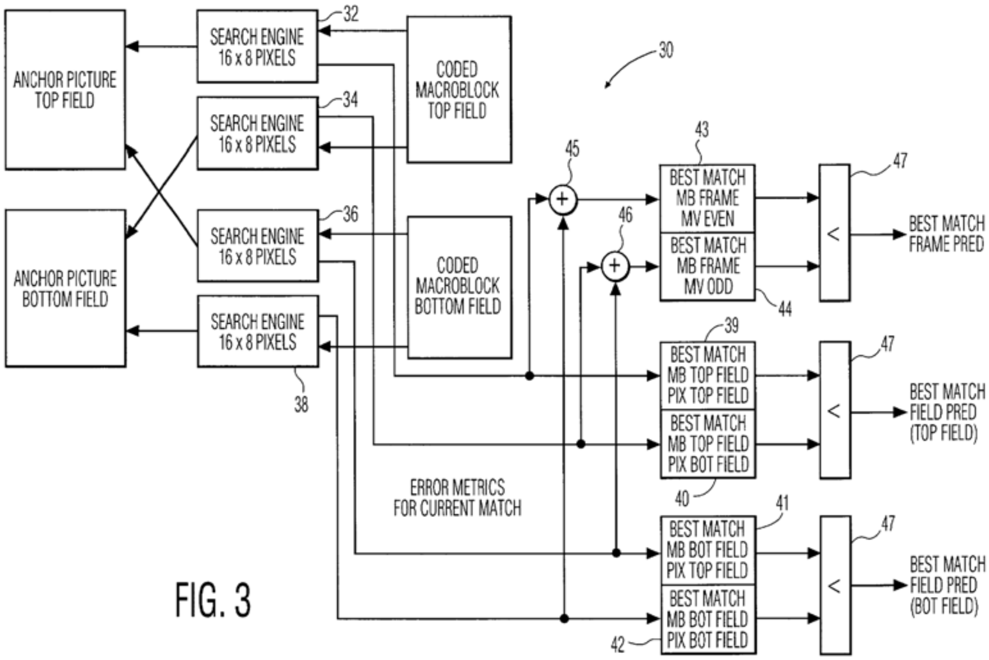


FIG. 3

81. 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 the ’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.

82. 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 <u>is simpler, faster, and less expensive than the presently available technology permits, and that permits concurrent motion estimation using multiple prediction modes</u>.

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

> In either case, the methods and architectures of the <u>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</u>.

’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, <u>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</u>.

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

83. 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.

84. Upon information and belief, Vudu 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 digital video data stream (collectively the "’005 Accused Infringing Devices").

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

86. The ’005 Accused Infringing Devices provide a method for motion coding an uncompressed (pixel level) digital video data stream. The ’005 Accused Infringing Devices receive input video streams which are then encoded and/or transcoded using at least the H.264 (AVC) standard. The H.264 standard 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.

Today, VUDU uses both Limelight and Akamai to deliver their videos to third party devices and encodes all of their content in H.264 for SD, HD and VUDU's proprietary HDX quality. For each quality classification, VUDU is doing multiple encodes which takes advantage of their own in-house adaptive streaming technology for the delivery. SD quality videos are encoded at 1Mbps, 1.5Mbps and 2Mbps. 720p HD content is encoded at 2.25Mbps, 3.75mbps and 4.5Mbps. 1080p HDX videos are encoded at 4.5Mbps, 6.75Mbps and 9Mbps. While VUDU encodes using the H.264 standard, they spend a lot of time to optimize their videos by using an open-source video encoding platform that they have made a lot of modifications to. This is one of the reasons why people who use VUDU, including myself, think they have the best looking videos today. To me, VUDU's 1.5Mbps stream looks much better quality wise, than Netflix's 1.5Mbps stream and has some of the fastest start times I have seen, outside of 1080p streaming on the Xbox 360.

Source: https://www.businessinsider.com/everything-you-need-to-know-about-vudu-2010-3

H.264 Uses Predictive Coding

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

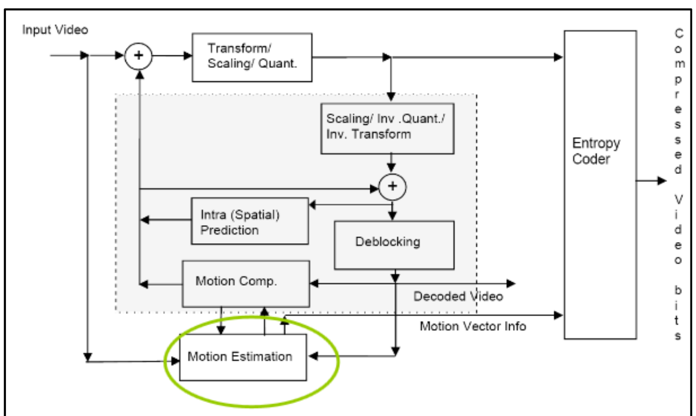
This subclause does not form an integral part of this Recommendation | International Standard.

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.

Source: H.264 Standard (03-2010) at pp. 3-4

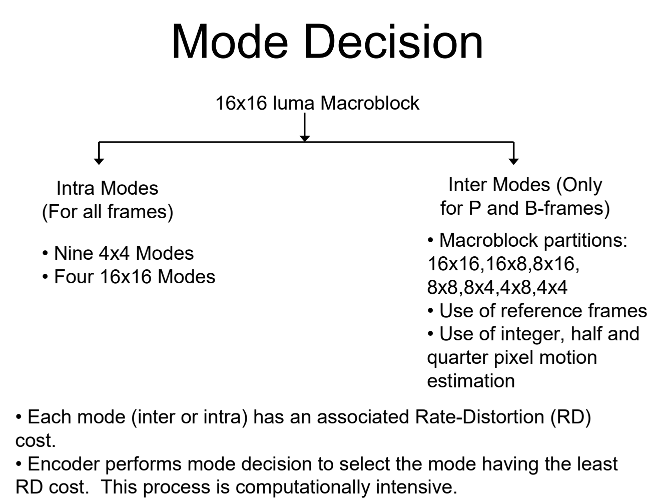


H.264/AVC Encoder [2]

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

87. The ’005 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.

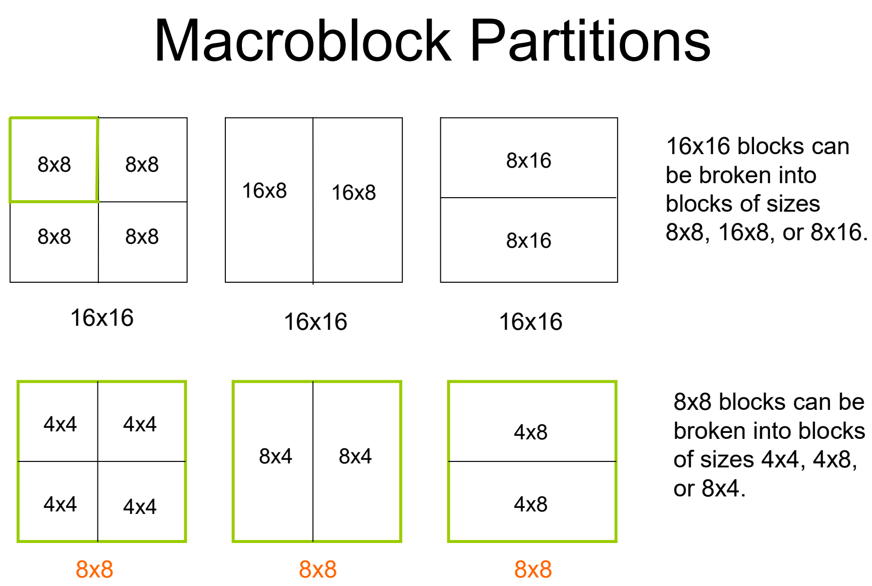
88. H.264 uses different motion estimation modes in inter-frame prediction. These modes are commonly referred to as inter-frame prediction modes, or inter modes. Each inter mode involves partitioning the current macroblock into a different combination of sub blocks, and selecting the optimum motion vector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

89. 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

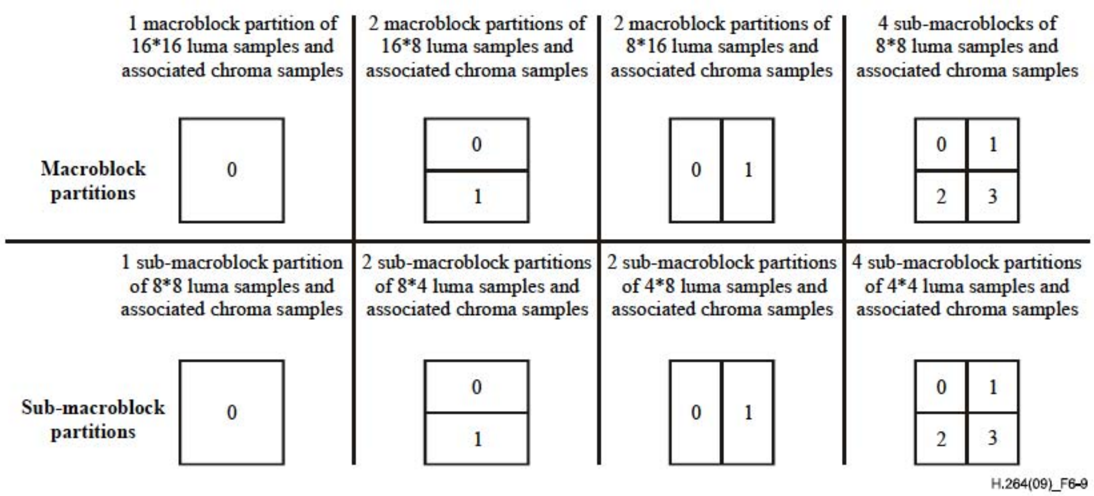


Figure 6-9 – Macroblock partitions, sub-macroblock partitions, macroblock partition scans, and sub-macroblock partition scans

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

90. 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

91. The ’005 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.

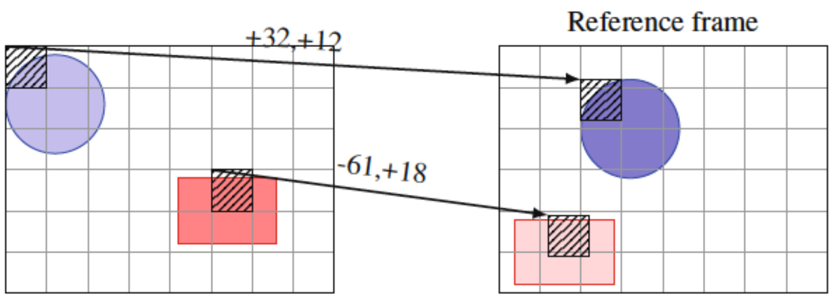


Fig. 2.4: Motion estimation. For each MB the best matching block in the reference frame is found. The encoder codes the differences (errors) between the MBs and their best matching blocks. Arrows indicate motion vectors and are labeled by the vector coordinates. In this example the shapes are identical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

92. 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.

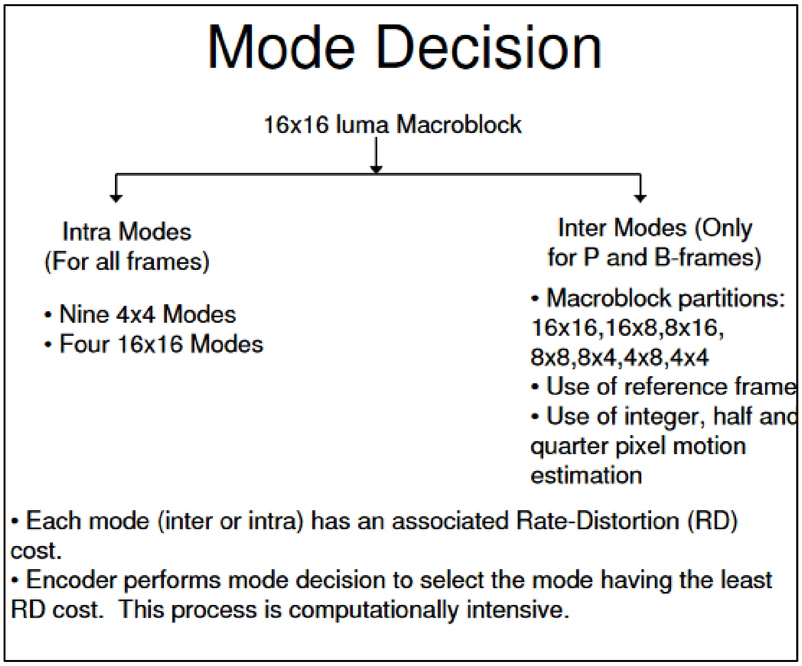
– P_8x8: for each sub-macroblock an additional syntax element (sub_mb_type[mbPartIdx] with mbPartIdx being the macroblock partition index for the corresponding sub-macroblock) is present in the bitstream that specifies the type of the corresponding sub-macroblock (see subclause 7.4.5.2).

– 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

93. The '005 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.

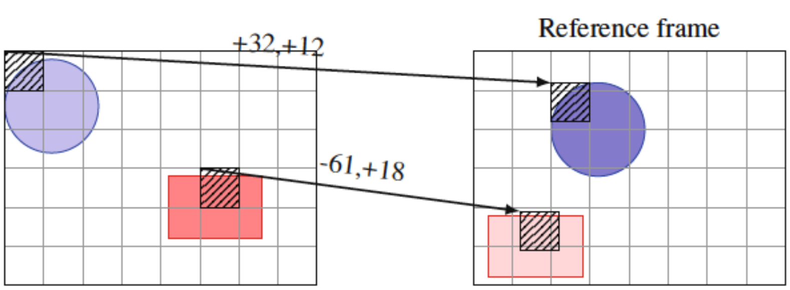


Fig. 2.4: Motion estimation. For each MB the best matching block in the reference frame is found. The encoder codes the differences (errors) between the MBs and their best matching blocks. Arrows indicate motion vectors and are labeled by the vector coordinates. In this example the shapes are identical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

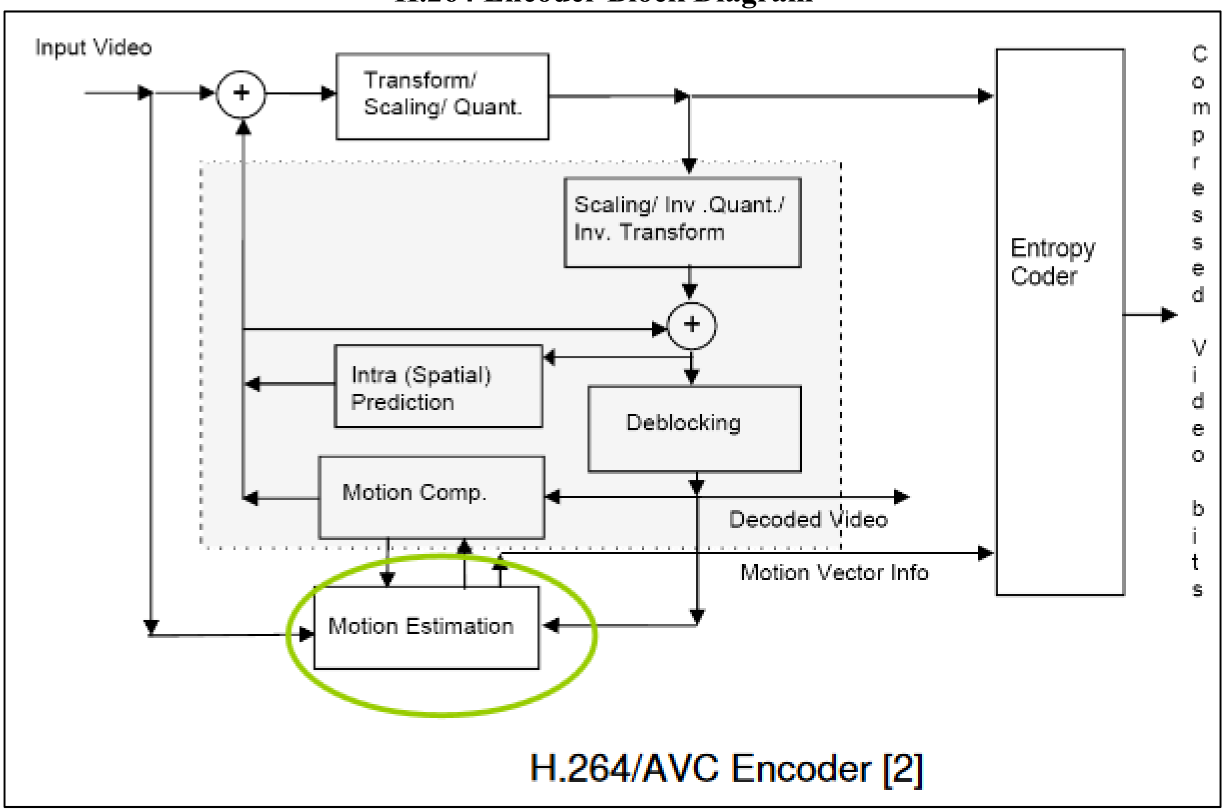
   – reference indices refIdxL0 and refIdxL1

   – 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

94. Vudu has thus infringed at least claim 1 of the ’005 patent by making, using, testing, selling, offering for sale, importing and/or licensing the ’005 Accused Infringing Devices, and operating them such that all steps of at least claim 1 are performed.

95. Vudu’s acts of direct infringement have caused damage to Uniloc, and Uniloc is entitled to recover damages sustained as a result of Vudu’s wrongful acts in an amount subject to proof at trial.

PRAYER FOR RELIEF

WHEREFORE, Uniloc 2017 respectfully requests the following relief:

A. A judgment that Vudu has infringed the ’609 patent;

B. A judgment that Vudu has infringed the ’118 patent;

C. A judgment that Vudu has infringed the ’005 patent;

D. A judgment that Uniloc be awarded damages adequate to compensate it for Vudu’s past infringement and any continuing or future infringement of the ’609 patent, the ’118 patent and the ’005 patent, including pre-judgment and post-judgment interest costs and disbursements as justified under 35 U.S.C. § 284 and an accounting;

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

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

Uniloc hereby demands trial by jury on all claims and issues so triable.

DATED: April 9, 2019

Respectfully submitted,

FARNAN LLP

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