UNITED STATES DISTRICT COURT
EASTERN DISTRICT OF TEXAS
MARSHALL DIVISION

DYNAMIC DATA TECHNOLOGIES, LLC, ***Plaintiff,*** v. **MICROSOFT CORPORATION,** ***Defendant.***	**Civil Action No. 2:18-CV-00469-RWS** **JURY TRIAL DEMANDED**

FIRST AMENDED COMPLAINT FOR PATENT INFRINGEMENT

Dynamic Data Technologies, LLC ("Dynamic Data") bring this action and make the following allegations of patent infringement relating to U.S. Patent Nos.: 8,135,073 (the "'073 patent"); 6,714,257 (the "'257 patent"); 8,073,054 (the "'054 patent"); 6,774,918 (the "'918 patent"); 8,184,689 (the "'689 patent"); 6,996,177 (the "'177 patent"); 7,010,039 (the "'039 patent"); 8,311,112 (the "'112 patent"); 6,646,688 (the "'688 patent"); 7,894,529 (the "'529 patent"); 7,542,041 (the "'041 patent"); 7,571,450 (the "'450 patent"); 7,750,979 (the "'979 patent"); 6,639,944 (the "'944 patent"); and 6,760,376 (the "'376 patent") (collectively, the "patents-in-suit"). Defendant Microsoft Corporation ("Microsoft" or "Defendant") infringes each of the patents-in-suit in violation of the patent laws of the United States of America, 35 U.S.C. § 1 *et seq*.

CO-PENDING ENFORCEMENT PROCEEDINGS IN EUROPE AND THE PEOPLE'S REPUBLIC OF CHINA

1. Dynamic Data's portfolio of over 1,200 patent assets encompasses core technologies in the field of image and video processing. The patent portfolio held by Dynamic Data is international in scope and includes several hundred European and Chinese patent grants.

2. In an effort to facilitate the licensing of Philips' foundational technology, Dynamic Data is pursuing remedies for infringement of its patents in venues throughout the world. Prior to filing this First Amended Complaint, Dynamic Data filed a patent enforcement action against Microsoft Corporation and Microsoft (China) Co., Ltd. in the Nanjing IP Court in Nanjing, People's Republic of China. Dynamic Data is represented by the law firm East & Concord Partners in its Chinese enforcement actions against Microsoft.[1]

3. In addition, contemporaneous to the filing of this First Amended Complaint, Dynamic Data is filing an enforcement action against Microsoft Corporation and Microsoft Deutschland GmbH in Düsseldorf, Germany. Dynamic Data is represented by the law firm Weitnauer Rechtsanwälte of Berlin, Germany in its European enforcement actions.

4. In addition to ensuring that its intellectual property is appropriately licensed, Dynamic Data has expanded its portfolio of motion estimation and motion compensation patents. On November 19, 2018, Dynamic Data acquired a further set of 85 patent assets from NXP B.V. relating to motion estimation and motion compensation.

DYNAMIC DATA'S LANDMARK INVENTIONS

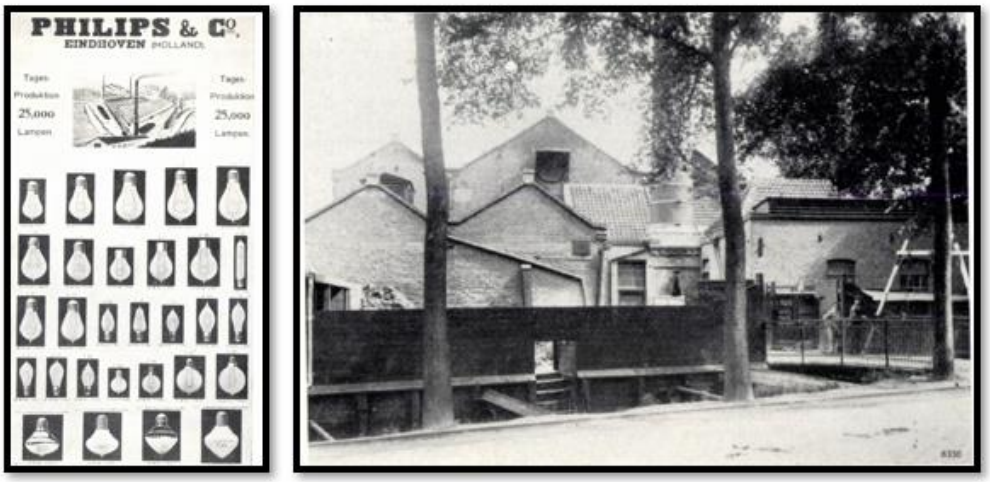
5. The groundbreaking inventions in image and video processing taught in the patents-in-suit were pioneered by Philips. Video and image processing were at the heart of Philips' business for over fifty years. In 1891, Philips, then known as Philips & Company, was founded in Eindhoven, Netherlands to manufacture carbon-filament lamps.[2] In the 1920s, Philips began to produce vacuum tubes and small radios, which would augur Philips' later entry into video and audio processing.

[1] *See* Case Nos. (2018) Su 01 Minchu 3500 ((2018)苏01民初3500号), (2018) Su 01 Minchu 3501 ((2018)苏01民初3501号), and (2018) Su 01 Minchu 3502 ((2018) 苏01民初3502号).

[2] Gerard O'Regan, A BRIEF HISTORY OF COMPUTING at 99 (2012).

N.A. Halbertsma, *The Birth of a Lamp Factory In 1891*, PHILIPS TECHNICAL REVIEW, Vol. 23 at 230, 234 (1961).

6. In 1962, Philips introduced the first audio cassette tape.[3] A year later, Philips launched a small battery-powered audio tape recorder that used a cassette instead of a loose spool.[4] Philips C-cassette was later used as the first mass storage device for early personal computers in the 1970s and 1980s.



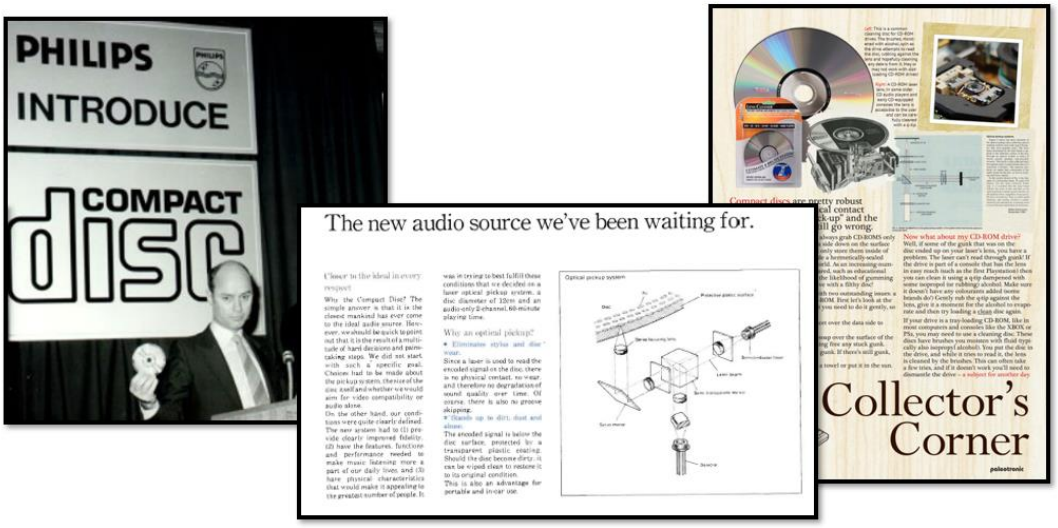
THE ROTARIAN MAGAZINE, Vol. 101 No. 6 at 70 (December 1962) (advertisement showing Philips Norelco device which used cassettes for recording audio for transcription); Fred Chandler,

[3] Gerard O'Regan, PILLARS OF COMPUTING: A COMPENDIUM OF SELECT, PIVOTAL TECHNOLOGY FIRMS at 172 (2015) ("Philips invented the compact cassette for audio storage in 1962.")

[4] Anthony Pollard, GRAMOPHONE: THE FIRST 75 YEARS at 231 (1998).

European Mfrs. Bid For Market Share, BILLBOARD MAGAZINE AT P-6 (April 8, 1967) (image of the Philips EL 3300 battery-operated tape recorder which was released in 1963); Jan Syrjala, *Car Stereo: How Does The Music Sound?*, N.Y. TIMES at 2-M (September 25, 1966) (showing Philips's Norelco Cassette "the Philips device has two tiny reels inside it, with the tape traveling from one to the other").

7. In 1971, Philips demonstrated the world's first videocassette records (VCR). A year later, Philips launched the world's first home video cassette recorder, the N1500. In 1982, Philips teamed with Sony to launch the Compact Disc; this format evolved into the DVD and later Blu-ray, which Philips launched with Sony in 1997 and 2006 respectively.



Hans Peek, Jan Bergmans, Jos Van Haaren, Frank Toolenaar, and Sorin Stan, ORIGINS AND SUCCESSORS OF THE COMPACT DISC: CONTRIBUTIONS OF PHILIPS TO OPTICAL STORAGE at 15 (2009) (showing image of Joop Sinjou of Philips introducing the compact disc in March 1979); Advertisements for Philip's Compact Disc Products (1982).

8. In the late 1990s and early 2000s, Philips pioneered the development of technologies for encoding and decoding of video and audio content. At the time most of the technologies claimed by the patents in Dynamic Data's portfolio were invented, Philips' subsidiary primarily responsible for Philips' work in this field, Philips Semiconductor was the world's sixth

largest semiconductor company.[5] The video encoding technologies developed by Philips Semiconductor enable video streaming on set-top boxes, smartphones, popular gaming consoles, Internet-connected computers, and numerous other types of media streaming devices.

9. Philips Semiconductor dedicated significant research and development resources to advancing the technology of video compression and transmission by reducing file sizes and decreasing the processing resources required to transmit the data.[6] Philips Semiconductor was among the first companies aggressively driving innovation in the field of video processing:

> The late 1980s and early 1990s saw the announcement of several complex, programmable VSPs. Important examples include chips from Matsushita, NTT, Philips [Semiconductors], and NEC. All of these processors were high-performance parallel processors architected from the ground up for real-time video signal processing. . . . The Philips VSP-1 and NEC processor were probably the most heavily used of these chips.[7]

10. Starting in the 1960s Philips pioneered the development of audio and video technologies that would establish itself as a leader in the field that would later develop into the audio and video encoding fields. Continuing Philips' pioneering history in these fields, the patents-in-suit disclose cutting-edge video compression and transmission technologies.

DYNAMIC DATA'S PATENT PORTFOLIO

11. Dynamic Data's patent portfolio includes over 1,200 patent assets, with over 470 issued patents granted by patent offices around the world. Dynamic Data owns numerous patents issued by the United States Patent and Trademark Office, including each of the patents-in-suit,

[5] *Company News; Philips in $1 Billion Deal for VLSI Technology*, THE NEW YORK TIMES (May 4, 1999), *available at*: https://www.nytimes.com/1999/05/04/business/company-news-philips-in-1-billion-deal-for-vlsi-technology.html.

[6] HU, YU HEN, PROGRAMMABLE DIGITAL SIGNAL PROCESSORS: ARCHITECTURE, PROGRAMMING, AND APPLICATIONS, at 190 (Dec. 6, 2001) ("Philips Semiconductors developed early dedicated video chips for specialized video processors.").

[7] *Id.* at 191.

The State Intellectual Property Office of the People's Republic of China,[8] the European Patent Office,[9] the German Patent and Trademark Office,[10] the Japan Patent Office,[11] and many other national patent offices.

12. Philips Semiconductor's pioneering work in the area of video processing and encoding has resulted in various inventions that are fundamental to today's video processing technologies. Dynamic Data is the owner by assignment of over 1,000 of these patent assets, which include over 400 patents issued by patent offices around the world.

13. Highlighting the importance of the patents-in-suit is the fact that the patents-in-suit have been cited by over 400 U.S. and international patents and patent applications by a wide variety of the largest companies operating in the field. For example, the patents-in-suit have been cited by companies such as:

- Samsung Electronics Co., Ltd.[12]
- Qualcomm Inc.[13]
- Google LLC[14]
- Intel Corporation[15]
- Broadcom Corporation[16]
- ***Microsoft Corporation***[17]
- Sony Corporation[18]

[8] *See, e.g.*, CN100504925C; CN100438609C; CN1679052B; CN1333373C; CN1329870C; CN1303818C.

[9] *See, e.g.*, European Patent Nos. EP1032921B1; EP1650978B1; EP1213700B1; EP1520409B1.

[10] *See, e.g.*, German Patent Nos. DE60120762; DE50110537; DE60126151; DE60348978; DE602004049357.

[11] *See, e.g.*, Japanese Patent Nos. JP4583924B2; JP5059855B2; JP5153336B2; JP4637585B2.

[12] *See, e.g.*, U.S. Patent Nos. 6,930,729; 7,911,537; 7,532,764; 8,605,790; and 8,095,887.

[13] *See, e.g.*, U.S. Patent Nos. 7,840,085; 8,649,437; 8,750,387; 8,918,533; 9,185,439; 9,209,934; 9,281,847; 9,319,448; 9,419,749; 9,843,844; 9,917,874; and 9,877,033.

[14] *See, e.g.*, U.S. Patent No. 8,787,454 and U.S. Patent Appl. No. 10/003,793.

[15] *See, e.g.*, U.S. Patent Nos. 7,554,559; 7,362,377; and 8,462,164.

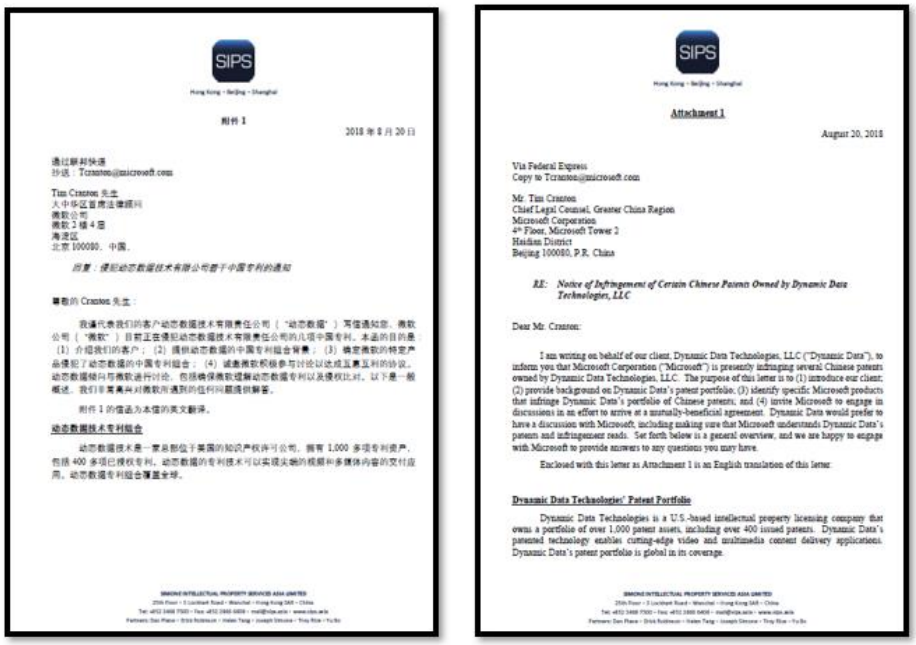
[16] *See, e.g.*, U.S. Patent Nos. 8,325,273 and 9,377,987.

[17] *See, e.g.*, U.S. Patent Nos. 7,453,939; 7,670,227; 7,408,986; 7,421,129; 7,558,320; and 7,929,599.

[18] *See, e.g.*, U.S. Patent Nos. 7,218,354 and 8,174,615.

- Fujitsu Ltd.[19]
- Panasonic Corporation[20]
- Matsushita Electric Industrial Company Limited[21]

14. Microsoft has had knowledge of Dynamic Data's patent portfolio, and each of the patents-in-suit, since at least August 20, 2018, when Dynamic Data's Chinese counsel sent a letter regarding Dynamic Data's portfolio and Microsoft's infringement of certain Chinese patents owned by Dynamic Data. Dynamic Data's August 20, 2018, letter was sent to Mr. Tim Cranton, whose title is Chief Legal Counsel, Greater China Region. In addition to addressing Microsoft's infringement of certain Chinese patents, Dynamic Data included a list of all patents owned by Dynamic Data, including each of the patents-in-suit in this case and included a request to discuss the potential for a mutually-agreeable license agreement to Dynamic Data's patent portfolio.



Attachment 1

August 20, 2018

Via Federal Express
Copy to Tcranton@microsoft.com

Mr. Tim Cranton
Chief Legal Counsel, Greater China Region
Microsoft Corporation
4th Floor, Microsoft Tower 2
Haidian District
Beijing 100080, P.R. China

RE: *Notice of Infringement of Certain Chinese Patents Owned by Dynamic Data Technologies, LLC*

Dear Mr. Cranton:

I am writing on behalf of our client, Dynamic Data Technologies, LLC ("Dynamic Data"), to inform you that Microsoft Corporation ("Microsoft") is presently infringing several Chinese patents owned by Dynamic Data Technologies, LLC. The purpose of this letter is to (1) introduce our client; (2) provide background on Dynamic Data's patent portfolio; (3) identify specific Microsoft products that infringe Dynamic Data's portfolio of Chinese patents; and (4) invite Microsoft to engage in discussions in an effort to arrive at a mutually-beneficial agreement. Dynamic Data would prefer to have a discussion with Microsoft, including making sure that Microsoft understands Dynamic Data's patents and infringement reads. Set forth below is a general overview, and we are happy to engage with Microsoft to provide answers to any questions you may have.

Enclosed with this letter as Attachment 1 is an English translation of this letter.

Dynamic Data Technologies' Patent Portfolio

Dynamic Data Technologies is a U.S.-based intellectual property licensing company that owns a portfolio of over 1,000 patent assets, including over 400 issued patents. Dynamic Data's patented technology enables cutting-edge video and multimedia content delivery applications. Dynamic Data's patent portfolio is global in its coverage.

DYNAMIC DATA NOTICE LETTER TO MICROSOFT (August 20, 2018) (images of Dynamic Data's notice letter sent to Microsoft in Mandarin and English).

[19] *See, e.g.*, U.S. Patent Nos. 7,092,032 and 8,290,308.
[20] *See, e.g.*, U.S. Patent Nos. 8,164,687 and 8,432,495.
[21] *See, e.g.*, U.S. Patent Nos. 7,362,378 and 7,423,961.

15. On the same day Dynamic Data sent its August 20, 2018, letter to Mr. Cranton, Mr. Cranton responded via email, confirming receipt of Dynamic Data's letter and introducing Dynamic Data's Chinese counsel to Ms. Katharine Bostick, whose title is Assistant General Counsel for Greater China. Mr. Cranton indicated that Ms. Bostick would respond to Dynamic Data's letter; however, to date, Dynamic Data has received no further communications from Microsoft.

THE PARTIES

DYNAMIC DATA TECHNOLOGIES, LLC

16. Dynamic Data Technologies, LLC ("Dynamic Data" or "Plaintiff") is a limited liability company organized under the laws of Delaware.

17. In an effort to obtain compensation for Philips' pioneering work in the fields of video data encoding, decoding, and transmission, Dynamic Data acquired the patents-in-suit along with the several hundred additional issued United States and international Patents.

18. Dynamic Data pursues the reasonable royalties owed for Microsoft's use of the inventions claimed in Dynamic Data's patent portfolio, which primarily arise from Philips' groundbreaking technology, both here in the United States and throughout the world.

MICROSOFT

19. On information and belief, Microsoft Corporation ("Microsoft") is a corporation organized and existing under the laws of the state of Washington with its principal place of business at 1 Microsoft Way, Redmond, Washington 98052. Microsoft does business throughout the State of Texas and in the Eastern District of Texas. Microsoft may be served with process through its registered agent for service in Texas: Corporation Service Company, 211 E. 7th Street,

Suite 620, Austin, Texas 78701. On information and belief, Microsoft is registered to do business in the State of Texas and has been since at least March 13, 1995.

20. On information and belief, Microsoft conducts business operations within the Eastern District of Texas in its facilities at 2601 Preston Road, Suite 1176, Frisco, Texas 75034.

21. On information and belief, Microsoft has facilities in the Eastern District of Texas where it sells and/or markets its products, including products accused of infringing the patents-in-suit in this action, including its retail sales location in Frisco, Texas.

JURISDICTION AND VENUE

22. This action arises under the patent laws of the United States, Title 35 of the United States Code. Accordingly, this Court has exclusive subject matter jurisdiction over this action under 28 U.S.C. §§ 1331 and 1338(a).

23. Upon information and belief, this Court has personal jurisdiction over Microsoft in this action because Microsoft has committed acts within the Eastern District of Texas giving rise to this action and has established minimum contacts with this forum such that the exercise of jurisdiction over Microsoft would not offend traditional notions of fair play and substantial justice. Microsoft, directly and/or through subsidiaries or intermediaries (including distributors, retailers, and others), has committed and continues to commit acts of infringement in this District by, among other things, offering to sell and selling products and/or services that infringe the patents-in-suit. Moreover, Microsoft is registered to do business in the State of Texas, has offices and facilities in the State of Texas and the Eastern District of Texas, and actively directs its activities to customers located in the State of Texas.

24. On information and belief, Microsoft has directly financially benefitted from doing business with the State of Texas. Microsoft has entered into contracts with the State of Texas

valued at several hundred thousand dollars. For example, Microsoft has entered into contracts (*see, e.g.*, DIR-TSO-3373 and DIR-TSO-3781) with the State of Texas whereby Microsoft is paid by the State of Texas to provide technical consulting services and Microsoft products.

25. Venue is proper in this district under 28 U.S.C. §§ 1391(b)-(d) and 1400(b). Microsoft is registered to do business in the State of Texas, maintains offices and facilities in the State of Texas and one or more regular and established places of business within the Eastern District of Texas, and has transacted business in the Eastern District of Texas and has committed acts of direct and indirect infringement in the Eastern District of Texas.

THE ASSERTED PATENTS

U.S. PATENT NO. 8,135,073

26. U.S. Patent No. 8,135,073 (the "'073 patent") entitled, *Enhancing Video Images Depending On Prior Image Enhancements*, was filed on December 12, 2003, and claims priority to December 19, 2002. The '073 patent is subject to a 35 U.S.C. § 154(b) term extension of 1,799 days. Dynamic Data is the owner by assignment of all right, title, and interest in the '073 patent. A true and correct copy of the '073 patent is attached hereto as Exhibit 1.

27. The '073 patent discloses novel methods and systems for enhancing subsequent images of a video stream in which frames are encoded based on previous frames using prediction and motion estimation.

28. The inventions disclosed in the '073 patent reduce the processing capacity required for providing video enhancements to video processing through re-mapping of previous frames for subsequent frames.

29. Accordingly, the technologies disclosed in the '073 patent enable the provision of enhanced video pictures with minimal additional hardware costs for the components required to successfully process the video data.

30. The ‘073 patent discloses a video decoder comprising an input for receiving a video stream containing encoded frame based video information including an encoded first frame and an encoded second frame.

31. The ‘073 patent discloses a video decoder comprising an input for receiving video information wherein the encoding of the second frame depends on the encoding of the first frame, the encoding of the second frame includes motion vectors indicating differences in positions between regions of the second frame and corresponding regions of the first frame, the motion vectors define correspondence between regions of the second frame and corresponding regions of the first frame.

32. The ‘073 patent discloses a video decoder comprising a decoding unit for decoding the frames, wherein the decoding unit recovers the motion vectors for the second frame.

33. The ‘073 patent discloses a video decoder comprising a processing component configured to determine a re-mapping strategy for video enhancement of the decoded first frame using a region-based analysis, re-map the first frame using the re-mapping strategy, and re-map one or more regions of the second frame depending on the re-mapping strategy for corresponding regions of the first frame.

34. The ‘073 patent and its underlying patent application have been cited by 36 patents and patent applications as relevant prior art. Specifically, patents issued to the following companies have cited the ‘073 patent and its underlying patent application as relevant prior art:

- Canon Inc.
- ***Microsoft Corporation***
- International Business Machines Corporation
- Qualcomm Inc.
- Digital Fountain Incorporated
- Samsung Electronics Co., Ltd.
- SK Planet Co. Ltd.

U.S. PATENT NO. 6,714,257

35. U.S. Patent No. 6,714,257 (the "'257 patent") entitled, *Color Key Preservation During Sample Rate Conversion*, was filed on June 29, 2001. The '257 patent is subject to a 35 U.S.C. § 154(b) term extension of 445 days. Dynamic Data is the owner by assignment of all right, title, and interest in the '257 patent. A true and correct copy of the '257 patent is attached hereto as Exhibit 2.

36. The '257 patent claims specific methods and systems for processing a keyed image. For example, one or more of the '257 patent claims describe a method for scaling a keyed image where a key-only image corresponding to key regions in the keyed images is created. The key-only image is scaled to form a scaled key-only image. The keyed image is scaled for form a scaled keyed image, and the scaled key-only image is merged with the scaled keyed image.

37. The '257 patent discloses additional improvements to scaling and filtering color-keyed images.

38. The inventions taught in the '257 patent achieve improvements in scaling and filtering color-keyed images by allowing the replacement of color-keyed regions with background image information, without introducing visible artifacts.

39. The '257 patent discloses embodiments that extract the color-keyed regions from a color-keyed image, and independently scale the color-keyed regions and the non-color keyed regions.

40. The '257 patent discloses that blurring of edges in non-color-key regions are minimized by extending the non-color-key colors into color-keyed regions after the color-keyed information is extracted from the color-keyed image.

41. The ‘257 patent has been cited by several United States and International patents and patent applications as relevant prior art. Specifically, patents issued to ***Microsoft Corporation***, Texas Instruments Incorporated, Samsung Corporation, Marvell International Limited, Innolux Corporation, and China Digital Video (Beijing) Limited have all cited the ‘257 patent as relevant prior art.

U.S. PATENT NO. 8,073,054

42. U.S. Patent No. 8,073,054 (the “’054 patent”) entitled, *Unit For And Method Of Estimating A Current Motion Vector*, was filed on December 12, 2002, and claims priority to January 17, 2002. The ‘054 patent is subject to a 35 U.S.C. § 154(b) term extension of 1,162 days. Dynamic Data is the owner by assignment of all right, title, and interest in the ‘054 patent. A true and correct copy of the ‘054 patent is attached hereto as Exhibit 3.

43. The ‘054 patent discloses novel methods and apparatuses for estimating a current motion vector for a group of pixels of an image.

44. The inventions disclosed in the ‘054 patent enable motion estimation with a relatively fast convergence in finding the appropriate motion vectors of the motion vector fields by adding a further candidate motion vector to the set of candidate motion vectors.

45. The ‘054 patent discloses a motion estimation unit comprising a generating unit for generating a set of candidate motion vectors for the group of pixels, with the candidate motion vectors being extracted from a set of previously estimated motion vectors.

46. The ‘054 patent discloses a motion estimation unit comprising a match error unit for calculating match errors of respective candidate motion vectors.

47. The ‘054 patent discloses a motion estimation unit comprising a selector for selecting the current motion vector from the candidate motion vectors by comparing the match

errors of the respective candidate motion vectors, characterized in that the motion estimation unit is arranged to add a further candidate motion vector to the set of candidate motion vectors by calculating the further candidate motion vector on basis of a first motion vector and a second motion vector, both belonging to the set of previously estimated motion vectors.

48. The '054 patent discloses a motion estimation unit that calculates the further candidate motion vector on basis of the first motion vector and the second motion vector, with the first motion vector belonging to a first forward motion vector field and the second motion vector belonging to a second forward motion vector field, with the first forward motion vector field and the second forward motion vector field being different.

49. The '054 patent discloses a motion estimation unit that arranges to calculate the further candidate motion vector by calculating a difference between the second motion vector and the first motion vector.

50. The '054 patent and its underlying patent application have been cited by 14 patents and patent applications as relevant prior art. Specifically, patents issued to the following companies have cited the '054 patent and its underlying patent application as relevant prior art:

- Canon Inc.
- Huawei Technologies, Ltd.
- Imagination Technologies Ltd.
- MediaTek Inc.
- Panasonic Corp.
- Samsung Electronics Co., Ltd.
- Siemens Healthcare GmbH
- Tencent Technology (Shenzhen) Co., Ltd.

U.S. PATENT NO. 6,774,918

51. U.S. Patent No. 6,774,918 ("the '918 patent") entitled, *Video Overlay Processor with Reduced Memory And Bus Performance Requirements*, was filed on June 28, 2000. The '918

patent is subject to a 35 U.S.C. § 154(b) term extension of 591 days. Dynamic Data is the owner by assignment of all right, title, and interest in the '918 patent. A true and correct copy of the '918 patent is attached hereto as Exhibit 4.

52. The '918 patent claims specific methods and systems for providing an overlay such as a cursor in an on-screen display in a consumer electronic device. On-screen display (OSD) data for generating an image on a display device are downloaded to an OSD unit on an integrated circuit.

53. The '918 patent discloses downloading on-screen display (OSD) data for generating an image on a display device.

54. The '918 patent further discloses downloading the on-screen display (OSD) data in segments separated by gaps.

55. The '918 patent further discloses, during a gap in downloading the on-screen display data, downloading an amount of overlay data for generating an overlay on the image generated on a display device.

56. Further, the '918 patent discloses that the overlay data downloaded during a gap comprises a portion of the overlay data.

57. The inventions disclosed in the '918 patent improve the operation and efficiency of computer components because only a portion of the overlay data is downloaded during each burst gap, thus reducing the amount of memory needed to store the overlay data. The inventions disclosed in the '918 patent further eliminate the requirement that on-chip memory be large enough to hold the data needed for an entire overlay. Instead, only one line or a part of one line of the overlay needs to be stored on-chip.

58. The '918 patent claims a technical solution to a problem unique to video processing.

59. The ‘918 patent has been cited by several United States patents and patent applications as relevant prior art. Specifically, patents issued to Realtek Semiconductor Corp., Samsung Electronics Co., Ltd., and Thomson Licensing SA have all cited the ‘918 patent as relevant prior art.

U.S. PATENT NO. 8,184,689

60. U.S. Patent No. 8,184,689 (the “’689 patent”) entitled, *Method Video Encoding And Decoding Preserving Cache Localities*, was filed on August 7, 2006, and claims priority to August 17, 2005. The ‘689 patent is subject to a 35 U.S.C. § 154(b) term extension of 948 days. Dynamic Data is the owner by assignment of all right, title, and interest in the ‘689 patent. A true and correct copy of the ‘689 patent is attached hereto as Exhibit 5.

61. The ‘689 patent discloses novel methods and apparatuses for encoding and decoding video data.

62. The inventions disclosed in the ‘689 patent processing time and power consumption associated with encoding and decoding video stream data is reduced by reducing off-chip memory accesses through using simultaneous encoded/decoded images as a reference image for encoding/decoding at least one of the other simultaneously encoded/decoded images.

63. The ‘689 patent discloses a method for encoding and decoding a video stream, including a plurality of images in a video processing apparatus having a processing unit coupled to a first memory, further comprising a second memory.

64. The ‘689 patent discloses a method for encoding and decoding a video stream comprising providing a subset of image data stored in the second memory in the first memory.

65. The ‘689 patent discloses a method for encoding and decoding a video stream comprising simultaneous encoding/decoding of more than one image of the video stream, by

accessing said subset, wherein the simultaneously encoding/decoding is performed by access sharing to at least one image.

66. The ‘689 patent and its underlying patent application have been cited by several patents and patent applications as relevant prior art. Specifically, patents issued to Fujitsu Ltd., Qualcomm Inc., Sony Corporation, Sun Patent Trust, and VIXS Systems Incorporated have all cited the ‘689 patent and its underlying patent application as relevant prior art.

U.S. PATENT NO. 6,996,177

67. U.S. Patent No. 6,996,177 (the “‘177 patent”) entitled, *Motion Estimation*, was filed on July 24, 2000, and claims priority to August 22, 1999. The ‘177 patent is subject to a 35 U.S.C. § 154(b) term extension of 1,103 days. Dynamic Data is the owner by assignment of all right, title, and interest in the ‘177 patent. A true and correct copy of the ‘177 patent is attached hereto as Exhibit 6.

68. The ‘177 patent claims specific methods and devices for motion estimation and motion-compensated picture signal processing.

69. The ‘177 patent discloses a motion vector estimation method and device that carries out a block-based motion vector estimation process that involves comparing a plurality of candidate vectors to determine block-based motion vectors.

70. The ‘177 patent discloses a motion vector estimation method and device that determines at least a most frequently occurring block-based motion vector.

71. The ‘177 patent discloses a motion vector estimation method and device that carries out a global motion vector estimation process using at least the most frequently occurring block-based motion vector to obtain a global motion vector.

72. The ‘177 patent discloses a motion vector estimation method and device that applies the global motion vector as a candidate vector to the block-based motion vector estimation process.

73. The inventions disclosed in the ‘177 patent improve the operation of the computer components necessary to the performance of picture signal processing by reducing the load on the central processing unit.

74. The ‘177 patent has been cited by 16 United States and International patents and patent applications as relevant prior art. Specifically, patents issued to the following companies have cited the ‘177 patent as relevant prior art:

- Qualcomm Incorporated
- LG Electronics
- ***Microsoft Corporation***
- Samsung Electronics Co., Ltd.
- VIXS Systems Incorporated
- General Instrument Corporation

U.S. PATENT NO. 7,010,039

75. U.S. Patent No. 7,010,039 (the “‘039 patent”) entitled, *Motion Estimator for Reduced Halos in MC Up-Conversion*, was filed on May 15, 2001, and claims priority to May 18, 2000. The ‘039 patent is subject to a 35 U.S.C. § 154(b) term extension of 768 days. Dynamic Data is the owner by assignment of all right, title, and interest in the ‘039 patent. A true and correct copy of the ‘039 patent is attached hereto as Exhibit 7.

76. The ‘039 patent claims specific methods and apparatuses detecting motion at a temporal intermediate position between previous and next images. The inventions disclosed in the ‘039 patent solve a problem wherein an estimator estimating motion between two successive pictures from a video sequence cannot perform well in areas where covering or uncovering occurs.

77. The ‘039 patent solves this problem by carrying out the optimization at the temporal position of the next image in covering areas and at the temporal position of the previous image in uncovering areas.

78. The ‘039 patent discloses a method and apparatus for detecting motion at a temporal intermediate position between previous and next images.

79. The ‘039 patent discloses the use of a criterion function for selecting and optimizing candidate vectors.

80. The ‘039 patent further discloses a criterion function that depends on data from both previous and next images and in which the optimizing is carried out at the temporal intermediate position in non-covering and non-uncovering areas, characterized in that the optimizing is carried out at the temporal position of the next image in covering areas and at the temporal position of the previous image in uncovering areas.

81. The ‘039 patent and its related patents have been cited by 30 United States and International patents and patent applications as relevant prior art. Specifically, patents issued to the following companies have cited the ‘039 patent family as relevant prior art:

- Qualcomm Incorporated
- Panasonic Corporation
- Samsung Electronics Co., Ltd.
- Matsushita Electric Industrial Co., Ltd.
- Sharp Kabushiki Kaisha
- Integrated Device Technology, Inc.
- Zoran Corporation

U.S. PATENT NO. 8,311,112

82. U.S. Patent No. 8,311,112 (the “’112 patent”) entitled, *System And Method For Video Compression Using Predictive Coding*, was filed on December 31, 2008. The ‘112 patent is subject to a 35 U.S.C. § 154(b) term extension of 847 days. Dynamic Data is the owner by

assignment of all right, title, and interest in the '112 patent. A true and correct copy of the '112 patent is attached hereto as Exhibit 8.

83. The '112 patent discloses novel methods and systems for video compression.

84. The '112 patent discloses novel technologies for video compression that perform predictive coding on a macroblock of a video frame such that a set of pixels of the macroblock is coded using some of the pixels from the same video frame as reference pixels and the rest of the macroblock is coded using reference pixels from at least one other video frame.

85. The '112 patent discloses a system for video compression comprising an intra-frame coding unit configured to perform predictive coding on a set of pixels of a macroblock of pixels using a first group of reference pixels, the macroblock of pixels and the first group of reference pixels being from a video frame.

86. The '112 patent discloses a system for video compression comprising an inter-frame coding unit configured to perform predictive coding on the rest of the macroblock of pixels using a second group of reference pixels, the second group of reference pixels being from at least one other video frame.

87. The '112 patent and its underlying patent application have been cited by 10 patents and patent applications as relevant prior art. Specifically, patents issued to the following companies have cited the '112 patent and its underlying patent application as relevant prior art:

- British Broadcasting Corporation
- Google LLC
- Megachips Corp.
- Olympus Corp.
- Samsung Electronics Co., Ltd.
- Sony Corporation
- Toshiba Corporation

U.S. PATENT NO. 6,646,688

88. U.S. Patent No. 6,646,688 (the "'688 patent") entitled, *High Quality Video and Graphics Pipeline*, was filed on November 10, 2000. The '688 patent is subject to a 35 U.S.C. § 154(b) term extension of 407 days. Dynamic Data is the owner by assignment of all right, title, and interest in the '688 patent. A true and correct copy of the '688 patent is attached hereto as Exhibit 9.

89. The '688 patent discloses multiple embodiments for optimally processing high quality video and graphics.

90. The '688 patent discloses a video/graphics data processing method wherein a stream of digital video/graphics data is pre-processed to output pre-processed data.

91. The '688 patent further discloses substituting the color key with a pre-selected color in the processing of a color key from the pre-processed data to output resulting data.

92. The '688 patent discloses processing and transforming the data resulting from the processing a color key from the pre-processed data to output resulting data.

93. The '688 patent has been cited by multiple United States patents and patent applications as relevant prior art. Specifically, patents and patent applications issued to Broadcom Corporation, Eastman Kodak Company, Nvidia Corporation, and Quantel Ltd. cited the '688 patent family as relevant prior art.

U.S. PATENT NO. 7,894,529

94. U.S. Patent No. 7,894,529 (the "'529 patent") entitled, *Method And Device For Determining Motion Vectors*, was filed on June 1, 2006, and claims priority to June 3, 2005. The '529 patent is subject to a 35 U.S.C. § 154(b) term extension of 1,301 days. Dynamic Data is the

owner by assignment of all right, title, and interest in the '529 patent. A true and correct copy of the '529 patent is attached hereto as Exhibit 10.

95. The '529 patent discloses novel methods and apparatuses for determining motion vectors that are each assigned to individual image regions.

96. The inventions disclosed in the '529 patent enable an increase in the resolution of video and image signals during the motion estimation process.

97. The '529 patent discloses a method for determining motion vectors which are assigned to individual image regions of an image.

98. The '529 patent discloses a method wherein an image is subdivided into a number of image blocks, and a motion estimation technique is implemented to assign at least one motion vector to each of the image blocks where a modified motion vector is generated for at least a first image block.

99. The '529 patent discloses a method that determines at least a second image block through which the motion vector assigned to the first image block at least partially passes.

100. The '529 patent discloses a method that generates the modified motion vector as a function of a motion vector assigned to at least the second image block.

101. The '529 patent discloses a method that assigns the modified motion vector as the motion vector to the first image block.

102. The '529 patent and its underlying patent application have been cited by multiple patents and patent applications as relevant prior art. Specifically, patents issued to Fujifilm Corp., and Samsung Electronics Co., Ltd. have cited the '529 patent and its underlying patent application as relevant prior art.

U.S. PATENT NO. 7,542,041

103. U.S. Patent No. 7,542,041 (the "041 patent") entitled, *Runtime Configurable Virtual Video Pipeline*, was filed on April 2, 2004, and claims priority to April 3, 2003. The '041 patent is subject to a 35 U.S.C. § 154(b) term extension of 288 days. Dynamic Data is the owner by assignment of all right, title, and interest in the '041 patent. A true and correct copy of the '041 patent is attached hereto as Exhibit 11.

104. The '041 patent discloses novel systems for dynamically configuring a multi-pipe pipeline system.

105. The inventions disclosed in the '041 patent enable a multiple-pipeline system that is dynamically configurable to effect various combinations of functions for each pipeline.

106. The inventions disclosed in the '041 patent teach a multiple pipeline system that includes a pool of auxiliary function blocks that are provided as required to select pipelines.

107. In one embodiment of the '041 patent, each pipeline of the multiple-pipeline system is configured to include a homogenous set of core functions. A pool of auxiliary functions is provided for selective insertion of auxiliary functions between core functions of select pipelines.

108. In one embodiment of the '041 patent, each auxiliary function includes a multiplexer that allows it to be selectively coupled within each pipeline.

109. The '041 patent discloses, in one embodiment, a processing system that includes a plurality of pipelines, with each pipeline of the plurality including a plurality of core pipeline elements that are configured to sequentially process data as it traverses the pipeline.

110. The '041 patent discloses, in one embodiment, a processing system that includes a plurality of auxiliary elements, each auxiliary element of the plurality of auxiliary elements being configured to be selectively coupled to multiple pipelines of the plurality of pipelines.

111. The ‘041 patent discloses, in one embodiment, a processing system wherein the auxiliary elements are responsive to external coupling-select signals.

112. The ‘041 patent discloses, in one embodiment, a processing system wherein a plurality of auxiliary elements are within a selected pipeline of the multiple pipelines, between a pair of core pipeline elements of the plurality of core pipeline elements to process the data as it traverses between the pair of core elements.

113. The ‘041 patent has been cited by several United States patents and patent applications as relevant prior art. Specifically, patents and patent applications issued to ***Microsoft Corporation***, Xilinx Inc., Canon Inc., Intel Corporation, and Nokia Oyj have cited the ‘041 patent and its underlying patent application as relevant prior art.

U.S. PATENT NO. 7,571,450

114. U.S. Patent No. 7,571,450 (the “’450 patent”) entitled, *System For And Method Of Displaying Information*, was filed on February 12, 2003, and claims priority to March 11, 2002. The ‘450 patent is subject to a 35 U.S.C. § 154(b) term extension of 846 days. Dynamic Data is the owner by assignment of all right, title, and interest in the ‘450 patent. A true and correct copy of the ‘450 patent is attached hereto as Exhibit 12.

115. The ‘450 patent discloses novel methods and systems for displaying information. The inventions disclosed in the ‘450 patent enable methods and systems wherein a user does not need to make a new selection after being switched from one service to a second service.

116. The inventions disclosed in the ‘450 patent permit a user of an information display system to have selections made on a first service also presented when the user switches to a second service without requiring the user to browse through the menus to define the type of information to be displayed a second time.

117. In one embodiment of the ‘450 patent, the user selection being made on the basis of the provided options while the first service was selected is use to select the appropriate data elements of the stream of the second service.

118. The inventions disclosed in the ‘450 patent enable various content sources to share similar information models.

119. The ‘450 patent, in one embodiment, discloses a method of displaying information on a display device wherein receiving a transport stream comprises services, with the services having elementary streams of video and of data elements.

120. The ‘450 patent, in one embodiment, discloses a method of displaying information on a display device wherein user actions of making a user selection of a type of information to be displayed on the device are received.

121. The ‘450 patent, in one embodiment, discloses a method of displaying information on a display device wherein filtering to select a data element of a first one of the services on the basis of the user selection is performed.

122. The ‘450 patent, in one embodiment, discloses a method of displaying information on a display device wherein rendering to calculate an output image to be displayed on the display device, on the basis of the first data element selected by the filer is performed.

123. The ‘450 patent, in one embodiment, discloses a method of displaying information on a display device wherein switching from the first one of the services to a second one of the services, characterized in comprising a second step of filtering to select a second data-element of the second one of the services, on basis of the user selection is performed.

124. The ‘450 patent, in one embodiment, discloses a method of displaying information on a display device wherein being switched from the first one of the services to the second one of

the services, with the data-element and the second data-element being mutually semantically related and a second step of rendering to calculate the output image to be displayed on the display device, on basis of the second data-element selected by the filter is performed.

125. The ‘450 patent and its underlying patent application have been cited by several patents and patent applications as relevant prior art. Specifically, patents issued to AT&T Intellectual Property I LP, Nokia Oyj, Samsung Electronics Co., Ltd., and ZTE Corporation have all cited the ‘450 patent and its underlying patent application as relevant prior art.

U.S. PATENT NO. 7,750,979

126. U.S. Patent No. 7,750,979 (the “’979 patent”) entitled, *Pixel-Data Line Buffer Approach Having Variable Sampling Patterns*, was filed on October 26, 2001. The ‘979 patent is subject to a 35 U.S.C. § 154(b) term extension of 2,749 days. Dynamic Data is the owner by assignment of all right, title, and interest in the ‘979 patent. A true and correct copy of the ‘979 patent is attached hereto as Exhibit 13.

127. The ‘979 patent discloses novel methods and systems for motion compensation in video signal processing.

128. The ‘979 patent discloses methods and systems that use line buffers that are decoupled and that can deliver a fixed number of pixels, as may be required by a video processing stage, using a sampling pattern that is defined as one among several selectable sampling windows.

129. The ‘979 patent discloses a video processing circuit having an input stream of pixels corresponding to an array of video pixels.

130. The ‘979 patent further discloses having a variable window size for sampling subsets of the array as a two-dimensional window that spans the pixels in the array.

131. The ‘979 patent further discloses having a video processing stage that inputs pixels using a fixed number of pixels.

132. The ‘979 patent further discloses a method for delivering the input stream of pixels to the video processing stage.

133. The ‘979 patent further discloses a method comprising establishing a window size and a sampling-window size, such that the window size is a multiple of the sampling-window size and the sampling-window size defines the fixed number of pixels.

134. The ‘979 patent further discloses a method comprising storing pixels from the input stream into a first set of line butters, the pixels stored in the first set of line butters including pixels for the established window size.

135. The ‘979 patent further discloses a method comprising prefetching the stored pixels from the first set of line butters into a second set of line buffers, the second set of line buffers being sufficiently long to store at least the pixels corresponding to the established sampling-window size.

136. The ‘979 patent further discloses a method comprising fetching the fixed number of pixels from the second set of line buffers for the video processing stage.

U.S. PATENT NO. 6,639,944

137. U.S. Patent No. 6,639,944 entitled, *Sub-Pixel Accurate Motion Vector Estimation And Compensated Interpolation*, was filed on April 26, 2000, and claims priority to April 26, 1999. Dynamic Data is the owner by assignment of all right, title, and interest in the ’944 Patent. A true and correct copy of the ’944 Patent is attached hereto as Exhibit 14.

138. The ’944 Patent discloses novel methods and systems for sub-pixel accurate motion vector estimation and motion-compensated interpolation or prediction.

139. The inventions disclosed in the ’944 Patent enables higher accuracy motion estimation at a lower cost through improvements in motion vector estimation and motion-compensated interpolation.

140. The ’944 Patent discloses a method of generating an intermediate image using sub-pixel accurate motion vectors having vector components that may have non-integer values, from first and second images having a given mutual temporal distance, the intermediate image being at a fractional distance from said first image, said fractional distance being a fraction of said given mutual temporal distance.

141. The ’944 Patent discloses a method that includes deriving first and second vectors from said sub-pixel accurate motion vectors.

142. The ’944 Patent discloses a method that includes generating an intermediate image by combining first positions in a first image shifted over first vectors and second positions in said second image shifted over second vectors.

143. The ’944 Patent discloses a method that includes deriving first and second vectors from sub-pixel accurate motion vectors by multiplying the vector components of the sub-pixel accurate motion vectors by a fraction to obtain fractional vector components.

144. The ’944 Patent discloses a method that includes deriving first and second vectors from sub-pixel accurate motion vectors by rounding the fractional vector components to obtain vector components of the first vectors, which have only integer vector components.

145. The ’944 Patent discloses a method that includes deriving first and second vectors from sub-pixel accurate motion vectors by subtracting the first vector from the candidate vector to obtain the second vector, whereby the second vectors have vector components that, depending on the candidate vector and the fraction, may have non-integer values.

146. The ’944 Patent and its underlying patent application have been cited by 23 patents and patent applications as relevant prior art. Specifically, patents issued to the following companies have cited the ’944 Patent and its underlying patent application as relevant prior art: Himax Media Solutions, Inc.; Cyberlink Corp.; and Marvell International Ltd.

U.S. PATENT NO. 6,760,376

147. U.S. Patent No. 6,760,376 entitled, *Motion Compensated Upconversion For Video Scan Rate Conversion*, was filed on November 6, 2000. The ’376 Patent is subject to a 35 U.S.C. § 154(b) term extension of 697 days. Dynamic Data is the owner by assignment of all right, title, and interest in the ’376 Patent. A true and correct copy of the ’376 Patent is attached hereto as Exhibit 15.

148. The ’376 Patent discloses novel methods and systems for motion compensated upconversion in a video image that uses motion compensation to generate an interpolated video field using motion vectors.

149. The inventions disclosed in the ’376 Patent provide a sharp video image by comparing a calculated correlation value of pixels with a threshold value.

150. The ’376 Patent discloses technologies that improve video image quality by selecting a motion compensated pixel that will provide a sharp video image by comparing a calculated correlation value of pixels with a threshold value.

151. The ’376 Patent discloses a method of motion compensation for use in a video image upconversion unit of the type that uses motion compensation to generate an interpolated field using motion vectors.

152. The ’376 Patent discloses a method of motion compensation that includes calculating a correlation value from the values of causal neighbor pixels of a generated field and from the values of corresponding neighbor pixels of a next field.

153. The ’376 Patent discloses a method of motion compensation that includes comparing the correlation value with a threshold value.

154. The ’376 Patent discloses a method of motion compensation that includes setting the value of a pixel to be created within the generated field to be equal to the value of a corresponding pixel of the next field if the correlation value is less than the threshold value.

155. The ’376 Patent and its underlying patent application have been cited by several patents and patent applications as relevant prior art. Specifically, patents issued to the following companies have cited the ’376 Patent and its underlying patent application as relevant prior art: Samsung Electronics Co., Ltd.; Blip X Ltd.; Himax Technologies Limited; and Snell Ltd.

COUNT I
INFRINGEMENT OF U.S. PATENT NO. 8,135,073

156. Dynamic Data references and incorporates by reference the preceding paragraphs of this Complaint as if fully set forth herein.

157. Microsoft designs, makes, uses, sells, and/or offers for sale in the United States products and/or services for enhancing subsequent images of a video stream in which frames are encoded based on previous frames using prediction and motion estimation.

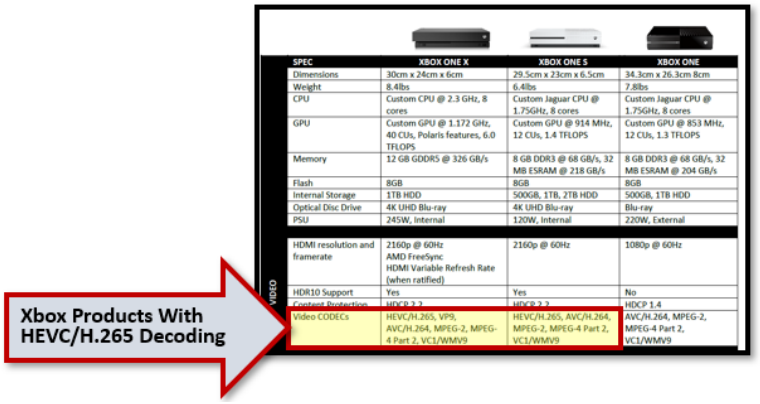
158. Microsoft designs, makes, sells, offers to sell, imports, and/or uses Microsoft products capable of decoding video data in compliance with the H.265 standard. By way of example, the following Microsoft Products perform decoding pursuant to the H.265 standard: Windows 10 products (including Windows 10 Home, Windows 10 Pro, Windows 10 Enterprise, Windows 10 Education, Windows 10 Pro Education, and Windows 10 LTSB); Microsoft Azure (including Microsoft Azure Media Services and Azure Content Delivery Network); Microsoft Xbox One S; and Microsoft Xbox One X (collectively, the “Microsoft ‘073 Product(s)”).

159. On information and belief, one or more Microsoft subsidiaries and/or affiliates use the Microsoft '073 Products in regular business operations.

160. On information and belief, one or more of the Microsoft '073 Products include technology for enhancing subsequent images of a video stream in which frames are encoded based on previous frames using prediction and motion estimation.

161. The Microsoft '073 Products perform video decoding compliant with the H.265/HEVC standard. *See e.g.*, *Xbox One Family of Devices*, MICROSOFT XBOX SPECIFICATION SHEET at 1 (October 2017) (stating that the Xbox One X and Xbox One S support HEVC/H.265 decoding). *Comparison of Azure on Demand Media Encoder*, AZURE MEDIA SERVICES DOCUMENTATION (October 23, 2018), *available at*: https://docs.microsoft.com/en-us/azure/media-services/previous/media-services-compare-encoders (showing that the Media Encoder Standard And Premium Workflow supports HEVC input); The Media *Microsoft H.265 Video Decoder*, MICROSOFT MEDIA FOUNDATION DOCUMENTATION (MAY 30, 2018), *available at*: https://docs.microsoft.com/en-us/windows/desktop/medfound/ ("The Media Foundation H.265 video decoder is a Media Foundation Transform that supports decoding H.265/HEVC content in Annex B format and can be used in playback of mp4 and m2ts files.").

162. Further, Microsoft documentation establishes that the Microsoft Xbox Products include input for receiving and decoding HEVC video data. "10-bit HD High Efficiency Video Coding (HEVC) platform support added: 10-bit HD HEVC enables video-streaming apps, like Netflix, to use lower bandwidth to deliver HD-quality video streams." *Xbox One 2015 Operation System Update*, XBOX.COM WEBSITE (last visited August 2018), *available at*: https://support.xbox.com/en-US/xbox-one/console/system-update-operating-system-2015.



SPEC	XBOX ONE X	XBOX ONE S	XBOX ONE
Dimensions	30cm x 24cm x 6cm	29.5cm x 23cm x 6.5cm	34.3cm x 26.3cm 8cm
Weight	8.4lbs	6.4lbs	7.8lbs
CPU	Custom CPU @ 2.3 GHz, 8 cores	Custom Jaguar CPU @ 1.75GHz, 8 cores	Custom Jaguar CPU @ 1.75GHz, 8 cores
GPU	Custom GPU @ 1.172 GHz, 40 CUs, Polaris features, 6.0 TFLOPS	Custom GPU @ 914 MHz, 12 CUs, 1.4 TFLOPS	Custom GPU @ 853 MHz, 12 CUs, 1.3 TFLOPS
Memory	12 GB GDDR5 @ 326 GB/s	8 GB DDR3 @ 68 GB/s, 32 MB ESRAM @ 218 GB/s	8 GB DDR3 @ 68 GB/s, 32 MB ESRAM @ 204 GB/s
Flash	8GB	8GB	8GB
Internal Storage	1TB HDD	500GB, 1TB, 2TB HDD	500GB, 1TB HDD
Optical Disc Drive	4K UHD Blu-ray	4K UHD Blu-ray	Blu-ray
PSU	245W, Internal	120W, Internal	220W, External
VIDEO			
HDMI resolution and framerate	2160p @ 60Hz AMD FreeSync HDMI Variable Refresh Rate (when ratified)	2160p @ 60Hz	1080p @ 60Hz
HDR10 Support	Yes	Yes	No
Content Protection	HDCP 2.2	HDCP 2.2	HDCP 1.4
Video CODECs	HEVC/H.265, VP9, AVC/H.264, MPEG-2, MPEG-4 Part 2, VC1/WMV9	HEVC/H.265, AVC/H.264, MPEG-2, MPEG-4 Part 2, VC1/WMV9	AVC/H.264, MPEG-2, MPEG-4 Part 2, VC1/WMV9

Xbox One Family of Devices, MICROSOFT XBOX SPECIFICATION SHEET at 1 (October 2017) (annotation added), *available at*: https://news.xbox.com/wp-content/uploads/Xbox_One_Spec_Sheet.pdf.

163. On information and belief, Microsoft has directly infringed and continues to directly infringe the '073 patent by, among other things, making, using, offering for sale, and/or selling technology for enhancing subsequent images of a video stream in which frames are encoded based on previous frames using prediction and motion estimation, including but not limited to the Microsoft '073 Products.

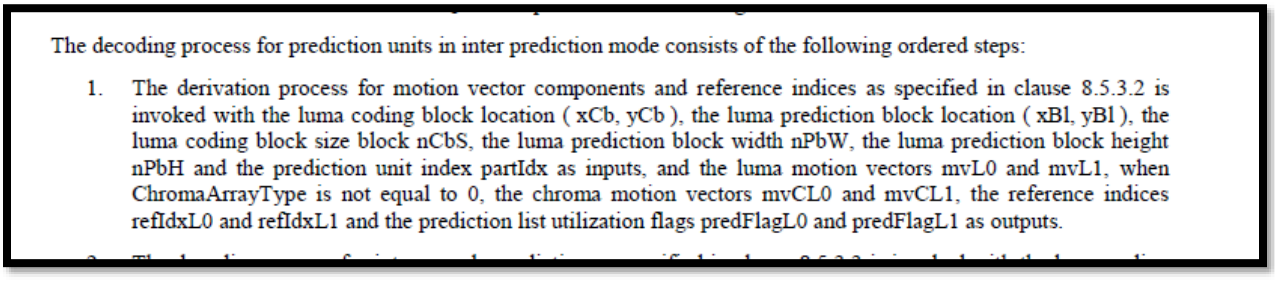
164. On information and belief, the Microsoft '073 Products contain a processor for decoding the received encoded frame-based encoded video data. Further, the Microsoft '073 Products apply a remapping policy to the first frame of decoded video data using a region-based luma analysis. As part of the decoding process performed by Microsoft '073 Products, a reference picture (first frame) is decoded and two in-loop filters (deblocking and a sample adaptive offset) are applied to the reference picture.

165. On information and belief, the Microsoft '073 Products, incorporate a decoding unit for decoding the frame of the received video data. The encoding and decoding process for video data received by the Microsoft '073 Products use inter-picture prediction wherein motion data comprises the selection of a reference frame and motion vectors to be applied in predicting the samples of each block.

166. On information and belief, one or more of the Microsoft '073 Products include technology for enhancing subsequent images of a video stream in which frames are encoded based on previous frames using prediction and motion estimation.

167. On information and belief, by complying with the HEVC standard, the Microsoft devices – such as the Microsoft '073 Products - necessarily infringe the '073 patent. The mandatory sections of the HEVC standard require the elements required by certain claims of the '073 patent, including but not limited to claim 14 of the '073 patent. *High Efficiency Video Coding*, SERIES H: AUDIOVISUAL AND Multimedia SYSTEMS: INFRASTRUCTURE OF AUDIOVISUAL SERVICES – CODING OF MOVING VIDEO REC. ITU-T H.265 (February 2018) (The following sections of the HEVC Standard are relevant to Microsoft's infringement of the '073 patent: "8.3.2 Decoding process for reference picture set;" "8.5.4 Decoding process for the residual signal of coding units coded in inter prediction mode;" "8.6 Scaling, transformation and array construction process prior to deblocking filter process;" "8.5.2 Inter prediction process;" "8.5.3 Decoding process for prediction units in inter prediction mode;" and "8.7.2 Deblocking filter process;" "8.7.3 Sample adaptive offset process.").

168. On information and belief, the Microsoft '073 Products comply with the HEVC standard, which requires that motion vectors are recovered from the second frame in the video stream.



The decoding process for prediction units in inter prediction mode consists of the following ordered steps:

1. The derivation process for motion vector components and reference indices as specified in clause 8.5.3.2 is invoked with the luma coding block location (xCb, yCb), the luma prediction block location (xBl, yBl), the luma coding block size block nCbS, the luma prediction block width nPbW, the luma prediction block height nPbH and the prediction unit index partIdx as inputs, and the luma motion vectors mvL0 and mvL1, when ChromaArrayType is not equal to 0, the chroma motion vectors mvCL0 and mvCL1, the reference indices refIdxL0 and refIdxL1 and the prediction list utilization flags predFlagL0 and predFlagL1 as outputs.

High Efficiency Video Coding, SERIES H: AUDIOVISUAL AND MULTIMEDIA SYSTEMS: INFRASTRUCTURE OF AUDIOVISUAL SERVICES – CODING OF MOVING VIDEO REC. ITU-T H.265 at § 8.5.3.1 (February 2018).

169. On information and belief, Microsoft has directly infringed and continues to directly infringe the '073 patent by, among other things, making, using, offering for sale, and/or selling technology for enhancing subsequent images of a video stream in which frames are encoded based on previous frames using prediction and motion estimation, including but not limited to the Microsoft '073 Products. The following excerpt explains how HEVC is a form of frame-based encoded video information.

> One way of achieving high video compression is to predict pixel values for a frame based on prior and succeeding pictures in the video. Like its predecessors, H.265 features the ability to predict pixel values between pictures, and in particular, to specify in which order pictures are coded and which pictures are predicted from which. The coding order is specified for Groups Of Pictures (GOP), where a number of pictures are grouped together and predicted from each other in a specified order. The pictures available to predict from, called reference pictures, are specified for every individual picture.

Johan Bartelmess. *Compression Efficiency of Different Picture Coding Structures in High Efficiency Video Coding (HEVC),* UPTEC STS 16006 at 4 (March 2016) (emphasis added).

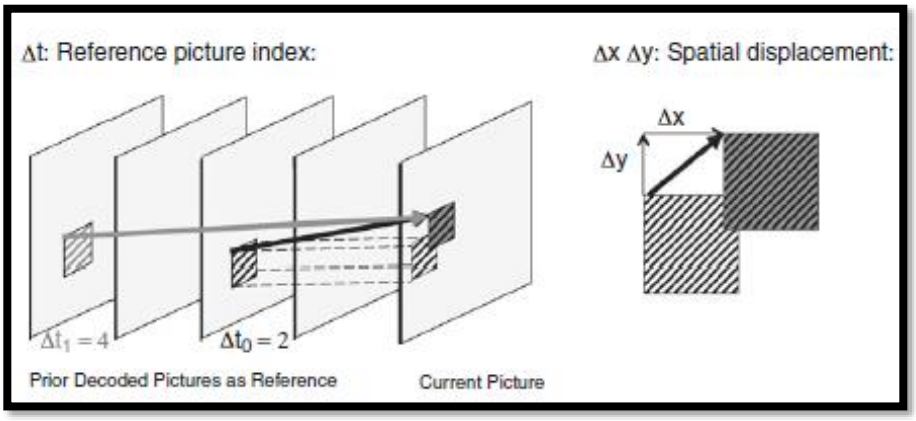
170. On information and belief, the Microsoft '073 Products receive encoded video data that is encoded using inter-frame coding. Specifically, the encoded video stream received by the Microsoft '073 Products is coded using its predecessor frame. Inter-prediction used in the encoded video data received by the Microsoft '073 Products allows a transform block to span across multiple prediction blocks for inter-picture predicted coding units to maximize the potential coding efficiency benefits of the quadtree-structured transform block partitioning.

> The basic source-coding algorithm is a hybrid of interpicture prediction to exploit temporal statistical dependences, intrapicture prediction to exploit spatial statistical dependences, and transform coding of the prediction residual signals to further exploit spatial statistical dependences.

G. J. Sullivan, J.-R. Ohm, W.-J. Han, and T. Wiegand, *Overview of the High Efficiency Video Coding (HEVC) standard*, IEEE TRANS. CIRCUITS SYST. VIDEO TECHNOL., vol. 22, no. 12, p. 1654 (December 2012) (emphasis added).

171. The encoded video stream received by the Microsoft '073 Products is encoded using inter-picture prediction that makes use of the temporal correlation between pictures to derive

a motion-compensated prediction (MCP) for a block of image samples. For this block-based motion compensated prediction, a video picture is divided into rectangular blocks. Assuming homogeneous motion inside one block, and that moving objects are larger than one block, for each block, a corresponding block in a previously decoded picture can be found that serves as a predictor. The general concept of inter-frame-based encoding using motion-compensated prediction based on a translational motion model is illustrated below.



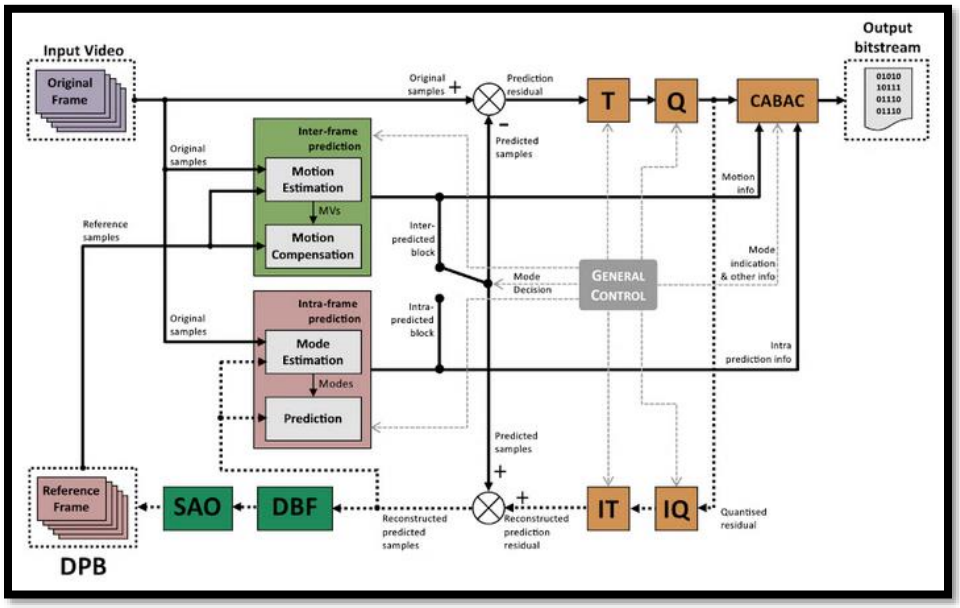
Benjamin Bross, *Inter-Picture Prediction In HEVC*, HIGH EFFICIENCY VIDEO CODING (HEVC) at 114 (September 2014).

172. The following excerpt from an article describing the architecture of the encoded video stream received by the Microsoft '073 Products describes the functionality wherein the second encoded frame of the video data is dependent on the encoding of a first frame. "HEVC inter prediction uses motion vectors pointing to one reference frame . . . to predict a block of pixels."

> HEVC inter prediction uses motion vectors pointing to one reference frame (uni-prediction) or two reference frames (bi-prediction) to predict a block of pixels. The size of the predicted block, called Prediction Unit (PU), is determined by the Coding Unit (CU) size and its partitioning mode. For example, a 32×32 CU with 2N×N partitioning is split into two PUs of size 32×16, or a 16×16 CU with nL×2N partitioning is split into 4×16 and 12×16 PUs.

Mehul Tikekar, *et al.*, *Decoder Hardware Architecture for HEVC*, HIGH EFFICIENCY VIDEO CODING (HEVC) (September 2014).

173. The following diagram shows how the Microsoft Products receive video data encoded using inter-frame prediction. Specifically, interframe prediction generates a motion vector based on the motion estimation across a first and second frame.



Guilherme Corrêa, *et al.*, COMPLEXITY-AWARE HIGH EFFICIENCY VIDEO CODING at 16 (2015).

174. On information and belief, one or more of the Microsoft '073 Products reduce the processing capacity required for providing video enhancements to video processing through re-mapping of previous frames for subsequent frames.

> So, this reduces guessing with frame dropping. Let's go over what we've learned. So, with HEVC hierarchical encoding, we have improved temporal scalability. There's a much more obvious frame dropping pattern and it removes frame drop guessing during playback. We also have improved motion compensation, the reference frames are much closer to each other, so we can use more parts of other frames and it also improves compression.

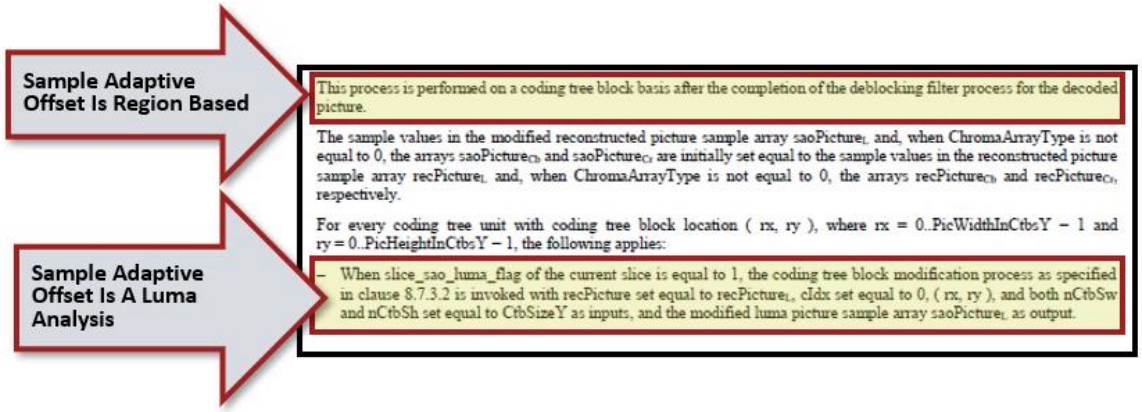
Erik Turnquist and Brad Ford, *Working with HEIF and HEVC*, MICROSOFT WORLDWIDE DEVELOPER CONFERENCE 2017: SESSION 511 Transcript (2017) (emphasis added), *available at*: https://developer.Microsoft.com/videos/play/wwdc2017/511.

175. On information and belief, any implementation of the HEVC standard would infringe the '073 patent as every possible implementation of the standard requires: receiving a video stream containing encoded frame based video information (including both an encoded first

frame and an encoded second frame); the encoded second frame that is received depends on the encoding of the first frame, the encoding of the second frame includes motion vectors indicating differences in positions between regions of the second frame and corresponding regions of the first frame; the motion vectors define correspondence between regions of the second frame and corresponding regions of the first frame; decoding the video stream by recovering the motion vectors in the second stream; and determining a re-mapping strategy for the video enhancement of the decoded first frame using a region-based analysis where the first frame is remapped using a remapping strategy and at least one region of the second frame is remapped depending on the re-mapping strategy for corresponding regions of the first frame.

176. On information and belief, the Microsoft '073 Products use of sample adaptive offset is a region-based luma analysis that is applied to the decoded first frame (reference picture). "The SAO reduces sample distortion by first classifying the samples in the region into multiple categories with as selected classifier and adding a specific offset to each sample depending on its category. The classifier index and the offsets for each region are signaled in the bitstream." Andrey Norkin, Chih-Ming Fu, Yu-Wen Huang, and Shawmin Lei, *In-Loop Filters In HEVC*, IN HIGH EFFICIENCY VIDEO CODING (HEVC) at 185 (September 2014) (emphasis added).

177. Further, the HEVC documentation requires that the application of a sample adaptive offset be region based (*e.g.*, applied to a coding block) ("This process is performed on a coding block basis after the completion for the deblocking filter process for the decoded picture").

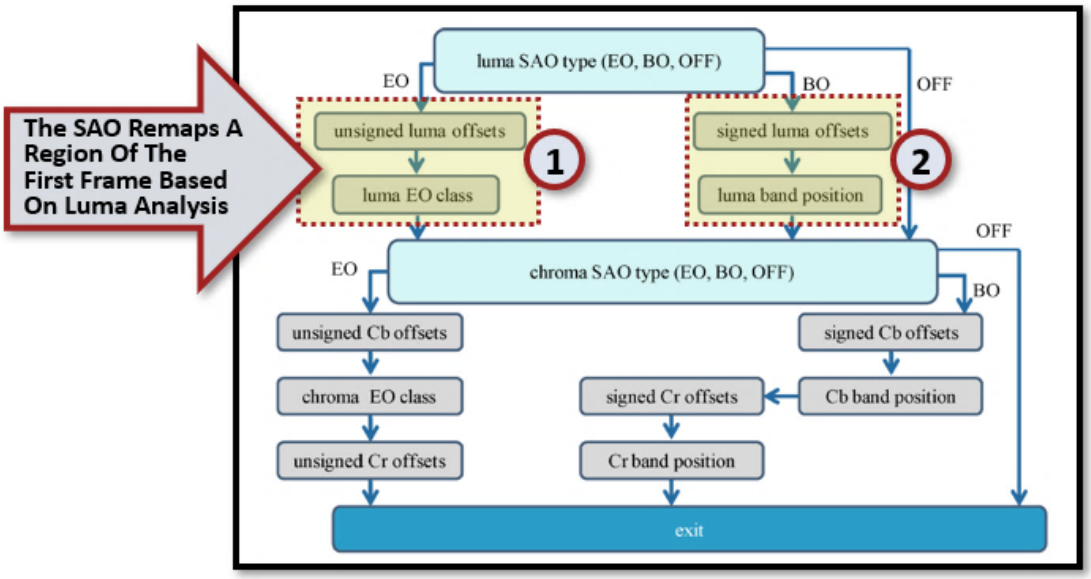


High Efficiency Video Coding, Series H: Audiovisual And Multimedia Systems: Infrastructure Of Audiovisual Services – Coding Of Moving Video Rec. ITU-T H.265 at § 8.7.3.1 (April 2015) (annotations added).

178. On information and belief, the Microsoft '073 Products contain functionality wherein a decoder applies sample adaptive offset to a decoded reference frame (first frame). Further, the Microsoft '073 Products apply the sample adaptive offset functions to remap a portion of the region based on luminance values (luma). "SAO can be applied to not only luma but also chroma." Chih-Ming Fu, *et al.*, *Sample Adaptive Offset in the HEVC Standard*, IEEE TRANSACTIONS ON CIRCUITS AND SYSTEMS FOR VIDEO TECHNOLOGY, VOL. 22, NO. 12 at 1765 (December 2012).

179. On information and belief, the Microsoft '073 Products apply the sample adaptive offset to a coding tree unit (region in the first frame), a luminance analysis is performed using two luminance analysis techniques: Edge Offset ("EO") and Band Offset ("BO"). Edge Offset "uses four 1-D directional patterns for sample classification: horizontal, vertical, 135° diagonal, and 45° diagonal." Chih-Ming Fu, *et al.*, Sample Adaptive Offset in the HEVC Standard, IEEE TRANSACTIONS ON CIRCUITS AND SYSTEMS FOR VIDEO TECHNOLOGY, VOL. 22, NO. 12 AT 1757 (December 2012). Band Offset "implies one offset is added to all samples of the same band. The sample value range is equally divided into 32 bands." *Id.* at 1757. The below diagram shows that

the Microsoft '073 Products use different sample adaptive offsets in a region of the first frame in conducting a luminance analysis.



Chih-Ming Fu, *et al.*, *Sample Adaptive Offset in the HEVC Standard*, IEEE TRANSACTIONS ON CIRCUITS AND SYSTEMS FOR VIDEO TECHNOLOGY, VOL. 22, NO. 12 AT 1759 (December 2012) (annotations added showing (1) edge offset and (2) band offset luma analysis).

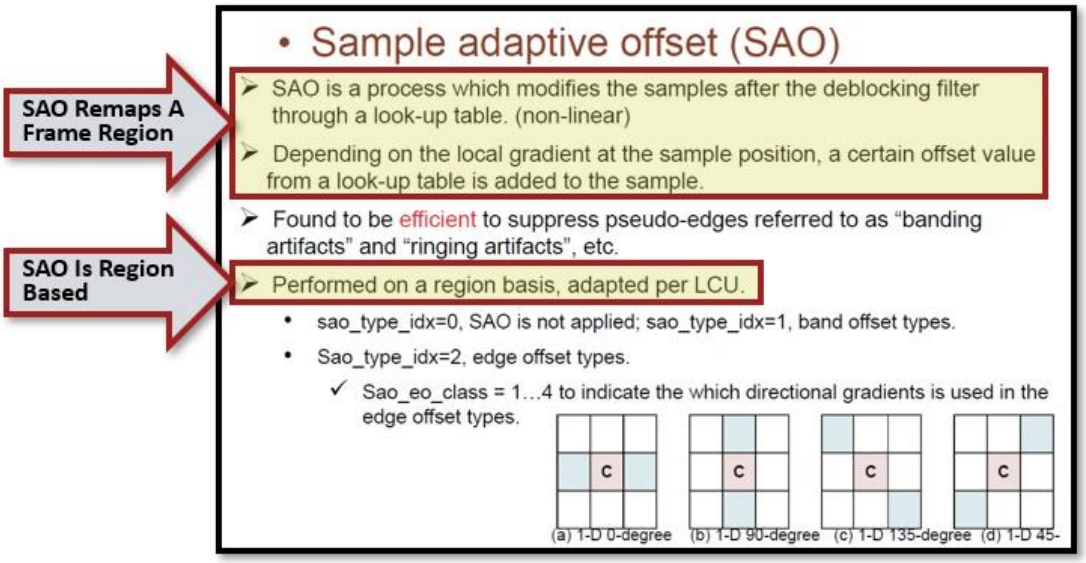
180. Further, HEVC documentation makes clear that the application of the standard adaptive offset remapping policy is based on a luminance analysis. The below shows that slices of a region have a standard adaptive offset applied based on a "luma flag."

if(sample_adaptive_offset_enabled_flag) {	
slice_sao_luma_flag	u(1)
if(ChromaArrayType != 0)	
slice_sao_chroma_flag	u(1)

High Efficiency Video Coding, SERIES H: AUDIOVISUAL AND MULTIMEDIA SYSTEMS: INFRASTRUCTURE OF AUDIOVISUAL SERVICES – CODING OF MOVING VIDEO REC. ITU-T H.265 at § F.7.3.6.1 (April 2015) ("sample_adaptive_offset_enabled_flag equal to 1 specifies that the sample adaptive offset process is applied to the reconstructed picture after the deblocking filter process.").

181. Commentary on the use of sample adaptive offset functionality in decoding HEVC video further confirms that the use of Sample Adaptive Offset (such as that implemented by the

Microsoft '073 Products) is region based and remaps pixel values in a region of a frame by modifying pixels based on an offset value. "[A]fter the deblocking filter through a look-up table . . . [and applying] a certain offset value from a look-up-table is added to the sample."[22]



Oscar C. Au, HIGH EFFICIENCY VIDEO CODING (HEVC) PRESENTATION at 43 (October 2013) (annotations added).

182. On information and belief, when the Microsoft '073 Products decode a second frame, the application of the remapping policy (sample adaptive offset) will be determined based on the application of sample adaptive offset to the first frame (reference picture). Thus, the application of the remapping policy (sample adaptive offset) to the first frame has the effect of increasing the quality of the reference picture such that the second frame might no longer require the application of sample adaptive offset (remapping policy).[23]

> The second in-loop filter, SAO, is applied to the output of the deblocking filter and further improves the quality of the decoded picture by attenuating ringing artifacts and changes in sample intensity of some areas of a picture. The most important

[22] Oscar C. Au, HIGH EFFICIENCY VIDEO CODING (HEVC) PRESENTATION at 43 (October 2013).

[23] Andrey Norkin, Chih-Ming Fu, Yu-Wen Huang, and Shawmin Lei, *In-Loop Filters In HEVC*, IN HIGH EFFICIENCY VIDEO CODING (HEVC) at 171 (September 2014) ("HEVC defines two in-loop filters, deblocking and sample adaptive offset (SAO), which significantly improve the subjective quality of decoded video sequences as well as compression efficiency by increasing the quality of the reconstructed/ reference pictures.").

> advantage of the in-loop filters is improved subjective quality of reconstructed pictures. In addition, using the filters in the decoding loop also increases the quality of the reference pictures and hence also the compression efficiency.

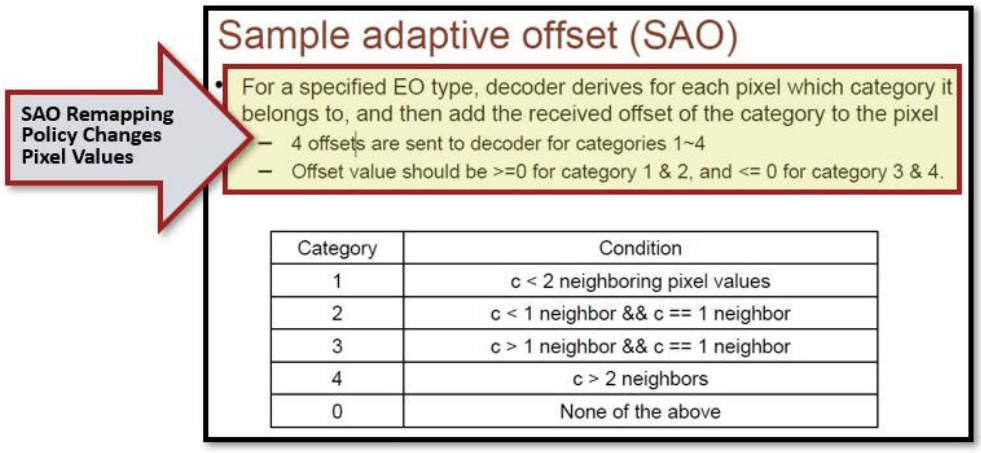
Andrey Norkin, Chih-Ming Fu, Yu-Wen Huang, and Shawmin Lei, *In-Loop Filters In HEVC*, IN HIGH EFFICIENCY VIDEO CODING (HEVC) (Vivienne Sze, Madhukar Budagavi, and Gary J. Sullivan (Editors)) at 171 (September 2014) (annotations added).

183. Sample adaptive offset as implemented by the Microsoft '073 Products is a policy that remaps the values of pixels. If sample adaptive offset is applied to a reference frame, regions in a second frame might not require the application of the remapping policy as the reference frame that was used to generate the second frame was of a better quality.

> SAO classifies each pixel into one of four bands or one of four edge types and adds an offset to it. For band offsets, the band of each pixel depends on its value and the position of the four bands. For edge offsets, the edge of each pixel depends on the whether its value is larger or smaller than two of its neighbors. The selection between band offsets and edge offsets, position of bands, choice of neighbors for edge offsets, and values of the offsets are signaled at the CTU level for luma and chroma separately.

Mehul Tikekar, *et al., Decoder Hardware Architecture for HEVC*, HIGH EFFICIENCY VIDEO CODING (HEVC) at 335 (September 2014).

184. The following excerpt from a presentation describing HEVC decoding provides details on how the application of sample adaptive offset remaps pixel values by adding an offset to the pixel value based on a luma analysis.

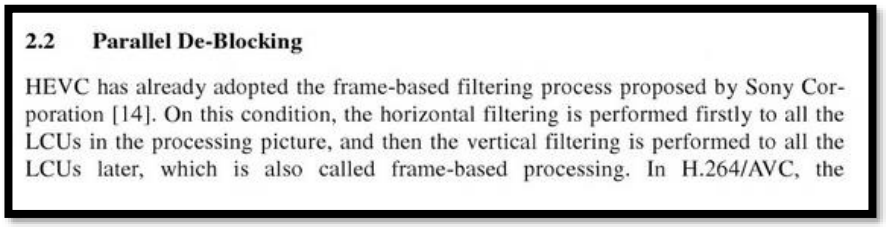


Oscar C. Au, HIGH EFFICIENCY VIDEO CODING (HEVC) PRESENTATION at 44 (October 2013) (annotation added).

185. The Microsoft ‘073 Products receive encoded video data wherein the second frame includes a region encoding a motion vector difference in position between the region corresponding to the second frame indicating the first frame, the motion vector defines a region between the frame and the second frame corresponding to the first region the correspondence relationship. Specifically, the encoded video data received by the Microsoft ‘073 Products use a translational motion model wherein the position of the block in a previously decoded picture is indicated by a motion vector: Δx; Δy where Δx specifies the horizontal and Δy the vertical displacement relative to the position of the current block. The motion vectors: Δx and Δy are of fractional sample accuracy to more accurately capture the movement of the underlying object. Interpolation is applied on the reference pictures to derive the prediction signal when the corresponding motion vector has fractional sample accuracy. The previously decoded picture is referred to as the reference picture and indicated by a reference index Δt to a reference picture list. These translational motion model parameters, *i.e.*, motion vectors and reference indices, are further referred to as motion data.

186. On information and belief, one or more of the Microsoft ‘073 Products enable the provision of enhanced video pictures with minimal additional hardware costs for the components required to successfully process the video data.

187. On information and belief, one or more of the Microsoft ‘073 Products include an input for receiving a video stream containing encoded frame-based video information including an encoded first frame and an encoded second frame.

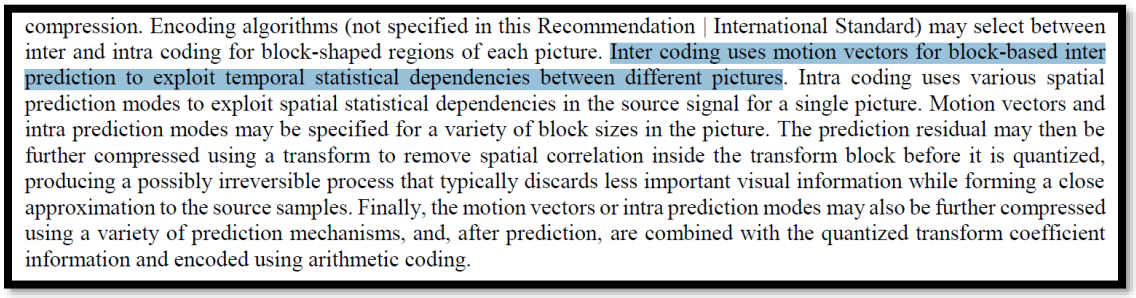


2.2 Parallel De-Blocking

HEVC has already adopted the frame-based filtering process proposed by Sony Corporation [14]. On this condition, the horizontal filtering is performed firstly to all the LCUs in the processing picture, and then the vertical filtering is performed to all the LCUs later, which is also called frame-based processing. In H.264/AVC, the

Ming-Ting Sun, *et al.*, *Advances in Multimedia Information Processing*, PCM 2012: 13TH PACIFIC-RIM CONFERENCE ON MULTIMEDIA PROCEEDINGS VOLUME 7674 at 274 (December 4-6, 2012) ("HEVC has already adopted the frame-based filtering process proposed by Sony Corporation.").

188. On information and belief, one or more of the Microsoft '073 Products include a video decoder comprising an input for receiving video information wherein the encoding of the second frame depends on the encoding of the first frame, the encoding of the second frame includes motion vectors indicating differences in positions between regions of the second frame and corresponding regions of the first frame, the motion vectors define correspondence between regions of the second frame and corresponding regions of the first frame. The Overview of Design Characteristics in the HEVC Standard describes the use of "motion vectors for block-based inter prediction to exploit temporal statistical dependencies between frames."

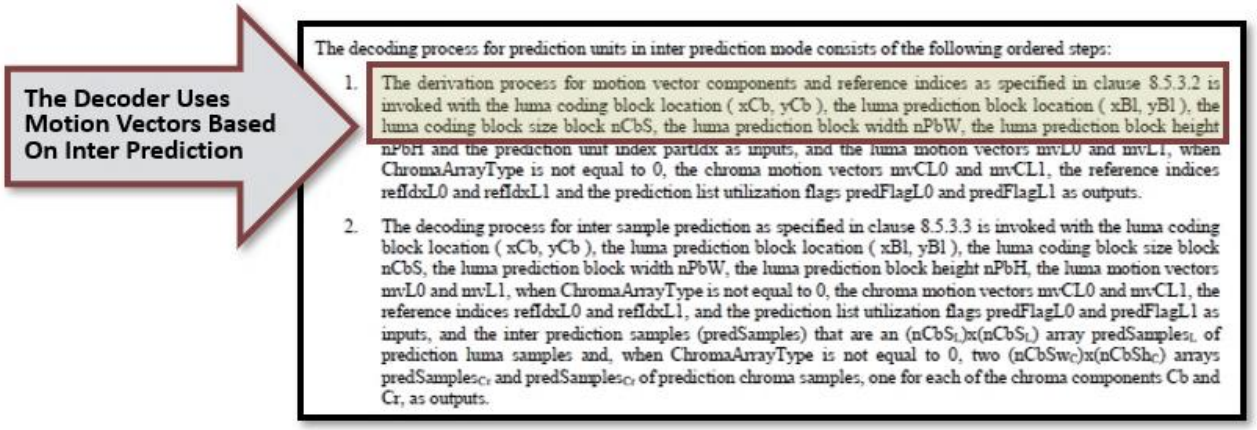


compression. Encoding algorithms (not specified in this Recommendation | International Standard) may select between inter and intra coding for block-shaped regions of each picture. Inter coding uses motion vectors for block-based inter prediction to exploit temporal statistical dependencies between different 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 may then be further compressed using a transform to remove spatial correlation inside the transform block before it is quantized, producing a possibly 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 may also be further compressed using a variety of prediction mechanisms, and, after prediction, are combined with the quantized transform coefficient information and encoded using arithmetic coding.

High Efficiency Video Coding, SERIES H: AUDIOVISUAL AND MULTIMEDIA SYSTEMS: INFRASTRUCTURE OF AUDIOVISUAL SERVICES – CODING OF MOVING VIDEO REC. ITU-T H.265 at § 0.7 (April 2015) (annotation added).

189. On information and belief, one or more of the Microsoft '073 Products include a video decoder comprising a decoding unit for decoding the frames, wherein the decoding unit recovers the motion vectors for the second frame. Further, HEVC documentation shows that

"motion vectors are used during the decoding process for prediction units in inter prediction mode."



High Efficiency Video Coding, SERIES H: AUDIOVISUAL AND MULTIMEDIA SYSTEMS: INFRASTRUCTURE OF AUDIOVISUAL SERVICES – CODING OF MOVING VIDEO REC. ITU-T H.265 at § 8.5.3.1 (April 2015) (annotation added).

190. On information and belief, one or more of the Microsoft '073 Products include a video decoder comprising a processing component configured to determine a re-mapping strategy for video enhancement of the decoded first frame using a region-based analysis, re-map the first frame using the re-mapping strategy, and re-map one or more regions of the second frame depending on the re-mapping strategy for corresponding regions of the first frame.

191. On information and belief, one or more Microsoft subsidiaries and/or affiliates use the Microsoft '073 Products in regular business operations.

192. On information and belief, the Microsoft '073 Products are available to businesses and individuals throughout the United States.

193. On information and belief, the Microsoft '073 Products are provided to businesses and individuals located in the Eastern District of Texas.

194. On information and belief, Microsoft has directly infringed and continues to directly infringe the '073 Patent by, among other things, making, using, offering for sale, and/or

selling technology for enhancing subsequent images of a video stream in which frames are encoded based on previous frames using prediction and motion estimation, including but not limited to the Microsoft '073 Products.

195. By making, using, testing, offering for sale, and/or selling products for resampling a primitive from texture space to screen space, including but not limited to the Microsoft '073 Products, Microsoft has injured Dynamic Data and is liable to the Plaintiff for directly infringing one or more claims of the '073 Patent, including at least claim 14 pursuant to 35 U.S.C. § 271(a).

196. On information and belief, Microsoft also indirectly infringes the '073 patent by actively inducing infringement under 35 USC § 271(b).

197. Microsoft has had knowledge of Dynamic Data's patent portfolio, and each of the patents-in-suit, since at least August 20, 2018, when Dynamic Data's Chinese counsel sent a letter to Microsoft regarding Dynamic Data's patent portfolio, in which Dynamic Data identified each of the patents-in-suit, including the '073 patent.

198. Alternatively, on information and belief, Microsoft has had knowledge of the '073 patent since at least service of the Original Complaint in this case or shortly thereafter, and on information and belief, Microsoft knew of the '073 patent and knew of its infringement, including by way of this lawsuit.

199. Alternatively, Microsoft has had knowledge of the '073 patent since at least July 19, 2016, when U.S. Patent No. 9,398,314, which is owned by Microsoft and cites the '073 patent as relevant prior art, was issued.

200. On information and belief, Microsoft intended to induce patent infringement by third-party customers and users of the Microsoft '073 Products and had knowledge that the inducing acts would cause infringement or was willfully blind to the possibility that its inducing

acts would cause infringement. Microsoft specifically intended and was aware that the normal and customary use of the accused products would infringe the '073 patent. Microsoft performed the acts that constitute induced infringement, and would induce actual infringement, with knowledge of the '073 patent and with the knowledge that the induced acts would constitute infringement. For example, Microsoft provides the Microsoft '073 Products that have the capability of operating in a manner that infringe one or more of the claims of the '073 patent, including at least claim 14, and Microsoft further provides documentation and training materials that cause customers and end users of the Microsoft '073 Products to utilize the products in a manner that directly infringe one or more claims of the '073 patent.[24] By providing instruction and training to customers and end-users on how to use the Microsoft '073 Products in a manner that directly infringes one or more claims of the '073 patent, including at least claim 14, Microsoft specifically intended to induce infringement of the '073 patent. On information and belief, Microsoft engaged in such inducement to promote the sales of the Microsoft '073 Products, e.g., through Microsoft user manuals, product support, marketing materials, and training materials to actively induce the users of the accused products to infringe the '073 patent. Accordingly, Microsoft has induced and continues to induce

[24] *See, e.g., CnX Player – Powerful Ultra HD 4K Video Player*, MICROSOFT WEBSITE, *available at:* https://www.microsoft.com/en-us/p/cnx-player-powerful-ultra-hd-4k-video-player/9nblggh1r7w5?activetab=pivot:overviewtab (last visited Nov. 2018); *Getting to know Windows 10*, MICROSOFT IT SHOWCASE, *available at*: https://www.microsoft.com/en-us/itpro/windows-10/end-user-readiness (last visited Nov. 2018); *Windows 10 Subscription Activation*, MICROSOFT WEBSITE (May 22, 2018); Bott, Ed, *Introducing Windows 10 for IT Professionals, Preview Edition*, MICROSOFT PRESS (2015); *Tutorial: Upload, encode, and stream videos using APIs*, MICROSOFT AZURE WEBSITE (Oct. 15, 2018); *Quickstart: Stream video files - .NET*, MICROSOFT AZURE WEBSITE (Oct. 15, 2018); *Quickstart: Create an Azure CDN profile and endpoint*, MICROSOFT AZURE WEBSITE (May 23, 2018); *What is 4K?, Video: Set up 4K and HDR*, XBOX WEBSITE, *available at*: https://support.xbox.com/en-US/xbox-one/console/4k-on-xbox-one (last visited Nov. 2018); *Capturing 4K HDR game clips and screenshots*, XBOX WEBSITE, *available at*: https://support.xbox.com/en-US/xbox-one/console/capture-4k-HDR-game-clips-and-screenshots (last visited Nov. 2018); *Set up your Xbox One X console*, XBOX SUPPORT WEBSITE, *available at*: https://support.xbox.com/en-US/xbox-one/console/set-up-new-xbox-x-solution (last visited Nov. 2018).

users of the accused products to use the accused products in their ordinary and customary way to infringe the '073 patent, knowing that such use constitutes infringement of the '073 patent.

201. The '073 patent is well-known within the industry as demonstrated by multiple citations to the '073 patent in published patents and patent applications assigned to technology companies and academic institutions. Microsoft is utilizing the technology claimed in the '073 patent without paying a reasonable royalty. Microsoft is infringing the '073 patent in a manner best described as willful, wanton, malicious, in bad faith, deliberate, consciously wrongful, flagrant, or characteristic of a pirate.

202. To the extent applicable, the requirements of 35 U.S.C. § 287(a) have been met with respect to the '073 patent.

203. As a result of Microsoft's infringement of the '073 patent, Dynamic Data has suffered monetary damages, and seeks recovery in an amount adequate to compensate for Microsoft's infringement, but in no event less than a reasonable royalty for the use made of the invention by Microsoft together with interest and costs as fixed by the Court.

COUNT II
INFRINGEMENT OF U.S. PATENT NO. 6,714,257

204. Dynamic Data references and incorporates by reference the preceding paragraphs of this Complaint as if fully set forth herein.

205. Microsoft designs, makes, uses, sells, and/or offers for sale in the United States products and/or services for image processing.

206. Microsoft designs, makes, sells, offers to sell, imports, and/or uses Microsoft products that support chroma-key effect functionality, including but not limited to Windows 10 products encompassing the following editions: Windows 10 Home; Windows 10 Pro; Windows

10 Enterprise; Windows 10 Education; Windows 10 Pro Education; and Windows 10 LTSB (collectively, the "Microsoft '257 Product(s)").

207. On information and belief, one or more Microsoft subsidiaries and/or affiliates use the Microsoft '257 Products in regular business operations.

208. On information and belief, one or more of the Microsoft '257 Products include technology for image processing.

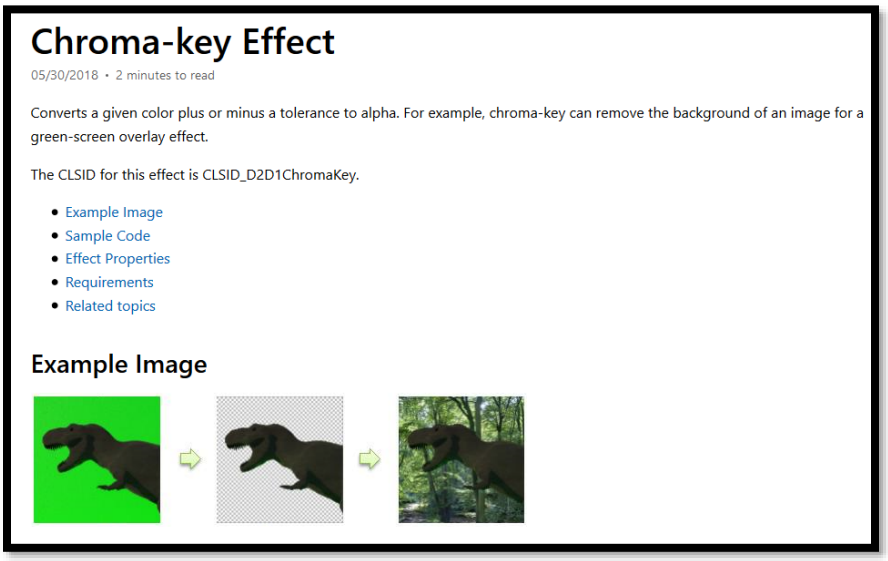
209. On information and belief, one or more of the Microsoft '257 Products include technology for scaling a keyed image.

210. On information and belief, the Microsoft '257 Products are available to businesses and individuals throughout the United States.

211. On information and belief, the Microsoft '257 Products are provided to businesses and individuals located in the Eastern District of Texas.

212. On information and belief, Microsoft has directly infringed and continues to directly infringe the '257 patent by, among other things, making, using, offering for sale, and/or selling technology for image processing, including but not limited to the Microsoft '257 Products.

213. On information and belief, the Microsoft '257 Products create a key-only image corresponding to key regions in a keyed image.



Chroma-key Effect

05/30/2018 • 2 minutes to read

Converts a given color plus or minus a tolerance to alpha. For example, chroma-key can remove the background of an image for a green-screen overlay effect.

The CLSID for this effect is CLSID_D2D1ChromaKey.

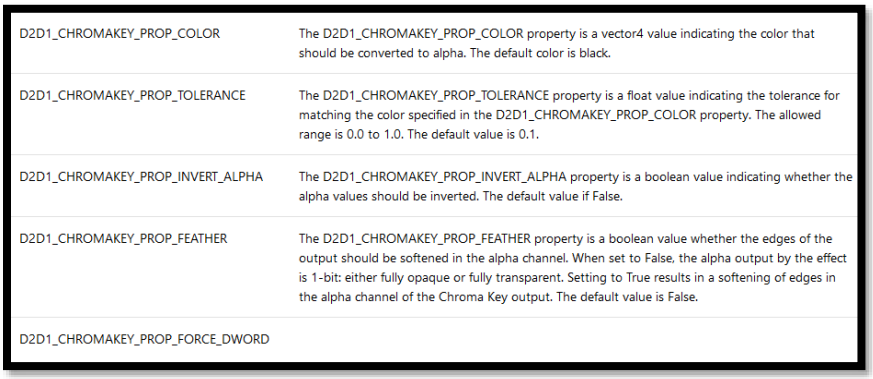
- Example Image
- Sample Code
- Effect Properties
- Requirements
- Related topics

Example Image

Windows API Reference | Chroma-key Effect, MICROSOFT WINDOWS DEV. CENTER (May 30, 2018), *available at*: https://docs.microsoft.com/en-us/windows/desktop/direct2d/chromakey-effect.

214. On information and belief, the Microsoft '257 Products scale the key-only image to form a scaled key-only image.

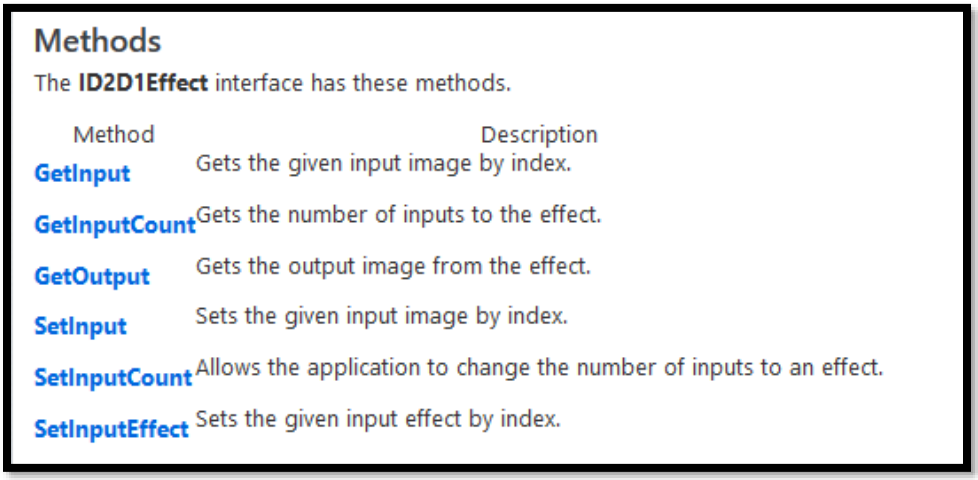
215. On information and belief, the Microsoft '257 Products scale the keyed image to form a scaled key image.



D2D1_CHROMAKEY_PROP_COLOR	The D2D1_CHROMAKEY_PROP_COLOR property is a vector4 value indicating the color that should be converted to alpha. The default color is black.
D2D1_CHROMAKEY_PROP_TOLERANCE	The D2D1_CHROMAKEY_PROP_TOLERANCE property is a float value indicating the tolerance for matching the color specified in the D2D1_CHROMAKEY_PROP_COLOR property. The allowed range is 0.0 to 1.0. The default value is 0.1.
D2D1_CHROMAKEY_PROP_INVERT_ALPHA	The D2D1_CHROMAKEY_PROP_INVERT_ALPHA property is a boolean value indicating whether the alpha values should be inverted. The default value if False.
D2D1_CHROMAKEY_PROP_FEATHER	The D2D1_CHROMAKEY_PROP_FEATHER property is a boolean value whether the edges of the output should be softened in the alpha channel. When set to False, the alpha output by the effect is 1-bit: either fully opaque or fully transparent. Setting to True results in a softening of edges in the alpha channel of the Chroma Key output. The default value is False.
D2D1_CHROMAKEY_PROP_FORCE_DWORD	

Windows D2d1Effects: D2D1_CHROMAKEY_PROP Enumeration, MICROSOFT WINDOWS DEV. CENTER (December 4, 2018), *available at*: https://docs.microsoft.com/en-us/windows/desktop/api/d2d1effects_2/ne-d2d1effects_2-d2d1_chromakey_prop ("The D2D1_CHROMAKEY_PROP_COLOR property is a vector4 value indicating the color that should be converted to alpha. The default color is black.").

216. On information and belief, the Microsoft '257 Products merge the scaled key-only image and the scaled keyed image.



Methods

The **ID2D1Effect** interface has these methods.

Method	Description
GetInput	Gets the given input image by index.
GetInputCount	Gets the number of inputs to the effect.
GetOutput	Gets the output image from the effect.
SetInput	Sets the given input image by index.
SetInputCount	Allows the application to change the number of inputs to an effect.
SetInputEffect	Sets the given input effect by index.

ID2D1Effect Interface, MICROSOFT MSDN NETWORK WEBSITE, *available at*: https://msdn.microsoft.com/en-us/sync/hh404566(v=vs.100) (describing how the images are processed and is according to Microsoft's documentation closely related to the Choma Key effect).

217. By making, using, testing, offering for sale, and/or selling products and services, including but not limited to the Microsoft '257 Products, Microsoft has injured Dynamic Data and is liable for directly infringing one or more claims of the '257 patent, including at least claim 9, pursuant to 35 U.S.C. § 271(a).

218. On information and belief, Microsoft also indirectly infringes the '257 patent by actively inducing infringement under 35 USC § 271(b).

219. Microsoft has had knowledge of Dynamic Data's patent portfolio, and each of the patents-in-suit, since at least August 20, 2018, when Dynamic Data's Chinese counsel sent a letter to Microsoft regarding Dynamic Data's patent portfolio, in which Dynamic Data identified each of the patents-in-suit, including the '257 patent.

220. Alternatively, on information and belief, Microsoft has had knowledge of the '257 patent since at least service of the Original Complaint in this case or shortly thereafter, and on

information and belief, Microsoft knew of the '257 patent and knew of its infringement, including by way of this lawsuit.

221. On information and belief, Microsoft has had knowledge of the '257 patent since at least March 2, 2010, when U.S. Patent No. 7,670,227, which is owned by Microsoft and cites the '257 patent as relevant prior art, was issued.

222. On information and belief, Microsoft intended to induce patent infringement by third-party customers and users of the Microsoft '257 Products and had knowledge that the inducing acts would cause infringement or was willfully blind to the possibility that its inducing acts would cause infringement. Microsoft specifically intended and was aware that the normal and customary use of the accused products would infringe the '257 patent. Microsoft performed the acts that constitute induced infringement, and would induce actual infringement, with knowledge of the '257 patent and with the knowledge that the induced acts would constitute infringement. For example, Microsoft provides the Microsoft '257 Products that have the capability of operating in a manner that infringe one or more of the claims of the '257 patent, including at least claim 9, and Microsoft further provides documentation and training materials that cause customers and end users of the Microsoft '257 Products to utilize the products in a manner that directly infringe one or more claims of the '257 patent.[25] By providing instruction and training to customers and end-users on how to use the Microsoft '257 Products in a manner that directly infringes one or more claims of the '257 patent, including at least claim 9, Microsoft specifically intended to induce infringement of the '257 patent. On information and belief, Microsoft engaged in such inducement

[25] *See, e.g.*, *Chroma-key Effect*, MICROSOFT WINDOWS DEV CENTER WEBSITE (May 30, 2018); *Getting to know Windows 10*, MICROSOFT IT SHOWCASE, *available at*: https://www.microsoft.com/en-us/itpro/windows-10/end-user-readiness (last visited Nov. 2018); *Windows 10 Subscription Activation*, MICROSOFT WEBSITE (May 22, 2018); Bott, Ed, *Introducing Windows 10 for IT Professionals, Preview Edition*, MICROSOFT PRESS (2015).

to promote the sales of the Microsoft '257 Products, e.g., through Microsoft user manuals, product support, marketing materials, and training materials to actively induce the users of the accused products to infringe the '257 patent. Accordingly, Microsoft has induced and continues to induce users of the accused products to use the accused products in their ordinary and customary way to infringe the '257 patent, knowing that such use constitutes infringement of the '257 patent.

223. The '257 patent is well-known within the industry as demonstrated by multiple citations to the '257 patent in published patents and patent applications assigned to technology companies and academic institutions. Microsoft is utilizing the technology claimed in the '257 patent without paying a reasonable royalty. Microsoft is infringing the '257 patent in a manner best described as willful, wanton, malicious, in bad faith, deliberate, consciously wrongful, flagrant, or characteristic of a pirate.

224. To the extent applicable, the requirements of 35 U.S.C. § 287(a) have been met with respect to the '257 patent.

225. As a result of Microsoft's infringement of the '257 patent, Dynamic Data has suffered monetary damages, and seeks recovery in an amount adequate to compensate for Microsoft's infringement, but in no event less than a reasonable royalty for the use made of the invention by Microsoft together with interest and costs as fixed by the Court.

COUNT III
INFRINGEMENT OF U.S. PATENT NO. 8,073,054

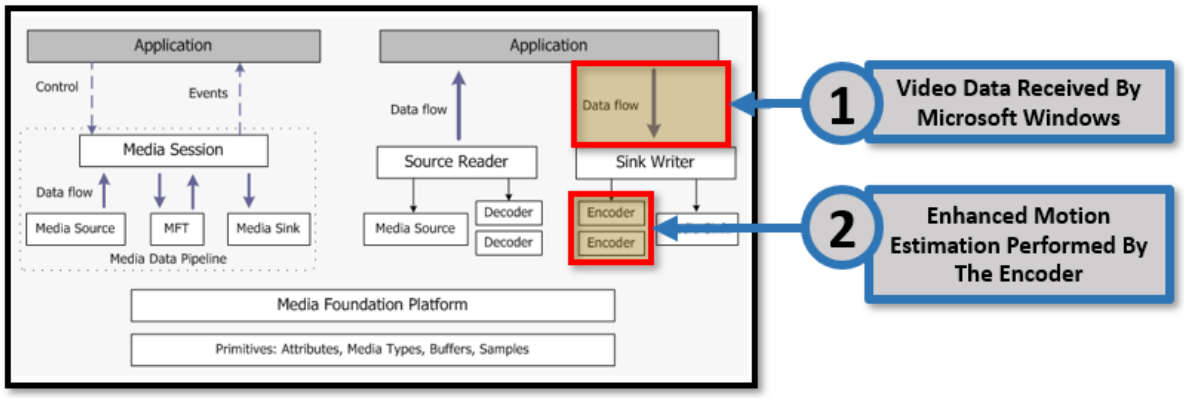
226. Dynamic Data references and incorporates by reference the preceding paragraphs of this Complaint as if fully set forth herein.

227. Microsoft designs, makes, uses, sells, and/or offers for sale in the United States products and/or services for estimating a current motion vector for a group of pixels of an image.

228. Microsoft designs, makes, sells, offers to sell, imports, and/or uses Microsoft products that comply with the H.265 standard. By way of example, the following Microsoft Products perform encoding pursuant to the H.265 standard: Windows 10 products (including Windows 10 Home, Windows 10 Pro, Windows 10 Enterprise, Windows 10 Education, Windows 10 Pro Education, and Windows 10 LTSB) and Microsoft Azure (including Microsoft Azure Media Services and Azure Content Delivery Network) (collectively, the "Microsoft '054 Product(s)").

229. The Microsoft '054 Products perform video encoding compliant with the H.265/HEVC standard. *Comparison of Azure on Demand Media Encoder*, AZURE MEDIA SERVICES DOCUMENTATION (October 23, 2018), *available at*: https://docs.microsoft.com/en-us/azure/media-services/previous/media-services-compare-encoders (showing that the Media Encoder Premium Workflow supports HEVC output); *Microsoft H.265 Video Encoder*, MICROSOFT MEDIA FOUNDATION DOCUMENTATION (MAY 30, 2018) *available at*: https://docs.microsoft.com/en-us/windows/desktop/medfound/ ("The Media Foundation H.265 video encoder is a Media Foundation Transform that supports encoding content into the H.265/HEVC format.").

230. Microsoft '054 Products perform video processing through the use of a video encoder for motion estimation. The below image identifies an exemplar of the image processing component in the Microsoft '054 Products.



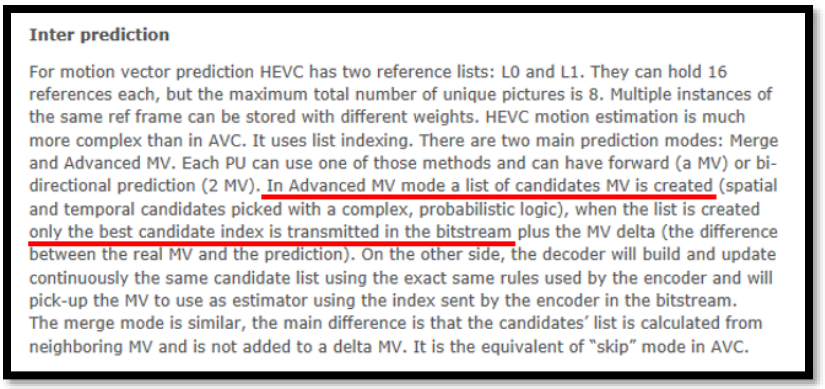
Overview of the Media Foundation Architecture, MICROSOFT DEVELOPER DOCUMENTATION, May 30, 2018 (annotations added).

231. On information and belief, one or more of the Microsoft '054 Products include technology for estimating a current motion vector for a group of pixels of an image

232. On information and belief, Microsoft has directly infringed and continues to directly infringe the '054 patent by, among other things, making, using, offering for sale, and/or selling technology for estimating a current motion vector for a group of pixels of an image, including but not limited to the Microsoft '054 Products.

233. On information and belief, by complying with the HEVC standard, Microsoft's devices – such as the Microsoft '054 Products - necessarily infringe the '054 patent. Mandatory sections of the HEVC standard require the elements required by certain claims of the '054 patent, including but not limited to claim 1. *High Efficiency Video Coding*, SERIES H: AUDIOVISUAL AND MULTIMEDIA SYSTEMS: INFRASTRUCTURE OF AUDIOVISUAL SERVICES – CODING OF MOVING VIDEO REC. ITU-T H.265 (February 2018) (The following sections of the HEVC Standard are relevant to Microsoft's infringement of the '054 patent: "7.3.4 Scaling list data syntax;" 7.3.6.1 General slice segment header syntax;" "7.3.6.3 Weighted prediction parameters syntax;" "7.3.8.14 Delta QP syntax;" "7.4.4 Profile, tier and level semantics;" and "7.4.7.3 Weighted prediction parameters semantics."

234. On information and belief, the Microsoft '054 Products comprise functionality for generating a set of candidate motion vectors for a grouping of pixels (prediction unit). The HEVC standard generates a set of candidate motion vectors for the group of pixels, with the candidate motion vectors being extracted from a set of previously estimated motion vectors. After the candidate motion vectors are generated, only the best candidate index is transmitted.



Inter prediction

For motion vector prediction HEVC has two reference lists: L0 and L1. They can hold 16 references each, but the maximum total number of unique pictures is 8. Multiple instances of the same ref frame can be stored with different weights. HEVC motion estimation is much more complex than in AVC. It uses list indexing. There are two main prediction modes: Merge and Advanced MV. Each PU can use one of those methods and can have forward (a MV) or bi-directional prediction (2 MV). In Advanced MV mode a list of candidates MV is created (spatial and temporal candidates picked with a complex, probabilistic logic), when the list is created only the best candidate index is transmitted in the bitstream plus the MV delta (the difference between the real MV and the prediction). On the other side, the decoder will build and update continuously the same candidate list using the exact same rules used by the encoder and will pick-up the MV to use as estimator using the index sent by the encoder in the bitstream. The merge mode is similar, the main difference is that the candidates' list is calculated from neighboring MV and is not added to a delta MV. It is the equivalent of "skip" mode in AVC.

Fabio Sonnati, *H265 – Part I: Technical Overview*, VIDEO ENCODING & STREAMING TECHNOLOGIES WEBSITE (June 20, 2014) (emphasis added).

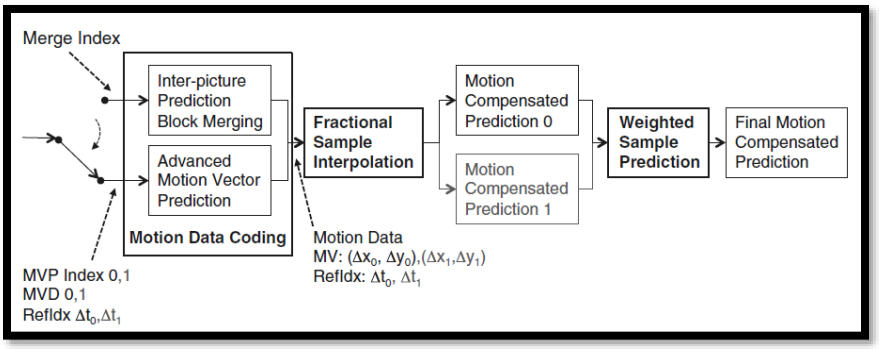
235. On information and belief, one or more of the Microsoft '054 Products enable motion estimation with a relatively fast convergence in finding the appropriate motion vectors of the motion vector fields by adding a further candidate motion vector to the set of candidate motion vectors.

> HEVC introduces a so-called merge mode, which sets all motion parameters of an inter picture predicted block equal to the parameters of a merge candidate [6]. The merge mode and the motion vector prediction process optionally allow a picture to reuse motion vectors of prior pictures for motion vector coding,

Frank Bossen, *et al*., *HEVC Complexity and Implementation Analysis*, IEEE TRANSACTIONS ON CIRCUITS AND SYSTEMS FOR VIDEO TECHNOLOGY VOL. 22 NO. 12 at 1686 (December (2012).

236. On information and belief, the following block diagram illustrates the form of encoded video data received by the Microsoft '054 Products. Specifically, the encoded video data received by the Microsoft '054 Products is encoded using inter-picture prediction where the motion data of a block is correlated with neighboring blocks. To exploit this correlation, motion data is

not directly coded in the bitstream, but predictively coded based on neighboring motion data. Further, the Microsoft '054 Products receive data that is encoded using advanced motion vector prediction where the best predictor for each motion block is signaled to the decoder. In addition, inter-prediction block merging derives all motion data of a block from the neighboring blocks.



Benjamin Bross, *et al*., *Inter-Picture Prediction in HEVC,* In HIGH EFFICIENCY VIDEO CODING (HEVC) at 115 (2014).

237. On information and belief, the Microsoft '054 products carry out a block-based motion vector estimation process that involves comparing a plurality of candidate vectors to determine block-based motion vectors. The Microsoft '054 Products generate two predictor candidate motion vectors (a spatial motion vector and temporal motion vector). The first predictor candidate motion vector is drawn from a list of spatial motion vector candidates.

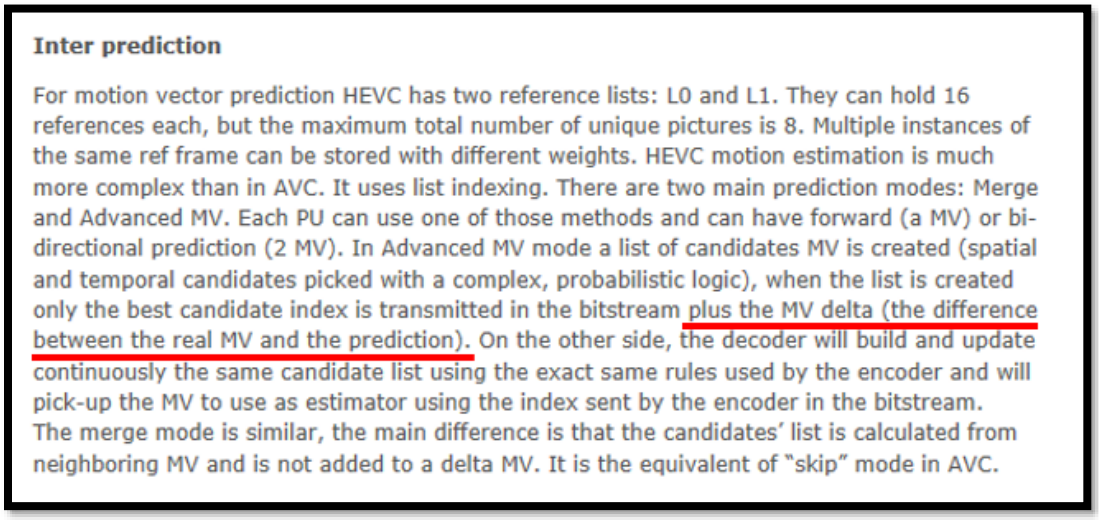
three spatially neighboring MVs. HEVC improves the MV prediction by applying an MV prediction competition as initially proposed in [18]. In HEVC, this competition was further adapted to large block sizes with so-called *advanced motion vector prediction* (AMVP) in [19]. In the DIS *Main profile*, AMVP has two predictor candidates competing for the prediction. Two spatial motion vector predictor (MVP) candidates are considered and, when at least one of them is not available or they are redundant, a temporal motion vector prediction (TMVP) candidate is considered. The candidates

Philipp Helle, Simon Oudin, Benjamin Bross, Detlev Marpe, M. Oguz Bici, Kemal Ugur, Joel Jung, Gordon Clare, and Thomas Wiegand, *Block Merging for Quadtree-Based Partitioning in HEVC, IEEE TRANS. CIR. AND SYS. FOR VIDEO TECHNOLOGY, Vol. 22* No. 12 (December 2012) ("AMVP has two predictor candidates competing for the prediction. Two spatial motion vector

predictor (MVP) candidates are considered and, when at least one of them is not available or they are redundant, a temporal motion vector prediction (TMVP) candidate is considered.").

238. On information and belief, one or more of the Microsoft '054 Products include a motion estimation unit comprising a generating unit for generating a set of candidate motion vectors for the group of pixels, with the candidate motion vectors being extracted from a set of previously estimated motion vectors.

239. On information and belief, the Microsoft '054 Products contain functionality for generating match errors of the respective candidate motion vectors. The HEVC standard calculates match errors of respective candidate motion vectors. The match errors are referred to as the MV delta. The MV delta is the difference between the real MV and the candidate predication.



Inter prediction

For motion vector prediction HEVC has two reference lists: L0 and L1. They can hold 16 references each, but the maximum total number of unique pictures is 8. Multiple instances of the same ref frame can be stored with different weights. HEVC motion estimation is much more complex than in AVC. It uses list indexing. There are two main prediction modes: Merge and Advanced MV. Each PU can use one of those methods and can have forward (a MV) or bi-directional prediction (2 MV). In Advanced MV mode a list of candidates MV is created (spatial and temporal candidates picked with a complex, probabilistic logic), when the list is created only the best candidate index is transmitted in the bitstream plus the MV delta (the difference between the real MV and the prediction). On the other side, the decoder will build and update continuously the same candidate list using the exact same rules used by the encoder and will pick-up the MV to use as estimator using the index sent by the encoder in the bitstream. The merge mode is similar, the main difference is that the candidates' list is calculated from neighboring MV and is not added to a delta MV. It is the equivalent of "skip" mode in AVC.

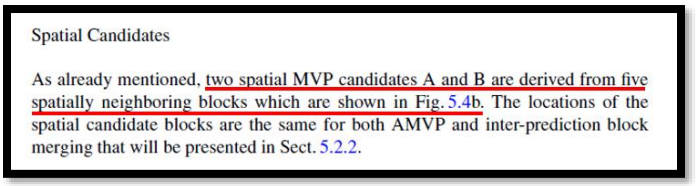
Fabio Sonnati, *H265 – Part I: Technical Overview*, VIDEO ENCODING & STREAMING TECHNOLOGIES WEBSITE (June 20, 2014) (emphasis added).

240. On information and belief, any implementation of the HEVC standard would infringe the '054 patent as every implementation of the standard requires the elements in one or more claims of the '054 patent, including but not limited to claim 1, by way of example: a match error unit for calculating match errors of respective candidate motion vectors and calculating the

further candidate motion vector by calculating a difference between the second motion vector and the first motion vector.

241. On information and belief, one or more of the Microsoft '054 Products include a motion estimation unit comprising a selector for selecting the current motion vector from the candidate motion vectors by comparing the match errors of the respective candidate motion vectors, characterized in that the motion estimation unit is arranged to add a further candidate motion vector to the set of candidate motion vectors by calculating the further candidate motion vector on the basis of a first motion vector and a second motion vector, both belonging to the set of previously estimated motion vectors.

242. On information and belief, the Microsoft '054 Products select the current motion vector from the candidate motion vectors by comparing the match errors of the respective candidate motion vectors, characterized in that the motion estimation unit is arranged to add a further candidate motion vector to the set of candidate motion vectors by calculating the further candidate motion vector on the basis of a first motion vector and a second motion vector, both belonging to the set of previously estimated motion vectors. The first motion vector is labeled 'A' and the second motion vector is labeled 'B.'



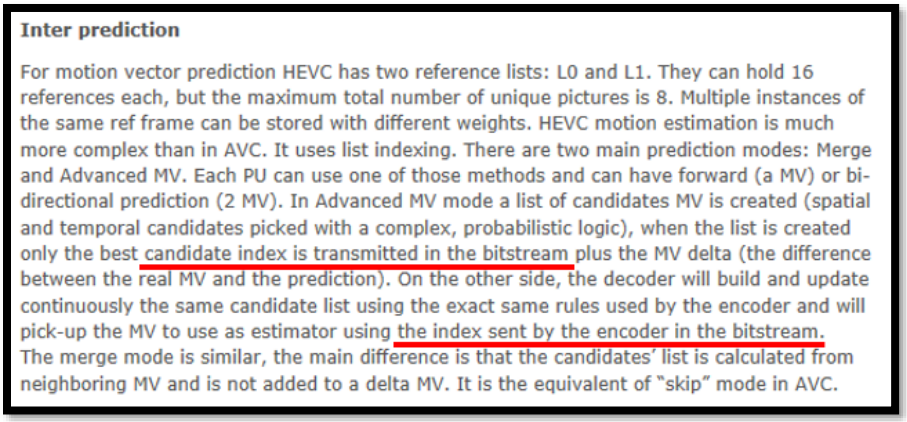
Spatial Candidates

As already mentioned, two spatial MVP candidates A and B are derived from five spatially neighboring blocks which are shown in Fig. 5.4b. The locations of the spatial candidate blocks are the same for both AMVP and inter-prediction block merging that will be presented in Sect. 5.2.2.

Gary Sullivan, *et al*., HIGH EFFICIENCY VIDEO CODING (HEVC) ALGORITHMS AND ARCHITECTURES at 117 (2014) (emphasis added).

243. Further, the Microsoft '054 Products perform motion vector "competition / weighted sample prediction" by comparing the match errors of the candidate motion vectors. The match errors generated by the Microsoft '054 Products comprise the difference value between the

second motion vector and the first motion vector. Documentation of the encoding process states that the encoder will "pick up the MV [motion vector] to use as an estimator using the index sent by the encoder in the bitstream."



Inter prediction

For motion vector prediction HEVC has two reference lists: L0 and L1. They can hold 16 references each, but the maximum total number of unique pictures is 8. Multiple instances of the same ref frame can be stored with different weights. HEVC motion estimation is much more complex than in AVC. It uses list indexing. There are two main prediction modes: Merge and Advanced MV. Each PU can use one of those methods and can have forward (a MV) or bi-directional prediction (2 MV). In Advanced MV mode a list of candidates MV is created (spatial and temporal candidates picked with a complex, probabilistic logic), when the list is created only the best candidate index is transmitted in the bitstream plus the MV delta (the difference between the real MV and the prediction). On the other side, the decoder will build and update continuously the same candidate list using the exact same rules used by the encoder and will pick-up the MV to use as estimator using the index sent by the encoder in the bitstream. The merge mode is similar, the main difference is that the candidates' list is calculated from neighboring MV and is not added to a delta MV. It is the equivalent of "skip" mode in AVC.

Fabio Sonnati, *H265 – Part I: Technical Overview*, VIDEO ENCODING & STREAMING TECHNOLOGIES WEBSITE (June 20, 2014) (emphasis added).

244. On information and belief, the Microsoft '054 Products calculate the square of the difference between two corresponding pixels of the spatial position of the candidate block where the motion vector is located and the spatial position where the reference motion vector is located. As a result, this value is used to assess the similarity, or the matching degree, of a candidate block. Thus, in order to obtain the best matching vector, the Microsoft '054 Products apply a penalty value to every candidate block with a different motion vector (*MVx, MVy*) within the search window defined by the search range in the reference frame. Finally, a candidate block with the minimum penalty value will be denoted as the best matching block and used to calculate the best motion vector from the candidate motion vectors. The below excerpt from an article discussing the selection of a best motion vector describes that the selection of a motion vector is based on the position of the motion vector.

> The entire ME process is made up of three coarse-to-fine procedures, namely, MV prediction, integer-pixel ME and fractional-pixel ME. First, MV prediction predicts the start search position for the following motion search by utilizing the neighboring motion information. In HEVC, Advanced Motion Vector Prediction (AMVP), a new and effective technology that predicts the starting search position by referencing the motion vector (MV) information of spatial and temporal motion vector candidates, is adopted, which derives several most probable candidates based on data from adjacent PBs and the reference picture. The displacement between the starting search position and the current coding PU is called a predictive motion vector (PMV). HEVC also introduces a merge mode to derive the motion information from spatially or temporally neighboring blocks [1].

Yongfei Zhang, Chao Zhang, and Rui Fan, *Fast Motion Estimation in HEVC Inter Coding: An Overview of Recent Advances*, PROCEEDINGS, APSIPA ANNUAL SUMMIT AND CONFERENCE 2018 at 1 (November 2018) (emphasis added).

245. On information and belief, one or more of the Microsoft '054 Products include a motion estimation unit that calculates the further candidate motion vector on the basis of the first motion vector and the second motion vector, with the first motion vector belonging to a first forward motion vector field and the second motion vector belonging to a second forward motion vector field, with the first forward motion vector field and the second forward motion vector field being different. Specifically, the HEVC standard arranges to calculate the further candidate motion vector by calculating a difference between the second motion vector and the first motion vector. The further candidate motion vector is calculated at the end of the process (see the red box in the below diagram).

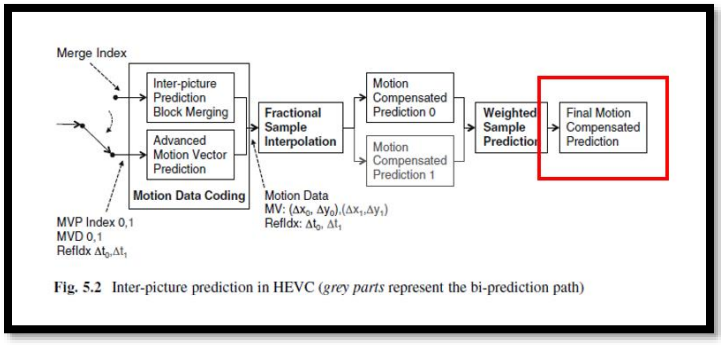


Fig. 5.2 Inter-picture prediction in HEVC (*grey parts* represent the bi-prediction path)

Gary J. Sullivan, *et al*., HEVC, HIGH EFFICIENCY VIDEO CODING (HEVC) at 115 (September 2014) (emphasis added).

246. On information and belief, one or more of the Microsoft '054 Products include a motion estimation unit that arranges to calculate the further candidate motion vector by calculating a difference between the second motion vector and the first motion vector.

247. On information and belief, the Microsoft '054 Products are available to businesses and individuals throughout the United States.

248. On information and belief, the Microsoft '054 Products are provided to businesses and individuals located in the Eastern District of Texas.

249. By making, using, testing, offering for sale, and/or selling products and services for estimating a current motion vector for a group of pixels of an image, including but not limited to the Microsoft '054 Products, Microsoft has injured Dynamic Data and is liable to the Plaintiff for directly infringing one or more claims of the '054 Patent, including at least claim 1 pursuant to 35 U.S.C. § 271(a).

250. On information and belief, Microsoft also indirectly infringes the '054 patent by actively inducing infringement under 35 USC § 271(b).

251. Microsoft has had knowledge of Dynamic Data's patent portfolio, and each of the patents-in-suit, since at least August 20, 2018, when Dynamic Data's Chinese counsel sent a letter to Microsoft regarding Dynamic Data's patent portfolio, in which Dynamic Data identified each of the patents-in-suit, including the '054 patent.

252. Alternatively, on information and belief, Microsoft has had knowledge of the '054 patent since at least service of the Original Complaint in this case or shortly thereafter, and on information and belief, Microsoft knew of the '054 patent and knew of its infringement, including by way of this lawsuit.

253. On information and belief, Microsoft intended to induce patent infringement by third-party customers and users of the Microsoft '054 Products and had knowledge that the inducing acts would cause infringement or was willfully blind to the possibility that its inducing acts would cause infringement. Microsoft specifically intended and was aware that the normal and customary use of the accused products would infringe the '054 patent. Microsoft performed the acts that constitute induced infringement, and would induce actual infringement, with knowledge of the '054 patent and with the knowledge that the induced acts would constitute infringement. For example, Microsoft provides the Microsoft '054 Products that have the capability of operating in a manner that infringe one or more of the claims of the '054 patent, including at least claim 1, and Microsoft further provides documentation and training materials that cause customers and end users of the Microsoft '054 Products to utilize the products in a manner that directly infringe one or more claims of the '054 patent.[26] By providing instruction and training to customers and end-users on how to use the Microsoft '054 Products in a manner that directly infringes one or more claims of the '054 patent, including at least claim 1, Microsoft specifically intended to induce infringement of the '054 patent. On information and belief, Microsoft engaged in such inducement to promote the sales of the Microsoft '054 Products, e.g., through Microsoft user manuals, product support, marketing materials, and training materials to actively induce the users of the accused products to infringe the '054 patent. Accordingly, Microsoft has induced and continues to induce

[26] *See, e.g.*, *CnX Player – Powerful Ultra HD 4K Video Player*, MICROSOFT WEBSITE, *available at:* https://www.microsoft.com/en-us/p/cnx-player-powerful-ultra-hd-4k-video-player/9nblggh1r7w5?activetab=pivot:overviewtab (last visited Nov. 2018); *Getting to know Windows 10*, MICROSOFT IT SHOWCASE, *available at*: https://www.microsoft.com/en-us/itpro/windows-10/end-user-readiness (last visited Nov. 2018); *Windows 10 Subscription Activation*, MICROSOFT WEBSITE (May 22, 2018); Bott, Ed, *Introducing Windows 10 for IT Professionals, Preview Edition*, MICROSOFT PRESS (2015); *Tutorial: Upload, encode, and stream videos using APIs*, MICROSOFT AZURE WEBSITE (Oct. 15, 2018); *Quickstart: Stream video files - .NET*, MICROSOFT AZURE WEBSITE (Oct. 15, 2018); *Quickstart: Create an Azure CDN profile and endpoint*, MICROSOFT AZURE WEBSITE (May 23, 2018).

users of the accused products to use the accused products in their ordinary and customary way to infringe the '054 patent, knowing that such use constitutes infringement of the '054 patent.

254. The '054 patent is well-known within the industry as demonstrated by multiple citations to the '054 patent in published patents and patent applications assigned to technology companies and academic institutions. Microsoft is utilizing the technology claimed in the '054 patent without paying a reasonable royalty. Microsoft is infringing the '054 patent in a manner best described as willful, wanton, malicious, in bad faith, deliberate, consciously wrongful, flagrant, or characteristic of a pirate.

255. To the extent applicable, the requirements of 35 U.S.C. § 287(a) have been met with respect to the '054 patent.

256. As a result of Microsoft's infringement of the '054 patent, Dynamic Data has suffered monetary damages, and seeks recovery in an amount adequate to compensate for Microsoft's infringement, but in no event less than a reasonable royalty for the use made of the invention by Microsoft together with interest and costs as fixed by the Court.

COUNT IV
INFRINGEMENT OF U.S. PATENT NO. 6,774,918

257. Dynamic Data references and incorporates by reference the preceding paragraphs of this Complaint as if fully set forth herein.

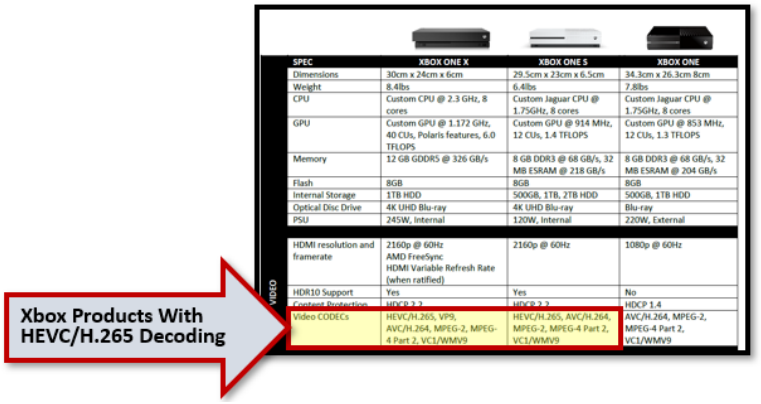
258. Microsoft designs, makes, uses, sells, and/or offers for sale in the United States products and/or services for image processing.

259. Microsoft designs, makes, sells, offers to sell, imports, and/or uses Microsoft products capable of decoding video data in compliance with the H.265 standard. By way of example, the following Microsoft Products perform decoding pursuant to the H.265 standard: Microsoft Xbox One X, Microsoft Xbox One S, Windows 10 products (including Windows 10

Home, Windows 10 Pro, Windows 10 Enterprise, Windows 10 Education, Windows 10 Pro Education, and Windows 10 LTSB), and Microsoft Azure (including Microsoft Azure Media Services and Azure Content Delivery Network) (collectively, the "Microsoft '918 Product(s)").

260. The Microsoft '918 Products perform video decoding compliant with the H.265/HEVC standard. *See e.g., Xbox One Family of Devices*, MICROSOFT XBOX SPECIFICATION SHEET at 1 (October 2017) (stating that the Xbox One X and Xbox One S support HEVC/H.265 decoding). *Comparison of Azure on Demand Media Encoder*, AZURE MEDIA SERVICES DOCUMENTATION (October 23, 2018), *available at*: https://docs.microsoft.com/en-us/azure/media-services/previous/media-services-compare-encoders (showing that the Media Encoder Standard And Premium Workflow supports HEVC input); The Media *Microsoft H.265 Video Decoder*, MICROSOFT MEDIA FOUNDATION DOCUMENTATION (MAY 30, 2018), *available at*: https://docs.microsoft.com/en-us/windows/desktop/medfound/ ("The Media Foundation H.265 video decoder is a Media Foundation Transform that supports decoding H.265/HEVC content in Annex B format and can be used in playback of mp4 and m2ts files.").

261. Further, Microsoft documentation establishes that the Microsoft Xbox Products include input for receiving and decoding HEVC video data. "10-bit HD High Efficiency Video Coding (HEVC) platform support added: 10-bit HD HEVC enables video-streaming apps, like Netflix, to use lower bandwidth to deliver HD-quality video streams." *Xbox One 2015 Operation System Update*, XBOX.COM WEBSITE (last visited August 2018), *available at*: https://support.xbox.com/en-US/xbox-one/console/system-update-operating-system-2015.



SPEC	XBOX ONE X	XBOX ONE S	XBOX ONE
Dimensions	30cm x 24cm x 6cm	29.5cm x 23cm x 6.5cm	34.3cm x 26.3cm 8cm
Weight	8.4lbs	6.4lbs	7.8lbs
CPU	Custom CPU @ 2.3 GHz, 8 cores	Custom Jaguar CPU @ 1.75GHz, 8 cores	Custom Jaguar CPU @ 1.75GHz, 8 cores
GPU	Custom GPU @ 1.172 GHz, 40 CUs, Polaris features, 6.0 TFLOPS	Custom GPU @ 914 MHz, 12 CUs, 1.4 TFLOPS	Custom GPU @ 853 MHz, 12 CUs, 1.3 TFLOPS
Memory	12 GB GDDR5 @ 326 GB/s	8 GB DDR3 @ 68 GB/s, 32 MB ESRAM @ 218 GB/s	8 GB DDR3 @ 68 GB/s, 32 MB ESRAM @ 204 GB/s
Flash	8GB	8GB	8GB
Internal Storage	1TB HDD	500GB, 1TB, 2TB HDD	500GB, 1TB HDD
Optical Disc Drive	4K UHD Blu-ray	4K UHD Blu-ray	Blu-ray
PSU	245W, Internal	120W, Internal	220W, External
VIDEO			
HDMI resolution and framerate	2160p @ 60Hz AMD FreeSync HDMI Variable Refresh Rate (when ratified)	2160p @ 60Hz	1080p @ 60Hz
HDR10 Support	Yes	Yes	No
Content Protection	HDCP 2.2	HDCP 2.2	HDCP 1.4
Video CODECs	HEVC/H.265, VP9, AVC/H.264, MPEG-2, MPEG-4 Part 2, VC1/WMV9	HEVC/H.265, AVC/H.264, MPEG-2, MPEG-4 Part 2, VC1/WMV9	AVC/H.264, MPEG-2, MPEG-4 Part 2, VC1/WMV9

Xbox One Family of Devices, MICROSOFT XBOX SPECIFICATION SHEET at 1 (October 2017) (annotation added), *available at*: https://news.xbox.com/wp-content/uploads/Xbox_One_Spec_Sheet.pdf.

262. On information and belief, the Microsoft '918 Products use two types of prediction methods for decoding video data: inter prediction and intra prediction. Inter prediction utilizes motion vectors as well as an offset center and creates a list of possible motion vectors (MV) for the search area. The HEVC Specification (*e.g.*, *High Efficiency Video Coding*, SERIES H: AUDIOVISUAL AND MULTIMEDIA SYSTEMS: INFRASTRUCTURE OF AUDIOVISUAL SERVICES – CODING OF MOVING VIDEO REC. ITU-T H.265 (April 2015)) sets forth the standard that is followed by HEVC compliant devices, and is relevant to both decoding and encoding that are performed pursuant to the HEVC standard. For instance, the Microsoft Products perform a method for decoding a video signal using motion vectors when performing encoding of H.265/HEVC video data. For example, the Microsoft Products contain functionality for decoding a video signal using motion vectors and motion estimation.

263. On information and belief, by complying with the HEVC standard, the Microsoft devices – such as the Microsoft '918 Products - necessarily infringe the '918 patent. Mandatory sections of the HEVC standard require the elements required by certain claims of the '918 patent, including but not limited to claim 18. *High Efficiency Video Coding*, SERIES H: AUDIOVISUAL AND Multimedia SYSTEMS: INFRASTRUCTURE OF AUDIOVISUAL SERVICES – CODING OF MOVING VIDEO

REC. ITU-T H.265 (February 2018). The following sections of the HEVC Standard are relevant to Microsoft's infringement of the '918 patent: "5.3 Logical operators;" "5.10 Variables, syntax elements and tables;" "5.11 Text description of logical operations;" "7.2 Specification of syntax functions and descriptors;" "7.3.1 NAL unit syntax;" "7.3.2 Raw byte sequence payloads, trailing bits and byte alignment syntax;" "7.3.5 Supplemental enhancement information message syntax;" "7.4.2 NAL unit semantics;" and "7.4.6 Supplemental enhancement information message semantics."

264. On information and belief, the Microsoft '918 Products receive a bitstream in which the data is segmented into Network Abstraction Layer ("NAL") Units. NAL Units are segments of data that can include video data and overlay data (such as captions and overlay images). The Microsoft Products support the receipt of VCL and non-VCL NAL units. The VCL NAL units contain the data that represents the values of the samples in the video pictures, and the non-VCL NAL units contain any associated additional information such as parameter sets or overlay data.

> HEVC uses a NAL unit based bitstream structure. A coded bitstream is partitioned into NAL units which, when conveyed over lossy packet networks, should be smaller than the maximum transfer unit (MTU) size. Each NAL unit consists of a NAL unit header followed by the NAL unit payload. There are two conceptual classes of NAL units. Video coding layer (VCL) NAL units containing coded sample data, e.g., coded slice NAL units, whereas non-VCL NAL units that contain metadata typically belonging to more than one coded picture, or where the association with a single coded picture would be meaningless, such as parameter set NAL units, or where the information is not needed by the decoding process, such as SEI NAL units.

Rickard Sjöberg et al, *Overview of HEVC High-Level Syntax and Reference Picture Management*, IEEE TRANSACTIONS ON CIRCUITS AND SYSTEMS FOR VIDEO TECHNOLOGY, Vol. 22, No. 12 at 1859 (December 2012) (emphasis added).

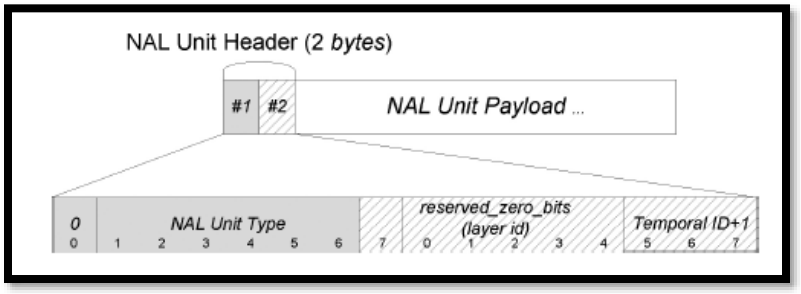
265. On information and belief, the VCL NAL Units contain segments of data which are used to generate an image (*e.g.*, HEVC image) on a display device. Each VCL NAL Unit comprises a discrete number of bites which make up a segment. The following excerpt from the

HEVC specification describes the NAL unit as being a segment with a "demarcation" setting forth where the segment ends and begins.

> NumBytesInNalUnit specifies the size of the NAL unit in bytes. This value is required for decoding of the NAL unit. Some form of demarcation of NAL unit boundaries is necessary to enable inference of NumBytesInNalUnit. One such demarcation method is specified in Annex B for the byte stream format. Other methods of demarcation may be specified outside of this Specification.

High Efficiency Video Coding, Series H: Audiovisual And Multimedia Systems: Infrastructure Of Audiovisual Services – Coding Of Moving Video Rec. ITU-T H.265 at § 7.4.2.1 (February 2018) (emphasis added).

266. On information and belief, VCL NAL Units comprise discrete video data that ends. It is between the receipt of VCL NAL Units that the overlay data (Non-VCL NAL Unit) data is received by the Microsoft Products.



Thomas Schierl, Miska M. Hannuksela, Ye-Kui Wang, and Stephan Wenger, System Layer Integration of High Efficiency Video Coding, *IEEE TRANS. CIR. AND SYS. FOR VIDEO TECHNOLOGY, VOL.* 22, NO. 12 at 1875 (December 2012).

267. On information and belief, the Microsoft '918 Products are available to businesses and individuals throughout the United States.

268. On information and belief, the Microsoft '918 Products are provided to businesses and individuals located in the Eastern District of Texas.

269. On information and belief, the HEVC bitstream structure is comprised of discreet data. In the gaps between the receipt by the Microsoft '918 Products of VCL NAL Units Non-VCL NAL Units are received by the Microsoft Products' decoder.

> An HEVC bitstream consists of a number of access units, each including coded data associated with a picture that has a distinct capturing or presentation time. Each access unit is divided into NAL units, including one or more VCL NAL units (i.e., coded slice NAL units) and zero or more non-VCL NAL units, e.g., parameter set NAL units or supplemental enhancement information (SEI) NAL units. Each NAL unit includes an NAL unit header and an NAL unit payload. Information in the NAL unit header can be (conveniently) accessed by media gateways, also known as media aware network elements (MANEs), for intelligent, media aware operations on the stream, such as stream adaptation.

Thomas Schierl, Miska M. Hannuksela, Ye-Kui Wang, and Stephan Wenger, System Layer Integration of High Efficiency Video Coding, *IEEE TRANS. CIR. AND SYS. FOR VIDEO TECHNOLOGY*, *VOL.* 22, NO. 12 at 1873 (December 2012).

270. On information and belief, Non-VCL NAL unit types include data such as supplemental enhancement information that is used to create overlays for display on the device.

Table 2.2 The 32 HEVC non-VCL NAL unit types

Non-VCL NAL unit types			
Parameter sets	32	VPS_NUT	Video parameter set
	33	SPS_NUT	Sequence parameter set
	34	PPS_NUT	Picture parameter set
Delimiters	35	AUD_NUT	Access unit delimiter
	36	EOS_NUT	End of sequence
	37	EOB_NUT	End of bitstream
Filler data	38	FD_NUT	Filler data
Supplemental enhancement information (SEI)	39	PREFIX_SEI_NUT	
	40	SUFFIX_SEI_NUT	
Reserved	41–47	RSV	
Unspecified	48–63	UNSPEC	

Gary J. Sullivan et al, HIGH EFFICIENCY VIDEO CODING (HEVC) at 29 (September 2014).

271. On information and belief, Non-VCL NAL Units include supplemental enhancement information ("SEI") messages. The SEI data that is received contains overlay information that can be combined with the image data that has already been received.

sei_message( ) {	Descriptor
payloadType = 0	
while(next_bits(8) == 0xFF) {	
ff_byte /* equal to 0xFF */	f(8)
payloadType += 255	
}	
last_payload_type_byte	u(8)
payloadType += last_payload_type_byte	
payloadSize = 0	
while(next_bits(8) == 0xFF) {	
ff_byte /* equal to 0xFF */	f(8)
payloadSize += 255	
}	
last_payload_size_byte	u(8)
payloadSize += last_payload_size_byte	
sei_payload(payloadType, payloadSize)	
}	

High Efficiency Video Coding, Series H: Audiovisual And Multimedia Systems: Infrastructure Of Audiovisual Services – Coding Of Moving Video Rec. ITU-T H.265 at § 7.3.5 (February 2018).

272. On information and belief, the Microsoft '918 Products combine the VCL NAL Unit and Non-VCL NAL Unit information to create images that contain overlay information.

> The NAL units are decoded by the decoder to produce the decoded pictures that are output from the decoder. Both the encoder and decoder store pictures in a decoded picture buffer (DPB). This buffer is mainly used for storing pictures so that previously coded pictures can be used to generate prediction signals to use when coding other pictures. These stored pictures are called reference pictures. . . . There are two classes of NAL units in HEVC—video coding layer (VCL) NAL units and non-VCL NAL units. Each VCL NAL unit carries one slice segment of coded picture data while the non-VCL NAL units contain control information that typically relates to multiple coded pictures. <u>One coded picture, together with the non-VCL NAL units that are associated with the coded picture, is called an HEVC access unit</u>.

Gary J. Sullivan et al, HIGH EFFICIENCY VIDEO CODING (HEVC) at 14-15 (September 2014) (emphasis added).

273. By making, using, testing, offering for sale, and/or selling products for downloading on-screen display (OSD) data for generating an image on a display device., including but not limited to the Microsoft '918 Products, Microsoft has injured Dynamic Data and is liable to the Plaintiff for directly infringing one or more claims of the '918 Patent, including at least claim 18 pursuant to 35 U.S.C. § 271(a).

274. On information and belief, Microsoft also indirectly infringes the '918 patent by actively inducing infringement under 35 USC § 271(b).

275. Microsoft has had knowledge of Dynamic Data's patent portfolio, and each of the patents-in-suit, since at least August 20, 2018, when Dynamic Data's Chinese counsel sent a letter to Microsoft regarding Dynamic Data's patent portfolio, in which Dynamic Data identified each of the patents-in-suit, including the '918 patent.

276. Alternatively, on information and belief, Microsoft has had knowledge of the '918 patent since at least service of the Original Complaint in this case or shortly thereafter, and on information and belief, Microsoft knew of the '918 patent and knew of its infringement, including by way of this lawsuit.

277. On information and belief, Microsoft intended to induce patent infringement by third-party customers and users of the Microsoft '918 Products and had knowledge that the inducing acts would cause infringement or was willfully blind to the possibility that its inducing acts would cause infringement. Microsoft specifically intended and was aware that the normal and customary use of the accused products would infringe the '918 patent. Microsoft performed the acts that constitute induced infringement, and would induce actual infringement, with knowledge of the '918 patent and with the knowledge that the induced acts would constitute infringement. For example, Microsoft provides the Microsoft '918 Products that have the capability of operating in a manner that infringe one or more of the claims of the '918 patent, including at least claim 18, and Microsoft further provides documentation and training materials that cause customers and end users of the Microsoft '918 Products to utilize the products in a manner that directly infringe one or more claims of the '918 patent.[27] By providing instruction and training to customers and end-

[27] *See, e.g., CnX Player – Powerful Ultra HD 4K Video Player*, MICROSOFT WEBSITE, *available at:* https://www.microsoft.com/en-us/p/cnx-player-powerful-ultra-hd-4k-video-

users on how to use the Microsoft '918 Products in a manner that directly infringes one or more claims of the '918 patent, including at least claim 18, Microsoft specifically intended to induce infringement of the '918 patent. On information and belief, Microsoft engaged in such inducement to promote the sales of the Microsoft '918 Products, e.g., through Microsoft user manuals, product support, marketing materials, and training materials to actively induce the users of the accused products to infringe the '918 patent. Accordingly, Microsoft has induced and continues to induce users of the accused products to use the accused products in their ordinary and customary way to infringe the '918 patent, knowing that such use constitutes infringement of the '918 patent.

278. The '918 patent is well-known within the industry as demonstrated by multiple citations to the '918 patent in published patents and patent applications assigned to technology companies and academic institutions. Microsoft is utilizing the technology claimed in the '918 patent without paying a reasonable royalty. Microsoft is infringing the '918 patent in a manner best described as willful, wanton, malicious, in bad faith, deliberate, consciously wrongful, flagrant, or characteristic of a pirate.

279. To the extent applicable, the requirements of 35 U.S.C. § 287(a) have been met with respect to the '918 patent.

280. As a result of Microsoft's infringement of the '918 patent, Dynamic Data has suffered monetary damages, and seeks recovery in an amount adequate to compensate for

player/9nblggh1r7w5?activetab=pivot:overviewtab (last visited Nov. 2018); *Getting to know Windows 10*, MICROSOFT IT SHOWCASE, *available at*: https://www.microsoft.com/en-us/itpro/windows-10/end-user-readiness (last visited Nov. 2018); *Windows 10 Subscription Activation*, MICROSOFT WEBSITE (May 22, 2018); Bott, Ed, *Introducing Windows 10 for IT Professionals, Preview Edition*, MICROSOFT PRESS (2015); *Tutorial: Upload, encode, and stream videos using APIs*, MICROSOFT AZURE WEBSITE (Oct. 15, 2018); *Quickstart: Stream video files - .NET*, MICROSOFT AZURE WEBSITE (Oct. 15, 2018); *Quickstart: Create an Azure CDN profile and endpoint*, MICROSOFT AZURE WEBSITE (May 23, 2018).

Microsoft's infringement, but in no event less than a reasonable royalty for the use made of the invention by Microsoft together with interest and costs as fixed by the Court.

COUNT V
INFRINGEMENT OF U.S. PATENT NO. 8,184,689

281. Dynamic Data references and incorporates by reference the preceding paragraphs of this Complaint as if fully set forth herein.

282. Microsoft designs, makes, uses, sells, and/or offers for sale in the United States products and/or services for encoding and decoding video data.

283. Microsoft designs, makes, sells, offers to sell, imports, and/or uses Microsoft products incorporating the Windows Display Driver Model ("WDDM") Version 2.0 functionality, including but not limited to Windows 10 products (including Windows 10 Home, Windows 10 Pro, Windows 10 Enterprise, Windows 10 Education, Windows 10 Pro Education, and Windows 10 LTSB) (collectively, the "Microsoft '689 Product(s)").

284. On information and belief, one or more Microsoft subsidiaries and/or affiliates use the Microsoft '689 Products in regular business operations.

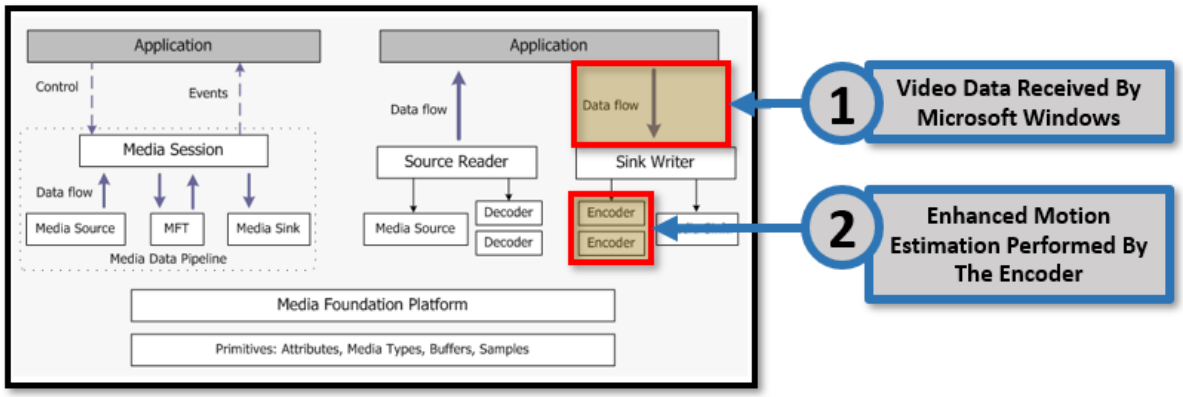
285. On information and belief, one or more of the Microsoft '689 Products include technology for encoding and decoding video data.

286. On information and belief, Microsoft has directly infringed and continues to directly infringe the '689 patent by, among other things, making, using, offering for sale, and/or selling technology for encoding and decoding video data, including but not limited to the Microsoft '689 Products.

287. On information and belief, one or more of the Microsoft '689 Products perform a method for encoding and decoding a video stream, including a plurality of images in a video

processing apparatus having a processing unit coupled to a first memory, further comprising a second memory.

288. Microsoft '689 Products perform video processing through the use of a video encoder for motion estimation. The below image identifies an exemplar of the image processing component in the Microsoft '689 Products.



Overview of the Media Foundation Architecture, MICROSOFT DEVELOPER DOCUMENTATION, May 30, 2018 (annotations added).

289. The Microsoft '689 Products perform encoding and decoding. *See e.g.*, *Microsoft H.265 Video Decoder*, MICROSOFT MEDIA FOUNDATION DOCUMENTATION (MAY 30, 2018), *available at*: https://docs.microsoft.com/en-us/windows/desktop/medfound/ ("The Media Foundation H.265 video decoder is a Media Foundation Transform that supports decoding H.265/HEVC content in Annex B format and can be used in playback of mp4 and m2ts files.").

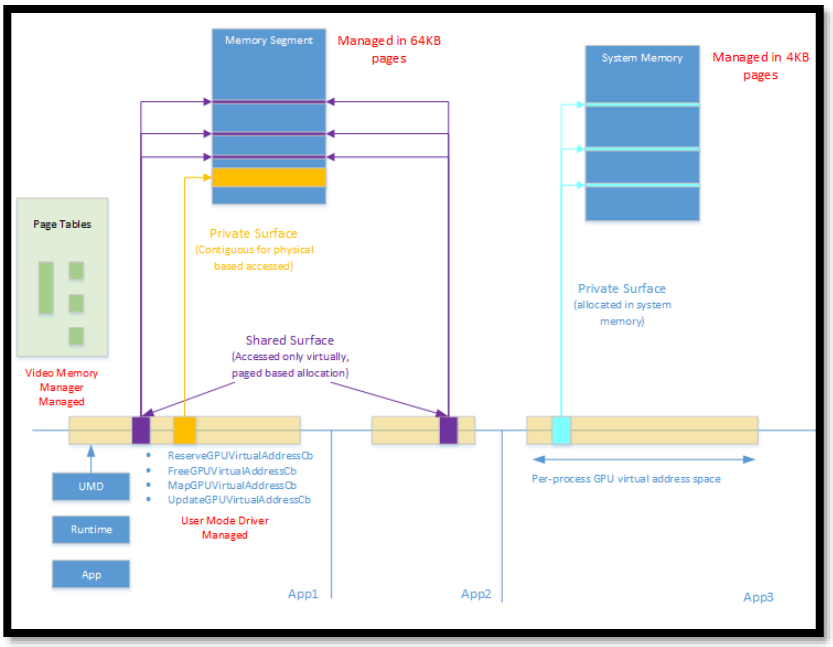
290. On information and belief, one or more of the Microsoft '689 Products perform a method for encoding and decoding a video stream comprising providing a subset of image data stored in the second memory in the first memory.

> Under Windows Display Driver Model (WDDM) v1.x, the device driver interface (DDI) is built such that graphics processing unit (GPU) engines are expected to reference memory through segment physical addresses. As segments are shared across applications and over committed, resources gets relocated through their lifetime and their assigned physical addresses change. This leads to the need to

> track memory references inside command buffers through allocation and patch location lists, and to patch those buffers with the correct physical memory reference before submission to a GPU engine. This tracking and patching is expensive and essentially imposes a scheduling model where the video memory manager has to inspect every packet before it can be submitted to an engi

GPU Virtual Memory In WDDM 2.0, MICROSOFT WINDOWS DEVICE AND DRIVER TECHNOLOGIES – WWDM 2.0 AND WINDOWS 10 (April 19, 2017), *available at*: https://docs.microsoft.com/en-us/windows-hardware/drivers/display/gpu-virtual-memory-in-wddm-2-0.

291. On information and belief, one or more of the Microsoft '689 Products perform a method for encoding and decoding a video stream comprising simultaneous encoding/decoding of more than one image of the video stream, bay accessing said subset, wherein the simultaneously encoding/decoding is performed by access sharing to at least one image.



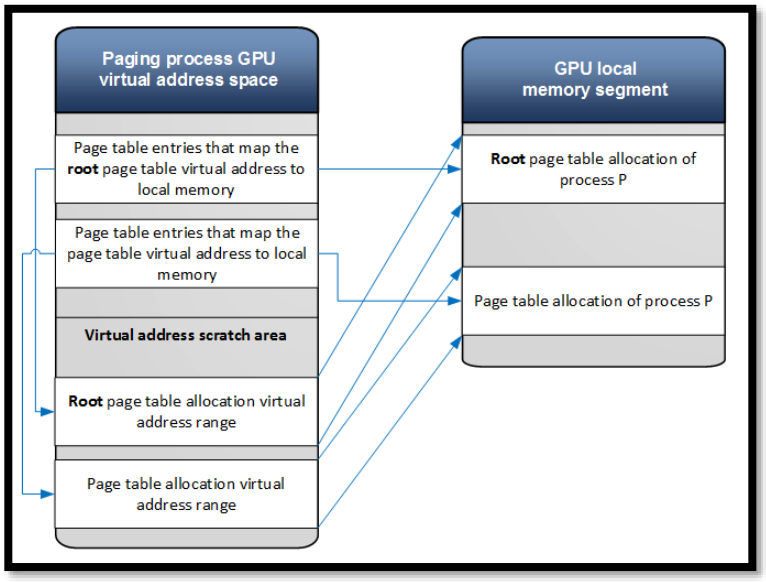
GpuMmu Model: GPU Virtual Memory In WWDM 2.0, MICROSOFT WINDOWS DEVICE AND DRIVER TECHNOLOGIES – WWDM 2.0 AND WINDOWS 10 (April 19, 2017), *available at*: https://docs.microsoft.com/en-us/windows-hardware/drivers/display/gpummu-model ("GPU virtual addresses are managed logically at a fixed 4KB page granularity through the DDI interface. GPU virtual addresses may reference allocations, which are resident in either a memory segment or system memory. System memory is managed at 4KB physical granularity while memory segments are managed at either 4KB or 64KB at the driver's choice. All video memory manager allocations are aligned and sized to be a multiple of the page size chosen by the driver.").

292. On information and belief, the Microsoft '689 Products contain a video memory manager that supports a multilevel virtual address translation scheme,

> The video memory manager supports a multilevel virtual address translation scheme, where several level of page tables are used to translate a virtual address. The levels are numbered from zero and the level zero is assigned to the leaf level. Translation starts from the root level page table. When the number of page table levels is two, the root page table can be resized to accommodate a process with variable GPU virtual address space size. Every level is described by the DXGK_PAGE_TABLE_LEVEL_DESC structure which is filled by the kernel mode driver during a DxgkDdiQueryAdapterInfo call

GPU Virtual Address: GPU Virtual Memory In WWDM 2.0, MICROSOFT WINDOWS DEVICE AND DRIVER TECHNOLOGIES – WWDM 2.0 AND WINDOWS 10 (April 19, 2017), *available at*: https://docs.microsoft.com/en-us/windows-hardware/drivers/display/gpu-virtual-address

293. On informatiom and belief, the Microsoft ,689 Products contain shared physical memory that is managed at least in part by WWDM 2.0.



GpuMmu Example Scenarios: GPU Virtual Address: GPU Virtual Memory In WWDM 2.0, MICROSOFT WINDOWS DEVICE AND DRIVER TECHNOLOGIES – WWDM 2.0 AND WINDOWS 10 (April 19, 2017), https://docs.microsoft.com/en-us/windows-hardware/drivers/display/examples ("Here is the sequence of operations to update page table entries to map an allocation that belong to a process (P) to physical memory. It is assumed that the page table allocations are already resident in a graphics processing unit (GPU) memory segment.")

294. On information and belief, the Microsoft ,689 Products are provided to businesses and individuals located in the United States.

295. On information and belief, the Microsoft '689 Products are provided to businesses and individuals located in the Eastern District of Texas.

296. By making, using, testing, offering for sale, and/or selling products and services for encoding and decoding video data, including but not limited to the Microsoft '689 Products, Microsoft has injured Dynamic Data and is liable to the Plaintiff for directly infringing one or more claims of the '689 patent, including at least claim 1 pursuant to 35 U.S.C. § 271(a).

297. On information and belief, Microsoft also indirectly infringes the '689 patent by actively inducing infringement under 35 U.S.C. § 271(b).

298. Microsoft has had knowledge of Dynamic Data's patent portfolio, and each of the patents-in-suit, since at least August 20, 2018, when Dynamic Data's Chinese counsel sent a letter to Microsoft regarding Dynamic Data's patent portfolio, in which Dynamic Data identified each of the patents-in-suit, including the '689 patent.

299. Alternatively, on information and belief Microsoft has had knowledge of the '689 patent since at least service of the Original Complaint in this case or shortly thereafter, and on information and belief, Microsoft knew of the '689 patent and knew of its infringement, including by way of this lawsuit.

300. On information and belief, Microsoft intended to induce patent infringement by third-party customers and users of the Microsoft '689 Products and had knowledge that the inducing acts would cause infringement or was willfully blind to the possibility that its inducing acts would cause infringement. Microsoft specifically intended and was aware that the normal and customary use of the accused products would infringe the '689 patent. Microsoft performed the acts that constitute induced infringement, and would induce actual infringement, with knowledge of the '689 patent and with the knowledge that the induced acts would constitute infringement.

For example, Microsoft provides the Microsoft '689 Products that have the capability of operating in a manner that infringe one or more of the claims of the '689 patent, including at least claim 1, and Microsoft further provides documentation and training materials that cause customers and end users of the Microsoft '689 Products to utilize the products in a manner that directly infringe one or more claims of the '689 patent.[28] By providing instruction and training to customers and end-users on how to use the Microsoft '689 Products in a manner that directly infringes one or more claims of the '689 patent, including at least claim 1, Microsoft specifically intended to induce infringement of the '689 patent. On information and belief, Microsoft engaged in such inducement to promote the sales of the Microsoft '689 Products, e.g., through Microsoft user manuals, product support, marketing materials, and training materials to actively induce the users of the accused products to infringe the '689 patent. Accordingly, Microsoft has induced and continues to induce users of the accused products to use the accused products in their ordinary and customary way to infringe the '689 patent, knowing that such use constitutes infringement of the '689 patent.

301. The '689 patent is well-known within the industry as demonstrated by multiple citations to the '689 patent in published patents and patent applications assigned to technology companies and academic institutions. Microsoft is utilizing the technology claimed in the '689 patent without paying a reasonable royalty. Microsoft is infringing the '689 patent in a manner best described as willful, wanton, malicious, in bad faith, deliberate, consciously wrongful, flagrant, or characteristic of a pirate.

[28] *See, e.g.*, *WDDM 2.0 and Windows 10*, MICROSOFT HARDWARE DEV CENTER WEBSITE (April 19, 2017); *Getting to know Windows 10*, MICROSOFT IT SHOWCASE, *available at*: https://www.microsoft.com/en-us/itpro/windows-10/end-user-readiness (last visited Nov. 2018); *Windows 10 Subscription Activation*, MICROSOFT WEBSITE (May 22, 2018); Bott, Ed, *Introducing Windows 10 for IT Professionals, Preview Edition*, MICROSOFT PRESS (2015).

302. To the extent applicable, the requirements of 35 U.S.C. § 287(a) have been met with respect to the '689 patent.

303. As a result of Microsoft's infringement of the '689 patent, Dynamic Data has suffered monetary damages, and seeks recovery in an amount adequate to compensate for Microsoft's infringement, but in no event less than a reasonable royalty for the use made of the invention by Microsoft together with interest and costs as fixed by the Court.

COUNT VI
INFRINGEMENT OF U.S. PATENT NO. 6,996,177

304. Dynamic Data references and incorporates by reference the preceding paragraphs of this Complaint as if fully set forth herein.

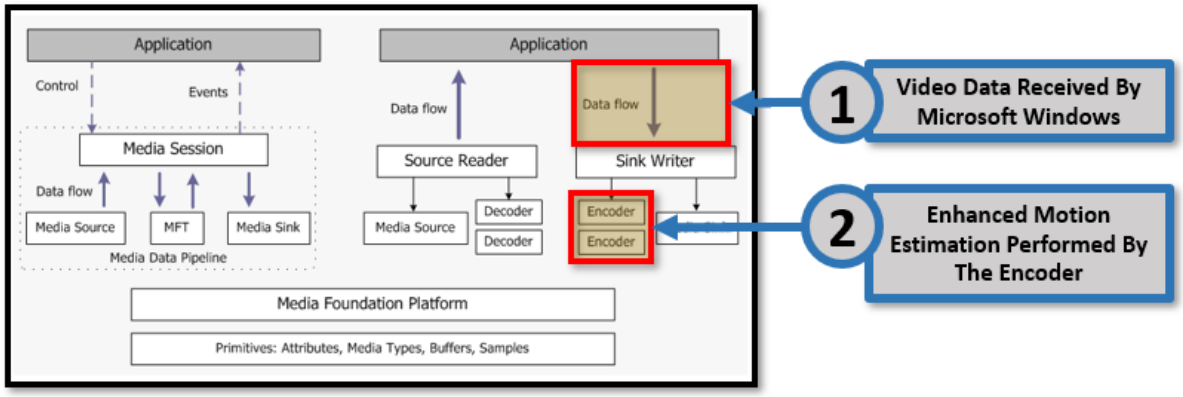
305. Microsoft designs, makes, uses, sells, and/or offers for sale in the United States products and/or services for motion estimation.

306. Microsoft designs, makes, sells, offers to sell, imports, and/or uses Microsoft products that comply with the H.265 video encoding standard. By way of example, the following Microsoft Products perform encoding pursuant to the H.265 standard: Windows 10 products (including Windows 10 Home, Windows 10 Pro, Windows 10 Enterprise, Windows 10 Education, Windows 10 Pro Education, and Windows 10 LTSB) and Microsoft Azure (including Microsoft Azure Media Services and Azure Content Delivery Network) (collectively, the "Microsoft '177 Product(s)").

307. The Microsoft '177 Products perform video encoding compliant with the H.265/HEVC standard. *Comparison of Azure on Demand Media Encoder*, AZURE MEDIA SERVICES DOCUMENTATION (October 23, 2018), *available at*: https://docs.microsoft.com/en-us/azure/media-services/previous/media-services-compare-encoders (showing that the Media

Encoder Premium Workflow supports HEVC output); *Microsoft H.265 Video Encoder*, MICROSOFT MEDIA FOUNDATION DOCUMENTATION (MAY 30, 2018) *available at*: https://docs.microsoft.com/en-us/windows/desktop/medfound/ ("The Media Foundation H.265 video encoder is a Media Foundation Transform that supports encoding content into the H.265/HEVC format.").

308. Microsoft '177 Products perform video processing through the use of a video encoder for motion estimation. The below image identifies an exemplar of the image processing component in the Microsoft '177 Products.



Overview of the Media Foundation Architecture, MICROSOFT DEVELOPER DOCUMENTATION, May 30, 2018 (annotations added).

309. On information and belief, the Microsoft '177 Products use a block-based motion vector estimation process that compares a plurality of candidate vectors to the determine block-based motion vectors.

310. On information and belief, the Microsoft '177 Products use a Prediction Unit matching method wherein the motion vector represents the displacement between the current Prediction Unit in the current frame and the matching Prediction Unit in the reference frame.

> Motion estimation compares the current prediction unit (PU) with the spatially neighboring PUs in the reference frames, and chooses the one with the least difference

> to the current PU. The displacement between the current PU and the matching PU in the reference frames is signaled using a motion vector.

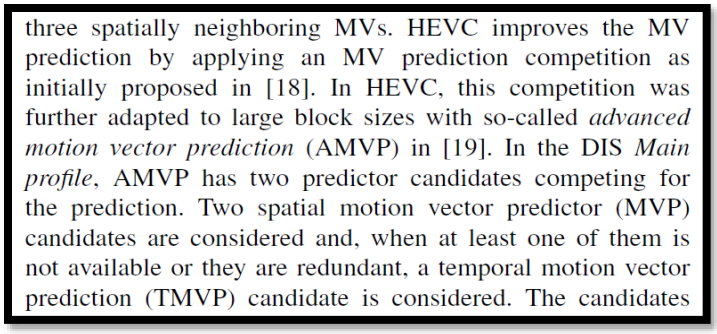
Sung-Fang Tsai, *et al., Encoder Hardware Architecture for HEVC*, HIGH EFFICIENCY VIDEO CODING (HEVC) at 347 (September 2014) (emphasis added).

311. On information and belief, by complying with the HEVC standard, the Microsoft devices – such as the Microsoft '177 Products - necessarily infringe the '177 patent. Mandatory sections of the HEVC standard require the elements required by certain claims of the '177 patent, including but not limited to claim 1. *High Efficiency Video Coding*, SERIES H: AUDIOVISUAL AND Multimedia SYSTEMS: INFRASTRUCTURE OF AUDIOVISUAL SERVICES – CODING OF MOVING VIDEO REC. ITU-T H.265 (February 2018). The following sections of the HEVC Standard are relevant to Microsoft's infringement of the '177 patent: "7.3.4 Scaling list data syntax;" 7.3.6.1 General slice segment header syntax;" "7.3.6.3 Weighted prediction parameters syntax;" "7.3.8.14 Delta QP syntax;" "7.4.4 Profile, tier and level semantics;" and "7.4.7.3 Weighted prediction parameters semantics."

312. On information and belief, one or more of the Microsoft '177 Products include technology for motion estimation and motion-compensated picture signal processing.

313. On information and belief, one or more of the Microsoft '177 Products include technology for estimating a current motion vector for a group of pixels of an image.

314. On information and belief, the Microsoft '177 Products carry out a block-based motion vector estimation process that involves comparing a plurality of candidate vectors to determine block-based motion vectors. The Microsoft '177 Products generate two predictor candidate motion vectors (a spatial motion vector and temporal motion vector). The first predictor candidate motion vector is drawn from a list of spatial motion vector candidates.



three spatially neighboring MVs. HEVC improves the MV prediction by applying an MV prediction competition as initially proposed in [18]. In HEVC, this competition was further adapted to large block sizes with so-called *advanced motion vector prediction* (AMVP) in [19]. In the DIS *Main profile*, AMVP has two predictor candidates competing for the prediction. Two spatial motion vector predictor (MVP) candidates are considered and, when at least one of them is not available or they are redundant, a temporal motion vector prediction (TMVP) candidate is considered. The candidates

Philipp Helle, Simon Oudin, Benjamin Bross, Detlev Marpe, M. Oguz Bici, Kemal Ugur, Joel Jung, Gordon Clare, and Thomas Wiegand, *Block Merging for Quadtree-Based Partitioning in HEVC*, IEEE TRANS. CIR. AND SYS. FOR VIDEO TECHNOLOGY, Vol. *22* No. 12 (December 2012) ("AMVP has two predictor candidates competing for the prediction. Two spatial motion vector predictor (MVP) candidates are considered and, when at least one of them is not available or they are redundant, a temporal motion vector prediction (TMVP) candidate is considered.").

315. On information and belief, the Microsoft '177 Products utilize a motion vector selection process wherein the candidate motion vectors are constructed into an index and then the motion vectors are compared. "In AMVP, the motion vector selection process is composed by two steps in encoder implementation. The first step is the motion vector candidate set construction process and the second step is the best motion vector selection step. In the first step, the motion vector candidate set is organized by selecting the motion vectors spatially and temporally." Gwo-Long Li, Chuen-Ching Wang, and Kuang-Hung Chiang, *An Efficient Motion Vector Prediction Method for Avoiding AMVP Data Dependency For HEVC*, 2014 IEEE INTERNATIONAL CONFERENCE ON ACOUSTIC, SPEECH AND SIGNAL PROCESSING (ICASSP) at 13 (2014).

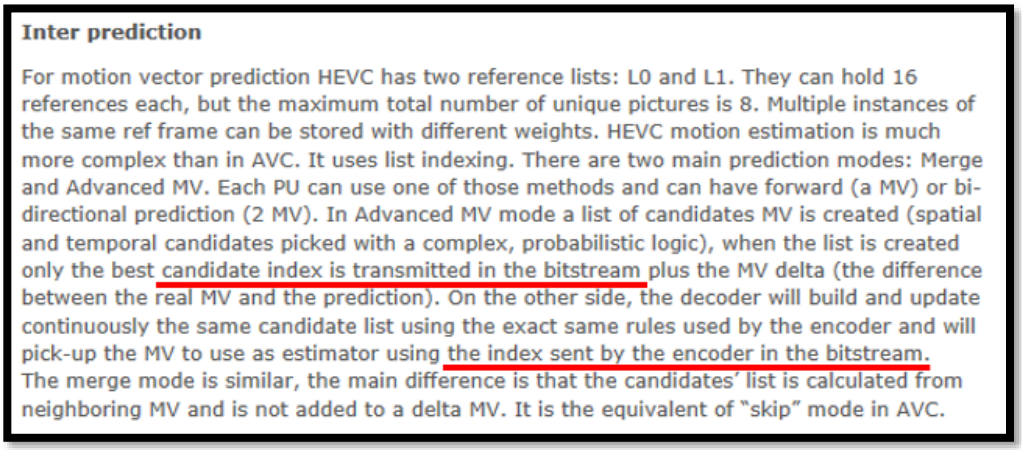
316. On information and belief, one or more Microsoft subsidiaries and/or affiliates use the Microsoft '177 Products in regular business operations.

317. The HEVC Standard provides details regarding what would be required for a compliant HEVC encoder—e.g., the standard uses terms such as "encoding," "coding," "compressing," and other similar terms to describe the encoding process.

318. On information and belief, Microsoft has directly infringed and continues to directly infringe the '177 patent by, among other things, making, using, offering for sale, and/or selling products and services for motion estimation and motion-compensated picture signal processing.

319. On information and belief, the Microsoft '177 Products use a block-based motion vector estimation process that compares a plurality of candidate vectors to determine block-based motion vectors. The Microsoft '177 Products contain a video encoder that selects an image segment of a second video image corresponding to an image segment of a first video image.

320. On information and belief, the Microsoft '177 Products determine at least a most frequently occurring block-based motion vector. The Microsoft '177 Products contain functionality wherein the motion vector prediction performed includes the ability to transmit in the bitstream the candidate index of motion vectors. Documentation of the encoding process states that the encoder will "pick up the MV [motion vector] to use as an estimator using the index sent by the encoder in the bitstream."



Inter prediction

For motion vector prediction HEVC has two reference lists: L0 and L1. They can hold 16 references each, but the maximum total number of unique pictures is 8. Multiple instances of the same ref frame can be stored with different weights. HEVC motion estimation is much more complex than in AVC. It uses list indexing. There are two main prediction modes: Merge and Advanced MV. Each PU can use one of those methods and can have forward (a MV) or bi-directional prediction (2 MV). In Advanced MV mode a list of candidates MV is created (spatial and temporal candidates picked with a complex, probabilistic logic), when the list is created only the best candidate index is transmitted in the bitstream plus the MV delta (the difference between the real MV and the prediction). On the other side, the decoder will build and update continuously the same candidate list using the exact same rules used by the encoder and will pick-up the MV to use as estimator using the index sent by the encoder in the bitstream. The merge mode is similar, the main difference is that the candidates' list is calculated from neighboring MV and is not added to a delta MV. It is the equivalent of "skip" mode in AVC.

Fabio Sonnati, *H265 – Part I: Technical Overview*, VIDEO ENCODING & STREAMING TECHNOLOGIES WEBSITE (June 20, 2014) (emphasis added).

321. On information and belief, any implementation of the HEVC standard would infringe the '177 patent as every possible implementation of the standard requires: compliant

devices to carry out a global motion vector estimation process using the most frequently occurring block-based motion vectors. This process of vector candidate selection allows the Microsoft '177 Products to obtain a global motion vector. Specifically, the HEVC standard generates a set of candidate motion vectors for the group of pixels, with the candidate motion vectors being extracted from a set of previously estimated motion vectors. After the candidate motion vectors are generated, if there are two spatial motion vectors that are identical, that is determined to be the most frequently occurring block-based motion vector and the frequently occurring spatial motion vector and temporal motion vector candidate are used to generate the global motion vector. "In HEVC, this competition was further adapted to large block sizes with so-called advanced motion vector prediction (AMVP). In the DIS Main profile, AMVP has two predictor candidates competing for the prediction. Two spatial motion vector predictor (MVP) candidates are considered and, when at least one of them is not available or they are redundant, a temporal motion vector prediction (TMVP) candidate is considered." Kemal Ugur, Joel Jung, Gordon Clare, and Thomas Wiegand, *Block Merging for Quadtree-Based Partitioning in HEVC, IEEE TRANS. CIR. AND SYS. FOR VIDEO TECHNOLOGY, Vol. 22* No. 12 (December 2012).

322. On information and belief, the Microsoft '177 Products apply a global motion vector as a candidate vector to the block-based motion vector estimation process. Specially, the Microsoft '177 Products calculate the global motion vector by calculating a difference between the second motion vector and the first motion vector. The further candidate motion vector is calculated at the end of the process diagram below (as shown in the below figure) and applied to the block-based motion vector estimation process.

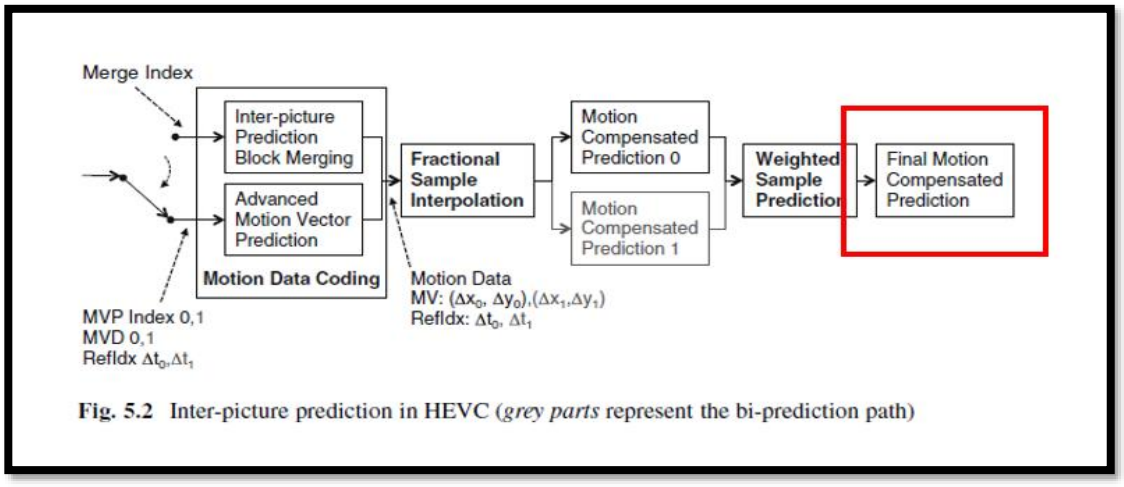


Fig. 5.2 Inter-picture prediction in HEVC (*grey parts* represent the bi-prediction path)

Gary J. Sullivan, *et al*., HEVC, HIGH EFFICIENCY VIDEO CODING (HEVC) at 115 (September 2014) (emphasis added).

323. Further, the Microsoft '177 Products enable AMVP wherein several of the most probable candidate vectors based on data from adjacent prediction blocks are used to create a global estimation vector and that vector is applied to the block-based motion estimation functionality.

> Motion vector signaling: Advanced motion vector prediction (AMVP) is used, including derivation of several most probable candidates based on data from adjacent PBs and the reference picture. A "merge" mode for MV coding can be also used, allowing the inheritance of MVs from neighboring PBs. Moreover, compared to H.264/MPEG-4 AVC, improved "skipped" and "direct" motion inference are also specified.

Gary J. Sullivan, *et al*., *Overview of the High Efficiency Video Coding (HEVC) Standard*, PRE-PUBLICATION DRAFT, TO APPEAR IN IEEE TRANS. ON CIRCUITS AND SYSTEMS FOR VIDEO TECHNOLOGY at 3 (December 2012) (emphasis added).

324. On information and belief, one or more Microsoft subsidiaries and/or affiliates use the Microsoft '177 Products in regular business operations.

325. On information and belief, Microsoft has directly infringed and continues to directly infringe the '177 Patent by, among other things, making, using, offering for sale, and/or selling technology for determining motion vectors that are each assigned to individual image regions, including but not limited to the Microsoft '177 Products.

326. On information and belief, the Microsoft '177 Products are available to businesses and individuals throughout the United States.

327. On information and belief, the Microsoft '177 Products are provided to businesses and individuals located in the Eastern District of Texas.

328. By making, using, testing, offering for sale, and/or selling products and services, including but not limited to the Microsoft '177 Products, Microsoft has injured Dynamic Data and is liable for directly infringing one or more claims of the '177 Patent, including at least claim 1, pursuant to 35 U.S.C. § 271(a).

329. On information and belief, Microsoft also indirectly infringes the '177 patent by actively inducing infringement under 35 USC § 271(b).

330. Microsoft has had knowledge of Dynamic Data's patent portfolio, and each of the patents-in-suit, since at least August 20, 2018, when Dynamic Data's Chinese counsel sent a letter to Microsoft regarding Dynamic Data's patent portfolio, in which Dynamic Data identified each of the patents-in-suit, including the '177 patent.

331. Alternatively, on information and belief, Microsoft has had knowledge of the '177 patent since at least service of the Original Complaint in this case or shortly thereafter, and on information and belief, Microsoft knew of the '177 patent and knew of its infringement, including by way of this lawsuit.

332. Alternatively, Microsoft has had knowledge of the '177 patent since at least August 5, 2008, when U.S. Patent No. 7,408,986, which is owned by Microsoft and cites the '177 patent as relevant prior art, was issued. Alternatively, Microsoft has had knowledge of the '177 patent since at least September 2, 2008, when U.S. Patent No. 7,421,129, which is owned by Microsoft and cites the '177 patent as relevant prior art, was issued. Alternatively, Microsoft has had

knowledge of the '177 patent since at least July 7, 2009, when U.S. Patent No. 7,558,320, which is owned by Microsoft and cites the '177 patent as relevant prior art, was issued.

333. On information and belief, Microsoft intended to induce patent infringement by third-party customers and users of the Microsoft '177 Products and had knowledge that the inducing acts would cause infringement or was willfully blind to the possibility that its inducing acts would cause infringement. Microsoft specifically intended and was aware that the normal and customary use of the accused products would infringe the '177 patent. Microsoft performed the acts that constitute induced infringement, and would induce actual infringement, with knowledge of the '177 patent and with the knowledge that the induced acts would constitute infringement. For example, Microsoft provides the Microsoft '177 Products that have the capability of operating in a manner that infringe one or more of the claims of the '177 patent, including at least claim 1, and Microsoft further provides documentation and training materials that cause customers and end users of the Microsoft '177 Products to utilize the products in a manner that directly infringe one or more claims of the '177 patent.[29] By providing instruction and training to customers and end-users on how to use the Microsoft '177 Products in a manner that directly infringes one or more claims of the '177 patent, including at least claim 1, Microsoft specifically intended to induce infringement of the '177 patent. On information and belief, Microsoft engaged in such inducement to promote the sales of the Microsoft '177 Products, e.g., through Microsoft user manuals, product

[29] *See, e.g.*, *CnX Player – Powerful Ultra HD 4K Video Player*, MICROSOFT WEBSITE, *available at:* https://www.microsoft.com/en-us/p/cnx-player-powerful-ultra-hd-4k-video-player/9nblggh1r7w5?activetab=pivot:overviewtab (last visited Nov. 2018); *Getting to know Windows 10*, MICROSOFT IT SHOWCASE, *available at*: https://www.microsoft.com/en-us/itpro/windows-10/end-user-readiness (last visited Nov. 2018); *Windows 10 Subscription Activation*, MICROSOFT WEBSITE (May 22, 2018); Bott, Ed, *Introducing Windows 10 for IT Professionals, Preview Edition*, MICROSOFT PRESS (2015); *Tutorial: Upload, encode, and stream videos using APIs*, MICROSOFT AZURE WEBSITE (Oct. 15, 2018); *Quickstart: Stream video files - .NET*, MICROSOFT AZURE WEBSITE (Oct. 15, 2018); *Quickstart: Create an Azure CDN profile and endpoint*, MICROSOFT AZURE WEBSITE (May 23, 2018).

support, marketing materials, and training materials to actively induce the users of the accused products to infringe the '177 patent. Accordingly, Microsoft has induced and continues to induce users of the accused products to use the accused products in their ordinary and customary way to infringe the '177 patent, knowing that such use constitutes infringement of the '177 patent.

334. The '177 patent is well-known within the industry as demonstrated by multiple citations to the '177 patent in published patents and patent applications assigned to technology companies and academic institutions. Microsoft is utilizing the technology claimed in the '177 patent without paying a reasonable royalty. Microsoft is infringing the '177 patent in a manner best described as willful, wanton, malicious, in bad faith, deliberate, consciously wrongful, flagrant, or characteristic of a pirate.

335. To the extent applicable, the requirements of 35 U.S.C. § 287(a) have been met with respect to the '177 patent.

336. As a result of Microsoft's infringement of the '177 patent, Dynamic Data has suffered monetary damages, and seeks recovery in an amount adequate to compensate for Microsoft's infringement, but in no event less than a reasonable royalty for the use made of the invention by Microsoft together with interest and costs as fixed by the Court.

COUNT VII
INFRINGEMENT OF U.S. PATENT NO. 7,010,039

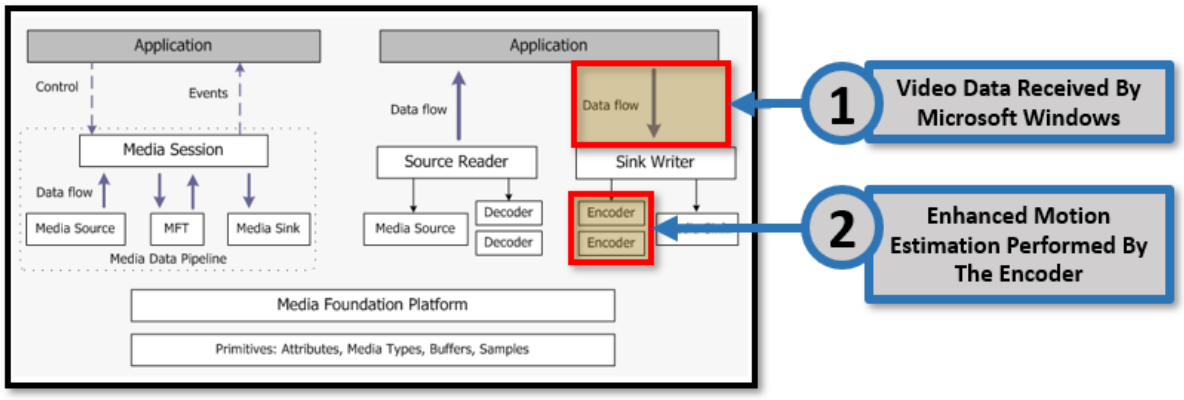
337. Dynamic Data references and incorporates by reference the preceding paragraphs of this Complaint as if fully set forth herein.

338. Microsoft designs, makes, uses, sells, and/or offers for sale in the United States products and/or services for detecting motion.

339. Microsoft designs, makes, sells, offers to sell, imports, and/or uses Microsoft products that comply with the H.265 video encoding standard. By way of example, the following Microsoft Products perform encoding pursuant to the H.265 standard: Windows 10 products (including Windows 10 Home, Windows 10 Pro, Windows 10 Enterprise, Windows 10 Education, Windows 10 Pro Education, and Windows 10 LTSB) and Microsoft Azure (including Microsoft Azure Media Services and Azure Content Delivery Network) (collectively, the "Microsoft '039 Product(s)").

340. The Microsoft '039 Products perform video encoding compliant with the H.265/HEVC standard. *Comparison of Azure on Demand Media Encoder*, AZURE MEDIA SERVICES DOCUMENTATION (October 23, 2018), *available at*: https://docs.microsoft.com/en-us/azure/media-services/previous/media-services-compare-encoders (showing that the Media Encoder Premium Workflow supports HEVC output); *Microsoft H.265 Video Encoder*, MICROSOFT MEDIA FOUNDATION DOCUMENTATION (MAY 30, 2018) *available at*: https://docs.microsoft.com/en-us/windows/desktop/medfound/ ("The Media Foundation H.265 video encoder is a Media Foundation Transform that supports encoding content into the H.265/HEVC format.").

341. Microsoft ''039 Products perform video processing through the use of a video encoder for motion estimation. The below image identifies an exemplar of the image processing component in the Microsoft ''039 Products.



Overview of the Media Foundation Architecture, MICROSOFT DEVELOPER DOCUMENTATION, May 30, 2018 (annotations added).

342. On information and belief, the Microsoft '039 Products contain functionality wherein a criterion function for candidate vectors is optimized. The criterion function depends on data obtained from the previous and next images in the video data stream. The optimizing is carried out at a temporal intermediate position in non-covered and covered areas. The following excerpts explain how HEVC is a form of encoding video information using a temporal intermediate position between previous and next images.

> One way of achieving high video compression is to predict pixel values for a frame based on prior and succeeding pictures in the video. Like its predecessors, H.265 features the ability to predict pixel values between pictures, and in particular, to specify in which order pictures are coded and which pictures are predicted from which. The coding order is specified for Groups Of Pictures (GOP), where a number of pictures are grouped together and predicted from each other in a specified order. The pictures available to predict from, called reference pictures, are specified for every individual picture.

Johan Bartelmess. Compression Efficiency of Different Picture Coding Structures in High Efficiency Video Coding (HEVC), UPTEC STS 16006 at 4 (March 2016)

> HEVC features both low- and high-level methods for dependency removal which can be used to leverage multi-core processors [13]. Only the three high-level mechanisms slices, tiles and WPP are of interest for this work. It is important to note that all of them subdivide individual video frames based on CTUs which are HEVC's basic processing unit. CTUs have a maximum size of 64×64 luma pixels and are recursively split into square-shaped Coding Units (CUs), which contain Prediction Units (PUs) and Transform Units (TUs) [14].

Stefan Radicke, *et al*., *Many-Core HEVC Encoding Based on Wavefront Parallel Processing and GPU -accelerated Motion Estimation*, E-BUSINESS AND TELECOMMUNICATIONS: 11TH INTERNATIONAL JOINT CONFERENCE at 296 (2015) ("HEVC feature both low- and high-level methods for dependency removal which can be used to leverage multi-core processors. . . It is important to note that all of them subdivide individual video frames based on CTUs which are HEVC' basic processing unit.").

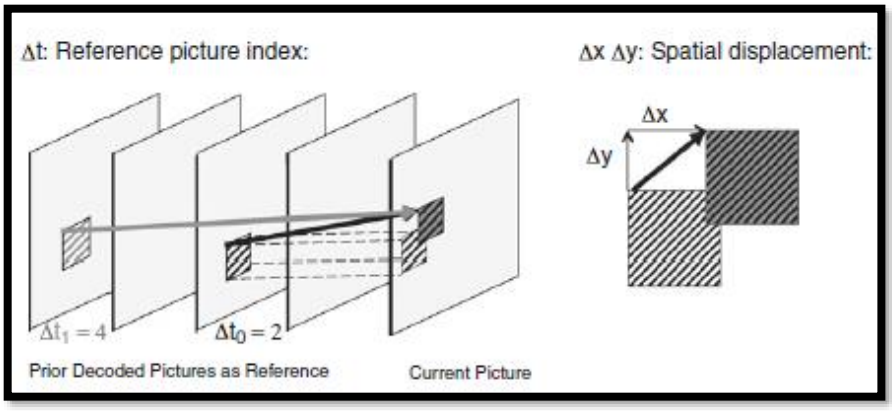
343. On information and belief, the Microsoft '039 Products receive encoded video data that is encoded using inter-frame coding. The encoded video stream received by the Microsoft Products are coded using its predecessor frame and subsequent frame. Inter-prediction used in the encoded video data received by the Microsoft Products allows a transform block to span across multiple prediction blocks for inter-picture predicted coding units to maximize the potential coding efficiency benefits of the quadtree-structured transform block partitioning.

> The basic source-coding algorithm is a hybrid of interpicture prediction to exploit ***temporal statistical dependences,*** intrapicture prediction to exploit spatial statistical dependences, and transform coding of the prediction residual signals to further exploit spatial statistical dependences.

G. J. Sullivan, J.-R. Ohm, W.-J. Han, and T. Wiegand, *Overview of the High Efficiency Video Coding (HEVC) standard*, IEEE TRANS. CIRCUITS SYST. VIDEO TECHNOL., vol. 22, no. 12, p. 1654 (December 2012) (emphasis added).

344. The encoded video stream received by the Microsoft Products are encoded using inter-picture prediction that makes use of the temporal correlation between pictures to derive a motion-compensated prediction (MCP) for a block of image samples. For this block-based motion compensated prediction, a video picture is divided into rectangular blocks. Assuming homogeneous motion inside one block, and that moving objects are larger than one block, for each block, a corresponding block in a previously decoded picture can be found that serves as a

predictor. The general concept of inter-frame-based encoding using motion-compensated prediction based on a translational motion model is illustrated below.



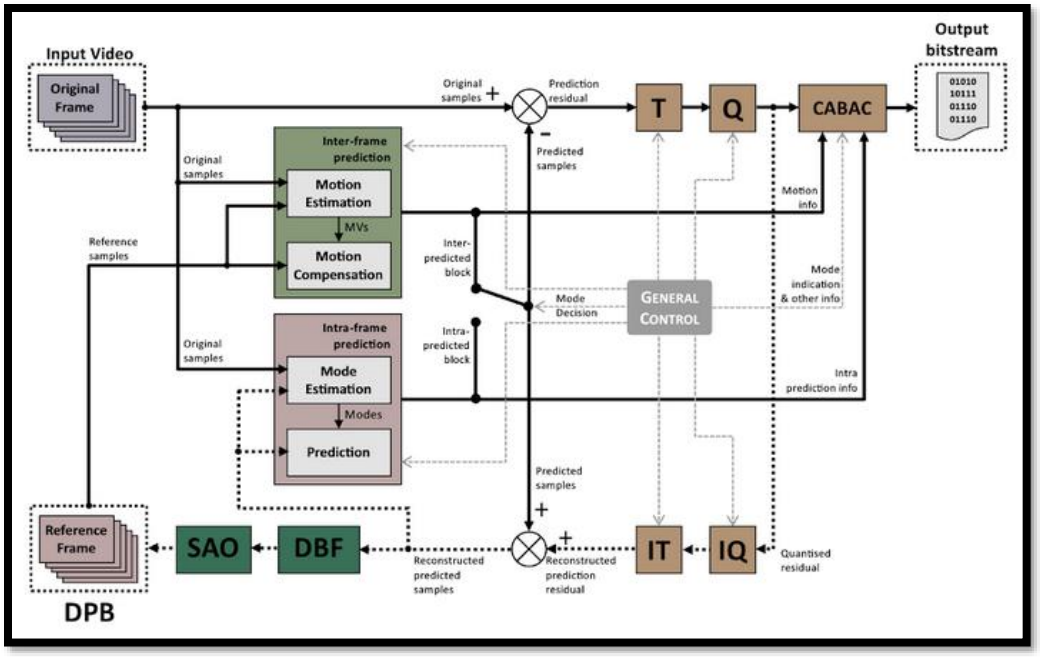
Benjamin Bross, *Inter-Picture Prediction In HEVC*, HIGH EFFICIENCY VIDEO CODING (HEVC) at 114 (September 2014).

345. On information and belief, the following excerpt from an article describing the architecture of the encoded video stream received by the Microsoft '039 Products describes the functionality wherein the second encoded frame of the video data is dependent on the encoding of a first frame. "HEVC inter prediction uses motion vectors pointing to one reference frame . . . or two reference frames (bi-prediction) to predict a block of pixels."

> HEVC inter prediction uses motion vectors pointing to one reference frame (uni-prediction) or two reference frames (bi-prediction) to predict a block of pixels. The size of the predicted block, called Prediction Unit (PU), is determined by the Coding Unit (CU) size and its partitioning mode. For example, a 32×32 CU with 2N×N partitioning is split into two PUs of size 32×16, or a 16×16 CU with nL×2N partitioning is split into 4×16 and 12×16 PUs.

Mehul Tikekar, *et al.*, *Decoder Hardware Architecture for HEVC*, HIGH EFFICIENCY VIDEO CODING (HEVC) (September 2014).

346. On information and belief, the following diagram shows how the Microsoft '039 Products receive video data encoded using inter-frame prediction. Specifically, interframe prediction generates a motion vector based on the motion estimation across frames.



Guilherme Corrêa, *et al.*, COMPLEXITY-AWARE HIGH EFFICIENCY VIDEO CODING at 16 (2015).

347. On information and belief, the Microsoft '039 Products receive encoded video data wherein the second frame includes a region encoding a motion vector difference in position between the region corresponding to the second frame indicating the first frame, the motion vector defines a region between the frame and the second frame corresponding to the first region the correspondence relationship. Specifically, the encoded video data received by the Microsoft Products use a translational motion model wherein the position of the block in a previously decoded picture is indicated by a motion vector: Δx; Δy where Δx specifies the horizontal and Δy the vertical displacement relative to the position of the current block. The motion vectors: Δx; Δy are of fractional sample accuracy to more accurately capture the movement of the underlying object. Interpolation is applied on the reference pictures to derive the prediction signal when the corresponding motion vector has fractional sample accuracy. The previously decoded picture is referred to as the reference picture and indicated by a reference index Δt to a reference picture list.

These translational motion model parameters, *i.e.*, motion vectors and reference indices, are further referred to as motion data.

348. The Microsoft '039 Products optimize the selection of candidate vectors by calculation a temporal position of the next image in covering areas and at the temporal position of the previous image in uncovering areas. Specifically, the encoding process for video data received by the Microsoft Products use inter-picture prediction wherein motion data comprises the selection of a reference frame and motion vectors to be applied in predicting the samples of each block.

349. On information and belief, the "Overview of Design Characteristics" in the HEVC specification describes the use of "motion vectors for block-based inter prediction to exploit temporal statistical dependencies between frames."

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 may then be further compressed using a transform to remove spatial correlation inside the transform block before it is quantized, producing a possibly 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 may also be further compressed using a variety of prediction mechanisms, and, after prediction, are combined with the quantized transform coefficient information and encoded using arithmetic coding.

High Efficiency Video Coding, Series H: Audiovisual And Multimedia Systems: Infrastructure Of Audiovisual Services – Coding Of Moving Video Rec. ITU-T H.265 at § 0.7 (April 2015) (annotation added).

350. On information and belief, by complying with the HEVC standard, the Microsoft devices – such as the Microsoft '039 Products - necessarily infringe the '039 patent. Mandatory sections of the HEVC standard require the elements required by certain claims of the '039 patent, including but not limited to claim 13. *High Efficiency Video Coding*, SERIES H: AUDIOVISUAL AND Multimedia SYSTEMS: INFRASTRUCTURE OF AUDIOVISUAL SERVICES – CODING OF MOVING VIDEO REC. ITU-T H.265 (February 2018). The following sections of the HEVC Standard are relevant to Microsoft's infringement of the '039 patent: "5.3 Logical operators;" "5.10 Variables, syntax

elements and tables;" "5.11 Text description of logical operations;" "7.2 Specification of syntax functions and descriptors;" "7.3.1 NAL unit syntax;" "7.3.2 Raw byte sequence payloads, trailing bits and byte alignment syntax;" "7.3.5 Supplemental enhancement information message syntax;" "7.4.2 NAL unit semantics;" and "7.4.6 Supplemental enhancement information message semantics."

351. On information and belief, one or more Microsoft subsidiaries and/or affiliates use the Microsoft '039 Products in regular business operations.

352. On information and belief, the Microsoft '039 Products are available to businesses and individuals throughout the United States.

353. On information and belief, the Microsoft '039 Products are provided to businesses and individuals located in the Eastern District of Texas.

354. On information and belief, the Microsoft '039 Products carry out the optimization at the temporal position of the next image in covering areas and at the temporal position of the previous image in uncovering areas.

355. On information and belief, the Microsoft '039 Products detect motion at a temporal intermediate position between previous and next images.

356. On information and belief, the Microsoft '039 Products utilize a criterion function for candidate vectors that is optimized.

357. On information and belief, the Microsoft '039 Products utilize a criterion function that depends on data from both previous and next images and in which the optimizing is carried out at the temporal intermediate position in non-covering and non-uncovering areas, characterized in that the optimizing is carried out at the temporal position of the next image in covering areas and at the temporal position of the previous image in uncovering areas.

358. By making, using, testing, offering for sale, and/or selling products and services, including but not limited to the Microsoft '039 Products, Microsoft has injured Dynamic Data and is liable for directly infringing one or more claims of the '039 patent, including at least claim 1, pursuant to 35 U.S.C. § 271(a).

359. On information and belief, Microsoft also indirectly infringes the '039 Patent by actively inducing infringement under 35 USC § 271(b).

360. On information and belief, Microsoft has had knowledge of the '039 Patent since at least service of the Original Complaint in this matter or shortly thereafter, and on information and belief, Microsoft knew of the '039 Patent and knew of its infringement, including by way of this lawsuit.

361. On information and belief, Microsoft intended to induce patent infringement by third-party customers and users of the Microsoft '039 Products and had knowledge that the inducing acts would cause infringement or was willfully blind to the possibility that its inducing acts would cause infringement. Microsoft specifically intended and was aware that the normal and customary use of the accused products would infringe the '039 patent. Microsoft performed the acts that constitute induced infringement, and would induce actual infringement, with knowledge of the '039 patent and with the knowledge that the induced acts would constitute infringement. For example, Microsoft provides the Microsoft '039 Products that have the capability of operating in a manner that infringe one or more of the claims of the '039 patent, including at least claim 13, and Microsoft further provides documentation and training materials that cause customers and end users of the Microsoft '039 Products to utilize the products in a manner that directly infringe one or more claims of the '039 patent. [30] By providing instruction and training to customers and end-

[30] *See, e.g., CnX Player – Powerful Ultra HD 4K Video Player*, MICROSOFT WEBSITE, *available at:* https://www.microsoft.com/en-us/p/cnx-player-powerful-ultra-hd-4k-video-

users on how to use the Microsoft '039 Products in a manner that directly infringes one or more claims of the '039 patent, including at least claim 13, Microsoft specifically intended to induce infringement of the '039 patent. On information and belief, Microsoft engaged in such inducement to promote the sales of the Microsoft '039 Products, e.g., through Microsoft user manuals, product support, marketing materials, and training materials to actively induce the users of the accused products to infringe the '039 patent. Accordingly, Microsoft has induced and continues to induce users of the accused products to use the accused products in their ordinary and customary way to infringe the '039 patent, knowing that such use constitutes infringement of the '039 patent.

362. The '039 patent is well-known within the industry as demonstrated by multiple citations to the '039 patent in published patents and patent applications assigned to technology companies and academic institutions. Microsoft is utilizing the technology claimed in the '039 patent without paying a reasonable royalty. Microsoft is infringing the '039 patent in a manner best described as willful, wanton, malicious, in bad faith, deliberate, consciously wrongful, flagrant, or characteristic of a pirate.

363. To the extent applicable, the requirements of 35 U.S.C. § 287(a) have been met with respect to the '039 patent.

364. As a result of Microsoft's infringement of the '039 patent, Dynamic Data has suffered monetary damages, and seeks recovery in an amount adequate to compensate for

player/9nblggh1r7w5?activetab=pivot:overviewtab (last visited Nov. 2018); *Getting to know Windows 10*, MICROSOFT IT SHOWCASE, *available at*: https://www.microsoft.com/en-us/itpro/windows-10/end-user-readiness (last visited Nov. 2018); *Windows 10 Subscription Activation*, MICROSOFT WEBSITE (May 22, 2018); Bott, Ed, *Introducing Windows 10 for IT Professionals, Preview Edition*, MICROSOFT PRESS (2015); *Tutorial: Upload, encode, and stream videos using APIs*, MICROSOFT AZURE WEBSITE (Oct. 15, 2018); *Quickstart: Stream video files - .NET*, MICROSOFT AZURE WEBSITE (Oct. 15, 2018); *Quickstart: Create an Azure CDN profile and endpoint*, MICROSOFT AZURE WEBSITE (May 23, 2018).

Microsoft's infringement, but in no event less than a reasonable royalty for the use made of the invention by Microsoft together with interest and costs as fixed by the Court.

COUNT VIII
INFRINGEMENT OF U.S. PATENT NO. 8,311,112

365. Dynamic Data references and incorporates by reference the preceding paragraphs of this Complaint as if fully set forth herein.

366. Microsoft designs, makes, uses, sells, and/or offers for sale in the United States products and/or services for video compression.

367. Microsoft designs, makes, sells, offers to sell, imports, and/or uses Microsoft products that comply with the H.265 video encoding standard. By way of example, the following Microsoft Products perform encoding pursuant to the H.265 standard: Windows 10 products (including Windows 10 Home, Windows 10 Pro, Windows 10 Enterprise, Windows 10 Education, Windows 10 Pro Education, and Windows 10 LTSB) and Microsoft Azure (including Microsoft Azure Media Services and Azure Content Delivery Network) (collectively, the "Microsoft '112 Product(s)").

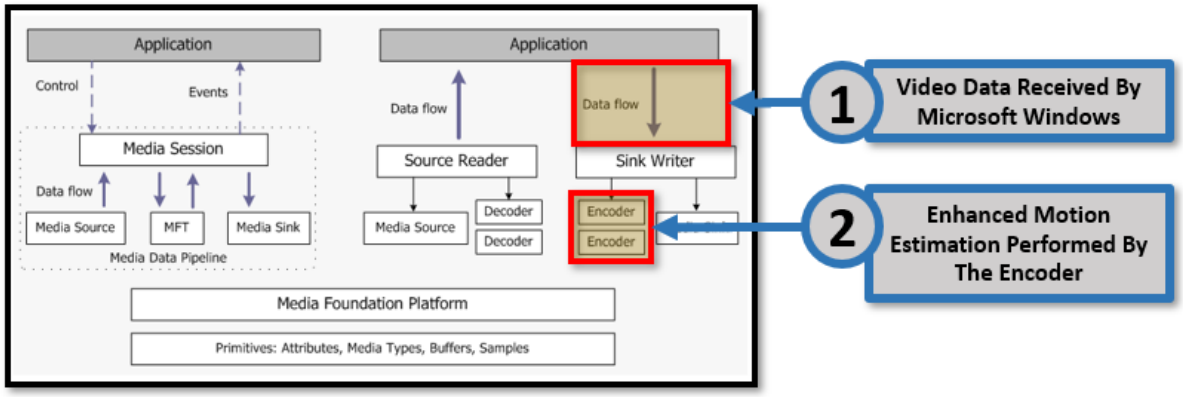
368. On information and belief, one or more Microsoft subsidiaries and/or affiliates use the Microsoft '112 Products in regular business operations.

369. On information and belief, one or more of the Microsoft '112 Products include technology for video compression.

370. The Microsoft '112 Products perform video encoding compliant with the H.265/HEVC standard. *Comparison of Azure on Demand Media Encoder*, AZURE MEDIA SERVICES DOCUMENTATION (October 23, 2018), *available at*: https://docs.microsoft.com/en-us/azure/media-services/previous/media-services-compare-encoders (showing that the Media

Encoder Premium Workflow supports HEVC output); *Microsoft H.265 Video Encoder*, MICROSOFT MEDIA FOUNDATION DOCUMENTATION (MAY 30, 2018) *available at*: https://docs.microsoft.com/en-us/windows/desktop/medfound/ ("The Media Foundation H.265 video encoder is a Media Foundation Transform that supports encoding content into the H.265/HEVC format.").

371. Microsoft '112 Products perform video processing through the use of a video encoder for motion estimation. The below image identifies an exemplar of the image processing component in the Microsoft '112 Products.



Overview of the Media Foundation Architecture, MICROSOFT DEVELOPER DOCUMENTATION, May 30, 2018 (annotations added).

372. On information and belief, the Microsoft '112 Products select the selected image selection area based on a range of possible motion vectors in the selected image search area. Further, the search area of the selected image segment has a center. Specifically, the Microsoft '112 Products contain functionality for selecting a coding unit. The coding unit comprises a selected image segment.

373. On information and belief, the H.265/HEVC encoding performed by the Microsoft '112 Products enables the selection of an image segment of a given image corresponding to an

image segment of a first video image. The selected image segment has a center and a search area is defined around the image segment.

374. The Microsoft '112 Products contain an image processing unit that receives, at a minimum, two frames of a video from memory. These frames are then processed by the video compensation unit of the Microsoft Products. Further, the Microsoft Products contain an encoder for motion estimation. "[***T]he encoder needs to perform motion estimation***, which is one of the most computationally expensive operations in the encoder, and complexity is reduced by allowing less candidates."[31]

375. The Microsoft '112 Products perform encoding using motion compensation, specifically, inter-picture prediction wherein the Microsoft Product makes use of the temporal correlation between pictures in order to derive a motion-compensated prediction for a block of image samples. Each image is divided into blocks (prediction units) and the Microsoft '112 Products compares the prediction unit in a first image with the spatially neighboring prediction units in a second image (reference image). The displacement between the current prediction unit and the matching prediction unit in the second image (reference image) is signaled using a motion vector.

376. The Microsoft '112 Products contain functionality wherein during the motion estimation process the block size used for prediction units can range from 4 × 8/8 × 4 to 64 × 64.

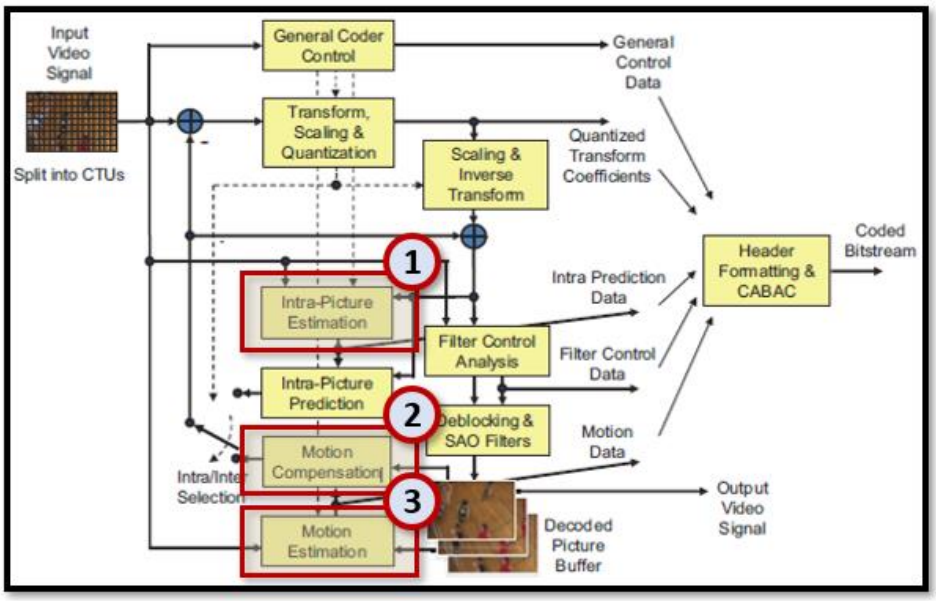
> A block-wise prediction residual <u>is computed from corresponding regions of previously decoded pictures (inter-picture motion compensated prediction) or neighboring previously decoded samples from the same picture (intra-picture spatial prediction)</u>. The residual is then processed by a block transform, and the transform coefficients are quantized and entropy coded. Side information data

[31] Gary J. Sullivan, *et al.*, *Overview of the High Efficiency Video Coding (HEVC) Standard*, PRE-PUBLICATION DRAFT, TO APPEAR IN IEEE TRANS. ON CIRCUITS AND SYSTEMS FOR VIDEO TECHNOLOGY at 13 (December 2012) (emphasis added).

> such as motion vectors and mode switching parameters are also encoded and transmitted.

Standardized Extensions of High Efficiency Video Coding (HEVC), IEEE JOURNAL OF SELECTED TOPICS IN SIGNAL PROCESSING, Vol. 7, No. 6 at 1002 (December 2013) (emphasis added).

377. The Microsoft '112 Products use intra-picture estimation between blocks (prediction units) within an image retrieved from memory. The frames are then processed using both motion compensation and motion estimation. The motion compensation functionality used by the Microsoft Products include quarter-sample precision for the motion vectors and 7-tap or 8-tap filters that are used for interpolation of fractional-sample positions.



Standardized Extensions of High Efficiency Video Coding (HEVC), IEEE JOURNAL OF SELECTED TOPICS IN SIGNAL PROCESSING, VOL. 7, NO. 6 at 1002 (December 2013) (emphasis added) (the annotations showing (1) intra-picture prediction, (2) motion compensation, and (3) motion estimation).

378. The Microsoft '112 Products contain functionality for motion compensation where two or more motion vectors can be applied. Further, one or two motion vectors can be applied to the image processing process. The application of the motion vectors leads to uni-predictive or bi-predictive coding, respectively, where bi-predictive coding uses an averaged result of two predictions to form the final prediction.

Summary

Recommendation ITU-T H.265 | International Standard ISO/IEC 23008-2 represents an evolution of the existing video coding Recommendations (ITU-T H.261, ITU-T H.262, ITU-T H.263 and ITU-T H.264) and was developed in response to the growing need for higher compression of moving pictures for various applications such as Internet streaming, communication, videoconferencing, digital storage media and television broadcasting. 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.

Series H: Audiovisual and Multimedia Systems- Infrastructure of Audiovisual Services – Coding of Moving Video, INTERNATIONAL TELECOMMUNICATIONS UNIONS - TU-T H.265, V.5 at I (February 2018).

379. Microsoft has directly infringed and continues to directly infringe the '112 patent by, among other things, making, using, offering for sale, and/or selling technology for video compression, including but not limited to the Microsoft '112 Products.

380. The Microsoft '112 Products comprise a system wherein an intra-frame coding unit is configured to perform predictive coding on a set of pixels of a macroblock of pixels. Further, the predictive coding functionality uses a first group of reference pixels and a macroblock of pixels from the video frame. Specifically, the Microsoft Products, when selecting a temporal candidate for HEVC intra-frame encoding, default to the right bottom position just outside of the collocated prediction unit.

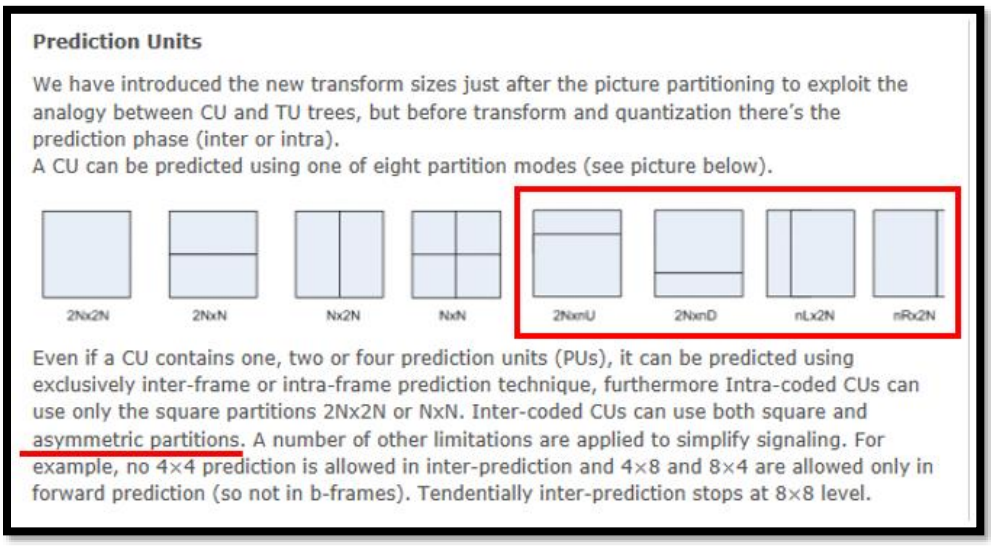
> It can be seen from Fig. 5.4b that only motion vectors from spatial neighboring blocks to the left and above the current block are considered as spatial MVP candidates. This can be explained by the fact that the blocks to the right and below the current block are not yet decoded and hence, their motion data is not available. Since the co-located picture is a reference picture which is already decoded, it is possible to also consider motion data from the block at the same position, from blocks to the right of the co-located block or from the blocks below**. *In HEVC, the block to the bottom right and at the center of the current block have been determined to be the most suitable to provide a good temporal motion vector predictor (TMVP).***

Benjamin Bross, *et al.*, *Inter-picture prediction in HEVC*, in HIGH EFFICIENCY VIDEO CODING (HEVC) at 119 (2014) (emphasis added);

381. Descriptions of the HEVC encoding process, which are implemented by the Microsoft '112 Products, state "for the temporal candidate, the right bottom position just outside of the collocated PU of the reference picture is used if it is available. Otherwise, the center position is used instead." Gary J. Sullivan, *et al.*, *Overview of the High Efficiency Video Coding (HEVC) Standard*, IEEE TRANS. ON CIRCUIT AND SYSTEMS FOR VIDEO TECHNOLOGY at 13 (December 2012).

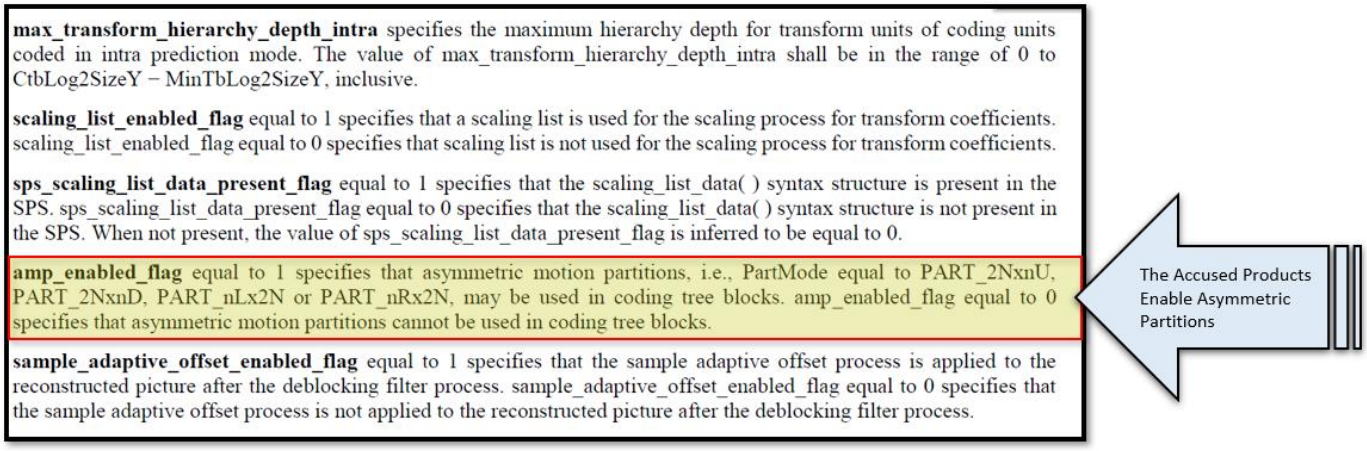
382. The Microsoft video encoder in the Microsoft '112 Products selects an image segment of a second video image corresponding to an image segment of a first video image. The image segment further has an image segment center.

383. The Microsoft '112 Products encode video data such that a predetermined search area (S) center is offset from the center of the image segment. The predetermined search area is called a partition and there are eight different partition modes in the H.265 standard, these partition modes are shown in the figure below. The last four partition modes are asymmetric, meaning their center is offset from the overall CU center.



Fabio Sonnati, *H265 – Part I: Technical Overview*, VIDEO ENCODING & STREAMING TECHNOLOGIES WEBSITE (June 20, 2014) (emphasis added).

384. The figure below shows the syntax as well as the instructions for enabling the asymmetric partitions within the H.265 standard which is used by the Microsoft '112 Products.



High Efficiency Video Coding, SERIES H: AUDIOVISUAL AND MULTIMEDIA SYSTEMS: INFRASTRUCTURE OF AUDIOVISUAL SERVICES – CODING OF MOVING VIDEO REC. ITU-T H.265 at 76 (April 2015) (annotation added).

385. The Microsoft '112 Products receive encoded video data that is encoded using intra-frame coding. Specifically, the encoded video stream received by the Microsoft '112 Products is coded using a reference group of pixels in the video frame. Intra-frame prediction used in the encoded video data received by the Microsoft '112 Products allows a transform block to span across multiple prediction blocks for intra-frame-picture predicted coding units to maximize the potential coding efficiency benefits of the quadtree-structured transform block partitioning.

> The basic source-coding algorithm is a hybrid of interpicture prediction to exploit ***temporal statistical dependences,*** intrapicture prediction to exploit spatial statistical dependences, and transform coding of the prediction residual signals to further exploit spatial statistical dependences.

G. J. Sullivan, J.-R. Ohm, W.-J. Han, and T. Wiegand, *Overview of the High Efficiency Video Coding (HEVC) standard*, IEEE TRANS. CIRCUITS SYST. VIDEO TECHNOL., vol. 22, no. 12, p. 1654 (December 2012) (emphasis added).

386. The Microsoft '112 Products comprise functionality for retrieving image motion data related to the search area. Specifically, the Microsoft '112 Products retrieve data relating to

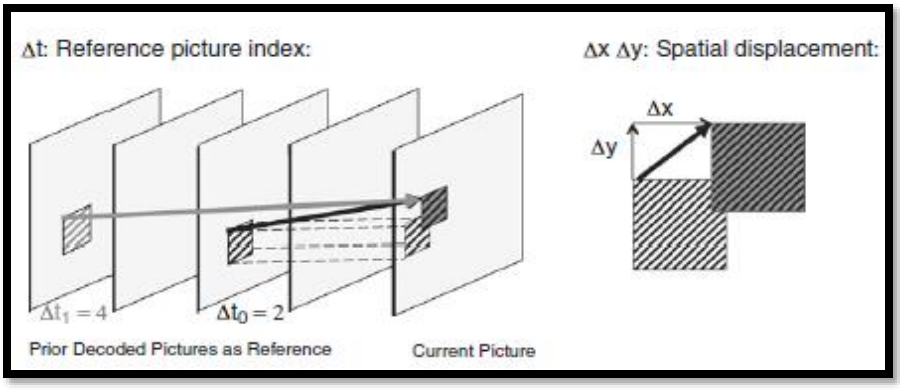
the motion search area. The data, which includes the motion vector index, is sent from the encoder and retrieved by the decoder.

> Since inter-picture prediction typically compensates for the motion of real-world objects between pictures of a video sequence, it is also referred to as motion-compensated prediction. While intra-picture prediction exploits the spatial redundancy between neighboring blocks inside a picture, motion-compensated prediction utilizes the large amount of temporal redundancy between pictures. In either case, the resulting prediction error, which is formed by taking the difference between the original block and its prediction, ***is transmitted using transform coding, which exploits the spatial redundancy inside a block and consists of a decorrelating linear transform, scalar quantization*** of the transform coefficients and entropy coding of the resulting transform coefficient levels.

Heiko Schwarz, Thomas Schierl, Detlev Marpe, *Block Structures and Parallelism Features in HEVC,* in HEVC, HIGH EFFICIENCY VIDEO CODING (HEVC) at 49 (September 2014) (emphasis added).

387. Microsoft '112 Products comprise an inter-frame coding unit that is configured to perform predictive coding on the rest of the macroblock of pixels using a second group of reference pixels. The second group of reference pixels that are used to perform inter-frame coding are drawn from at least one other video frame. The image data processed by the Microsoft '112 Products is encoded using inter-picture prediction that makes use of the temporal correlation between pictures to derive a motion-compensated prediction (MCP) for a block of image samples. For this block-based motion compensated prediction, an image is divided into rectangular blocks. Assuming homogeneous motion inside one block, and that moving objects are larger than one block, for each block, a corresponding block in a previously decoded picture can be found that serves as a predictor (a second image). Both the first and second images are retrieved by the Microsoft '112 Product

from storage such as on chip memory. The general concept of inter-frame-based encoding using motion-compensated prediction based on a translational motion model is illustrated below.



Benjamin Bross, *Inter-Picture Prediction In HEVC,* HIGH EFFICIENCY VIDEO CODING (HEVC) at 114 (September 2014).

388. On information and belief, the Microsoft '112 Products are available to businesses and individuals throughout the United States.

389. On information and belief, the Microsoft '112 Products are provided to businesses and individuals located in the Eastern District of Texas.

390. On information and belief, by complying with the HEVC standard, the Microsoft devices – such as the Microsoft '112 Products - necessarily infringe the '112 patent. The mandatory sections of the HEVC standard require the elements required by certain claims of the '112 patent, including but not limited to claim 11 of the '112 patent. *High Efficiency Video Coding*, SERIES H: AUDIOVISUAL AND Multimedia SYSTEMS: INFRASTRUCTURE OF AUDIOVISUAL SERVICES – CODING OF MOVING VIDEO REC. ITU-T H.265 (February 2018) (The following sections of the HEVC Standard are relevant to Microsoft's infringement of the '112 patent: "8.3.2 Decoding process for reference picture set;" "8.5.4 Decoding process for the residual signal of coding units coded in inter prediction mode;" "8.6 Scaling, transformation and array construction process prior to deblocking filter process;" "8.5.2 Inter prediction process;" "8.5.3 Decoding process for

prediction units in inter prediction mode;" and "8.7.2 Deblocking filter process;" "8.7.3 Sample adaptive offset process.").

391. By making, using, testing, offering for sale, and/or selling products and services for interpolating a pixel during the interlacing of a video signal, including but not limited to the Microsoft '112 Products, Microsoft has injured Dynamic Data and is liable to the Plaintiff for directly infringing one or more claims of the '112 patent, including at least claim 11 pursuant to 35 U.S.C. § 271(a).

392. On information and belief, Microsoft also indirectly infringes the '112 patent by actively inducing infringement under 35 USC § 271(b).

393. Microsoft has had knowledge of Dynamic Data's patent portfolio, and each of the patents-in-suit, since at least August 20, 2018, when Dynamic Data's Chinese counsel sent a letter to Microsoft regarding Dynamic Data's patent portfolio, in which Dynamic Data identified each of the patents-in-suit, including the '112 patent.

394. Alternatively, on information and belief, Microsoft has had knowledge of the '112 patent since at least service of the Original Complaint in this case or shortly thereafter, and on information and belief, Microsoft knew of the '112 patent and knew of its infringement, including by way of this lawsuit.

395. On information and belief, Microsoft intended to induce patent infringement by third-party customers and users of the Microsoft '112 Products and had knowledge that the inducing acts would cause infringement or was willfully blind to the possibility that its inducing acts would cause infringement. Microsoft specifically intended and was aware that the normal and customary use of the accused products would infringe the '112 patent. Microsoft performed the acts that constitute induced infringement, and would induce actual infringement, with knowledge

of the '112 patent and with the knowledge that the induced acts would constitute infringement. For example, Microsoft provides the Microsoft '112 Products that have the capability of operating in a manner that infringe one or more of the claims of the '112 patent, including at least claim 11, and Microsoft further provides documentation and training materials that cause customers and end users of the Microsoft '112 Products to utilize the products in a manner that directly infringe one or more claims of the '112 patent.[32] By providing instruction and training to customers and end-users on how to use the Microsoft '112 Products in a manner that directly infringes one or more claims of the '112 patent, including at least claim 11, Microsoft specifically intended to induce infringement of the '112 patent. On information and belief, Microsoft engaged in such inducement to promote the sales of the Microsoft '112 Products, e.g., through Microsoft user manuals, product support, marketing materials, and training materials to actively induce the users of the accused products to infringe the '112 patent. Accordingly, Microsoft has induced and continues to induce users of the accused products to use the accused products in their ordinary and customary way to infringe the '112 patent, knowing that such use constitutes infringement of the '112 patent.

396. The '112 patent is well-known within the industry as demonstrated by multiple citations to the '112 patent in published patents and patent applications assigned to technology companies and academic institutions. Microsoft is utilizing the technology claimed in the '112 patent without paying a reasonable royalty. Microsoft is infringing the '112 patent in a manner

[32] *See, e.g.*, *CnX Player – Powerful Ultra HD 4K Video Player*, MICROSOFT WEBSITE, *available at:* https://www.microsoft.com/en-us/p/cnx-player-powerful-ultra-hd-4k-video-player/9nblggh1r7w5?activetab=pivot:overviewtab (last visited Nov. 2018); *Getting to know Windows 10*, MICROSOFT IT SHOWCASE, *available at*: https://www.microsoft.com/en-us/itpro/windows-10/end-user-readiness (last visited Nov. 2018); *Windows 10 Subscription Activation*, MICROSOFT WEBSITE (May 22, 2018); Bott, Ed, *Introducing Windows 10 for IT Professionals, Preview Edition*, MICROSOFT PRESS (2015); *Tutorial: Upload, encode, and stream videos using APIs*, MICROSOFT AZURE WEBSITE (Oct. 15, 2018); *Quickstart: Stream video files - .NET*, MICROSOFT AZURE WEBSITE (Oct. 15, 2018); *Quickstart: Create an Azure CDN profile and endpoint*, MICROSOFT AZURE WEBSITE (May 23, 2018).

best described as willful, wanton, malicious, in bad faith, deliberate, consciously wrongful, flagrant, or characteristic of a pirate.

397. To the extent applicable, the requirements of 35 U.S.C. § 287(a) have been met with respect to the '112 patent.

398. As a result of Microsoft's infringement of the '112 patent, Dynamic Data has suffered monetary damages, and seeks recovery in an amount adequate to compensate for Microsoft's infringement, but in no event less than a reasonable royalty for the use made of the invention by Microsoft together with interest and costs as fixed by the Court.

COUNT IX
INFRINGEMENT OF U.S. PATENT NO. 6,646,688

399. Dynamic Data references and incorporates by reference the preceding paragraphs of this Complaint as if fully set forth herein.

400. Microsoft designs, makes, uses, sells, and/or offers for sale in the United States products and/or services for processing video and graphics data.

401. Microsoft designs, makes, sells, offers to sell, imports, and/or uses Microsoft products that support chroma-key effect functionality, including but not limited to Windows 10 products encompassing the following editions: Windows 10 Home; Windows 10 Pro; Windows 10 Enterprise; Windows 10 Education; Windows 10 Pro Education; and Windows 10 LTSB (collectively, the "Microsoft '688 Product(s)").

402. On information and belief, one or more Microsoft subsidiaries and/or affiliates use the Microsoft '688 Products in regular business operations.

403. On information and belief, one or more of the Microsoft '688 Products include technology for processing video and/or graphics data.

404. On information and belief, the Microsoft '688 Products are available to businesses and individuals throughout the United States.

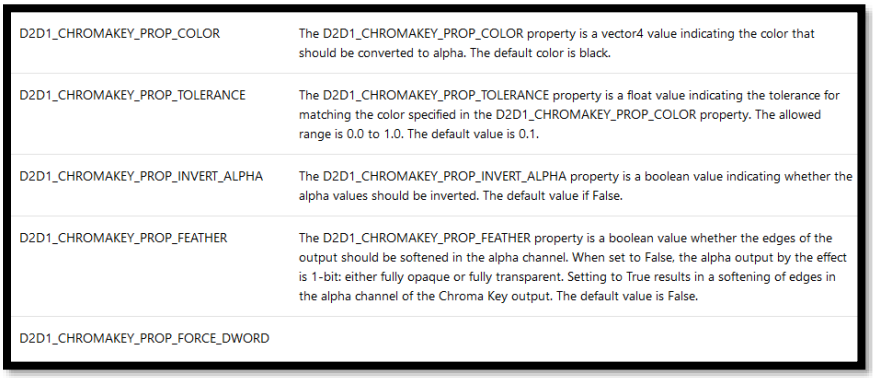
405. On information and belief, the Microsoft '688 Products are provided to businesses and individuals located in the Eastern District of Texas.

406. On information and belief, Microsoft has directly infringed and continues to directly infringe the '688 patent by, among other things, making, using, offering for sale, and/or selling technology for processing video and/or graphics data, including but not limited to the Microsoft '688 Products.

407. On information and belief, the Microsoft '688 Products process video and graphics data.

408. On information and belief, the Microsoft '688 Products pre-process a stream of digital video or graphics data to output pre-processed data.

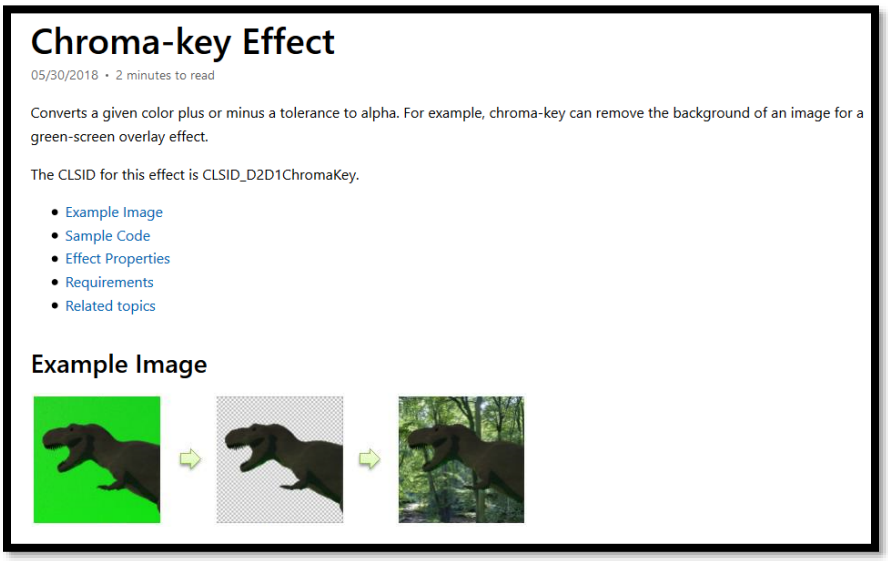
409. On information and belief, the Microsoft '688 Products process a color key from the pre-processed data to output resulting data.



D2D1_CHROMAKEY_PROP_COLOR	The D2D1_CHROMAKEY_PROP_COLOR property is a vector4 value indicating the color that should be converted to alpha. The default color is black.
D2D1_CHROMAKEY_PROP_TOLERANCE	The D2D1_CHROMAKEY_PROP_TOLERANCE property is a float value indicating the tolerance for matching the color specified in the D2D1_CHROMAKEY_PROP_COLOR property. The allowed range is 0.0 to 1.0. The default value is 0.1.
D2D1_CHROMAKEY_PROP_INVERT_ALPHA	The D2D1_CHROMAKEY_PROP_INVERT_ALPHA property is a boolean value indicating whether the alpha values should be inverted. The default value if False.
D2D1_CHROMAKEY_PROP_FEATHER	The D2D1_CHROMAKEY_PROP_FEATHER property is a boolean value whether the edges of the output should be softened in the alpha channel. When set to False, the alpha output by the effect is 1-bit: either fully opaque or fully transparent. Setting to True results in a softening of edges in the alpha channel of the Chroma Key output. The default value is False.
D2D1_CHROMAKEY_PROP_FORCE_DWORD	

Windows D2d1Effects: D2D1_CHROMAKEY_PROP Enumeration, WINDOWS DEV. CENTER (December 4, 2018), *available at*: https://docs.microsoft.com/en-us/windows/desktop/api/d2d1effects_2/ne-d2d1effects_2-d2d1_chromakey_prop ("The D2D1_CHROMAKEY_PROP_COLOR property is a vector4 value indicating the color that should be converted to alpha. The default color is black.").

410. On information and belief, the Microsoft '688 Products substitute the color key with a pre-selected color.



Chroma-key Effect

05/30/2018 • 2 minutes to read

Converts a given color plus or minus a tolerance to alpha. For example, chroma-key can remove the background of an image for a green-screen overlay effect.

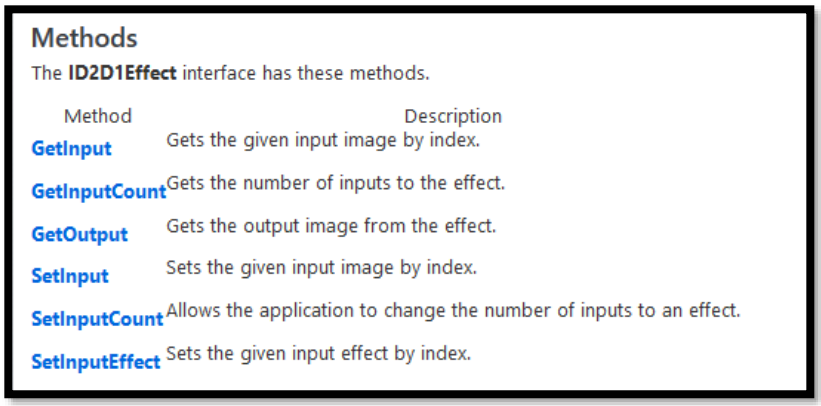
The CLSID for this effect is CLSID_D2D1ChromaKey.

- Example Image
- Sample Code
- Effect Properties
- Requirements
- Related topics

Example Image

Windows API Reference | Chroma-key Effect, WINDOWS DEV. CENTER (May 30, 2018), *available at*: https://docs.microsoft.com/en-us/windows/desktop/direct2d/chromakey-effect

411. On information and belief, the Microsoft '688 Products process and transform the data resulting from the processing a color key from the pre-processed data.



Methods

The **ID2D1Effect** interface has these methods.

Method	Description
GetInput	Gets the given input image by index.
GetInputCount	Gets the number of inputs to the effect.
GetOutput	Gets the output image from the effect.
SetInput	Sets the given input image by index.
SetInputCount	Allows the application to change the number of inputs to an effect.
SetInputEffect	Sets the given input effect by index.

ID2D1Effect Interface, MICROSOFT MSDN NETWORK WEBSITE, *available at*: https://msdn.microsoft.com/en-us/sync/hh404566(v=vs.100) (describing how the images are processed and is according to Microsoft's documentation closely related to the Choma Key effect).

412. By making, using, testing, offering for sale, and/or selling products and services, including but not limited to the Microsoft '688 Products, Microsoft has injured Dynamic Data and

is liable for directly infringing one or more claims of the '688 patent, including at least claim 6, pursuant to 35 U.S.C. § 271(a).

413. On information and belief, Microsoft also indirectly infringes the '688 patent by actively inducing infringement under 35 USC § 271(b).

414. Microsoft has had knowledge of Dynamic Data's patent portfolio, and each of the patents-in-suit, since at least August 20, 2018, when Dynamic Data's Chinese counsel sent a letter to Microsoft regarding Dynamic Data's patent portfolio, in which Dynamic Data identified each of the patents-in-suit, including the '688 patent.

415. Alternatively, on information and belief, Microsoft has had knowledge of the '688 patent since at least service of the Original Complaint in this case or shortly thereafter, and on information and belief, Microsoft knew of the '688 patent and knew of its infringement, including by way of this lawsuit.

416. On information and belief, Microsoft intended to induce patent infringement by third-party customers and users of the Microsoft '688 Products and had knowledge that the inducing acts would cause infringement or was willfully blind to the possibility that its inducing acts would cause infringement. Microsoft specifically intended and was aware that the normal and customary use of the accused products would infringe the '688 patent. Microsoft performed the acts that constitute induced infringement, and would induce actual infringement, with knowledge of the '688 patent and with the knowledge that the induced acts would constitute infringement. For example, Microsoft provides the Microsoft '688 Products that have the capability of operating in a manner that infringe one or more of the claims of the '688 patent, including at least claim 6, and Microsoft further provides documentation and training materials that cause customers and end users of the Microsoft '688 Products to utilize the products in a manner that directly infringe one

or more claims of the '688 patent.[33] By providing instruction and training to customers and end-users on how to use the Microsoft '688 Products in a manner that directly infringes one or more claims of the '688 patent, including at least claim 6, Microsoft specifically intended to induce infringement of the '688 patent. On information and belief, Microsoft engaged in such inducement to promote the sales of the Microsoft '688 Products, e.g., through Microsoft user manuals, product support, marketing materials, and training materials to actively induce the users of the accused products to infringe the '688 patent. Accordingly, Microsoft has induced and continues to induce users of the accused products to use the accused products in their ordinary and customary way to infringe the '688 patent, knowing that such use constitutes infringement of the '688 patent.

417. The '688 patent is well-known within the industry as demonstrated by multiple citations to the '688 patent in published patents and patent applications assigned to technology companies and academic institutions. Microsoft is utilizing the technology claimed in the '688 patent without paying a reasonable royalty. Microsoft is infringing the '688 patent in a manner best described as willful, wanton, malicious, in bad faith, deliberate, consciously wrongful, flagrant, or characteristic of a pirate.

418. To the extent applicable, the requirements of 35 U.S.C. § 287(a) have been met with respect to the '688 patent.

419. As a result of Microsoft's infringement of the '688 patent, Dynamic Data has suffered monetary damages, and seek recovery in an amount adequate to compensate for

[33] *See, e.g.*, *Chroma-key Effect*, MICROSOFT WINDOWS DEV CENTER WEBSITE (May 30, 2018); *Getting to know Windows 10*, MICROSOFT IT SHOWCASE, *available at*: https://www.microsoft.com/en-us/itpro/windows-10/end-user-readiness (last visited Nov. 2018); *Windows 10 Subscription Activation*, MICROSOFT WEBSITE (May 22, 2018); Bott, Ed, *Introducing Windows 10 for IT Professionals, Preview Edition*, MICROSOFT PRESS (2015).

Microsoft's infringement, but in no event less than a reasonable royalty for the use made of the invention by Microsoft together with interest and costs as fixed by the Court.

COUNT X
INFRINGEMENT OF U.S. PATENT NO. 7,894,529

420. Dynamic Data references and incorporates by reference the preceding paragraphs of this Complaint as if fully set forth herein.

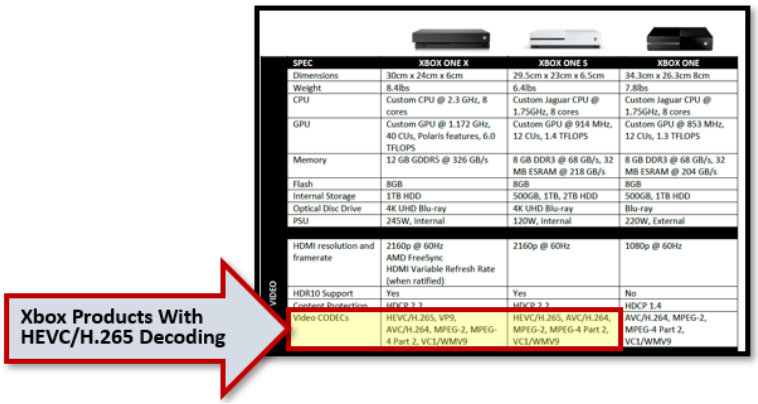
421. Microsoft designs, makes, uses, sells, and/or offers for sale in the United States products and/or services for determining motion vectors that are each assigned to individual image regions.

422. Microsoft designs, makes, sells, offers to sell, imports, and/or uses Microsoft products capable of decoding video data in compliance with the H.265 standard. By way of example, the following Microsoft Products perform decoding pursuant to the H.265 standard: Windows 10 products (including Windows 10 Home, Windows 10 Pro, Windows 10 Enterprise, Windows 10 Education, Windows 10 Pro Education, and Windows 10 LTSB); Microsoft Azure (including Microsoft Azure Media Services and Azure Content Delivery Network); Microsoft Xbox One S; and Microsoft Xbox One X (collectively, the "Microsoft '529 products").

423. The Microsoft '529 Products perform video decoding compliant with the H.265/HEVC standard. *See e.g.*, *Xbox One Family of Devices*, MICROSOFT XBOX SPECIFICATION SHEET at 1 (October 2017) (stating that the Xbox One X and Xbox One S support HEVC/H.265 decoding). *Comparison of Azure on Demand Media Encoder*, AZURE MEDIA SERVICES DOCUMENTATION (October 23, 2018), *available at*: https://docs.microsoft.com/en-us/azure/media-services/previous/media-services-compare-encoders (showing that the Media Encoder Standard And Premium Workflow supports HEVC input); *Microsoft H.265 Video Decoder*, MICROSOFT

MEDIA FOUNDATION DOCUMENTATION (MAY 30, 2018), *available at*: https://docs.microsoft.com/en-us/windows/desktop/medfound/ ("The Media Foundation H.265 video decoder is a Media Foundation Transform that supports decoding H.265/HEVC content in Annex B format and can be used in playback of mp4 and m2ts files.").

424. Further, Microsoft documentation establishes that the Microsoft Xbox Products include input for receiving and decoding HEVC video data. "10-bit HD High Efficiency Video Coding (HEVC) platform support added: 10-bit HD HEVC enables video-streaming apps, like Netflix, to use lower bandwidth to deliver HD-quality video streams." *Xbox One 2015 Operation System Update*, XBOX.COM WEBSITE (last visited August 2018), *available at*: https://support.xbox.com/en-US/xbox-one/console/system-update-operating-system-2015.



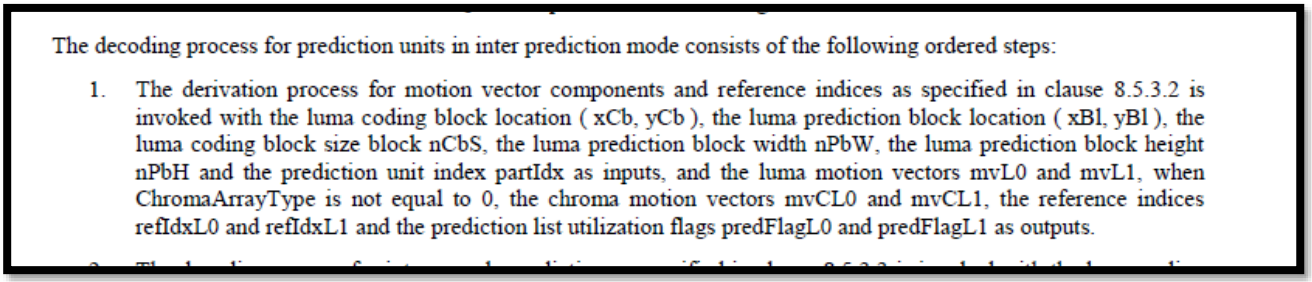
SPEC	XBOX ONE X	XBOX ONE S	XBOX ONE
Dimensions	30cm x 24cm x 6cm	29.5cm x 23cm x 6.5cm	34.3cm x 26.3cm 8cm
Weight	8.4lbs	6.4lbs	7.8lbs
CPU	Custom CPU @ 2.3 GHz, 8 cores	Custom Jaguar CPU @ 1.75GHz, 8 cores	Custom Jaguar CPU @ 1.75GHz, 8 cores
GPU	Custom GPU @ 1.172 GHz, 40 CUs, Polaris features, 6.0 TFLOPS	Custom GPU @ 914 MHz, 12 CUs, 1.4 TFLOPS	Custom GPU @ 853 MHz, 12 CUs, 1.3 TFLOPS
Memory	12 GB GDDR5 @ 326 GB/s	8 GB DDR3 @ 68 GB/s, 32 MB ESRAM @ 218 GB/s	8 GB DDR3 @ 68 GB/s, 32 MB ESRAM @ 204 GB/s
Flash	8GB	8GB	8GB
Internal Storage	1TB HDD	500GB, 1TB, 2TB HDD	500GB, 1TB HDD
Optical Disc Drive	4K UHD Blu-ray	4K UHD Blu-ray	Blu-ray
PSU	245W, Internal	120W, Internal	220W, External
VIDEO			
HDMI resolution and framerate	2160p @ 60Hz AMD FreeSync HDMI Variable Refresh Rate (when ratified)	2160p @ 60Hz	1080p @ 60Hz
HDR10 Support	Yes	Yes	No
Content Protection	HDCP 2.2	HDCP 2.2	HDCP 1.4
Video CODECs	HEVC/H.265, VP9, AVC/H.264, MPEG-2, MPEG-4 Part 2, VC1/WMV9	HEVC/H.265, AVC/H.264, MPEG-2, MPEG-4 Part 2, VC1/WMV9	AVC/H.264, MPEG-2, MPEG-4 Part 2, VC1/WMV9

Xbox One Family of Devices, MICROSOFT XBOX SPECIFICATION SHEET at 1 (October 2017) (annotation added), *available at*: https://news.xbox.com/wp-content/uploads/Xbox_One_Spec_Sheet.pdf.

425. The Microsoft '529 Products incorporate a decoding unit for decoding the frame of the received video data. The decoding utilizes a second frame recovery unit that is a decoding motion vector. Specifically, the encoding and decoding process for video data received by the Microsoft '529 Products use inter-picture prediction wherein motion data comprises the selection of a reference frame and motion vectors to be applied in predicting the samples of each block.

426. On information and belief, by complying with the HEVC standard, the Microsoft devices – such as the Microsoft '529 Products - necessarily infringe the '529 patent. Mandatory sections of the HEVC standard require the elements required by certain claims of the '529 patent, including but not limited to claim 1. *High Efficiency Video Coding*, SERIES H: AUDIOVISUAL AND Multimedia SYSTEMS: INFRASTRUCTURE OF AUDIOVISUAL SERVICES – CODING OF MOVING VIDEO REC. ITU-T H.265 (February 2018). The following sections of the HEVC Standard are relevant to Microsoft's infringement of the '529 patent: "3.110 Prediction Unit Definition;" "6.3.2 Block and quadtree structures;" "6.3.3 Spatial or component-wise partitioning;" "6.4.2 Derivation process for prediction block availability;" "7.3.8.5 Coding unit syntax;" "7.3.8.6 Prediction unit syntax;" "8.3.2 Decoding process for reference picture set;" "8.5.4 Decoding process for the residual signal of coding units coded in inter prediction mode;" "8.6 Scaling, transformation and array construction process prior to deblocking filter process;" "8.5.2 Inter prediction process;" "8.5.3 Decoding process for prediction units in inter prediction mode;" and "8.7.2 Deblocking filter process."

427. On information and belief, the Microsoft '529 Products comply with the HEVC standard, which requires determining motion vectors assigned to individual image regions of an image.



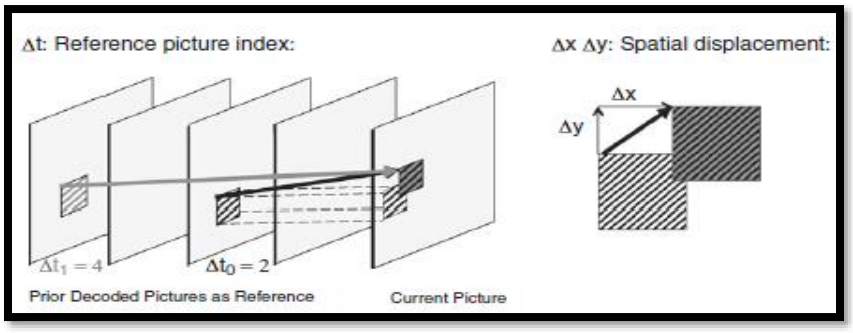
The decoding process for prediction units in inter prediction mode consists of the following ordered steps:

1. The derivation process for motion vector components and reference indices as specified in clause 8.5.3.2 is invoked with the luma coding block location (xCb, yCb), the luma prediction block location (xBl, yBl), the luma coding block size block nCbS, the luma prediction block width nPbW, the luma prediction block height nPbH and the prediction unit index partIdx as inputs, and the luma motion vectors mvL0 and mvL1, when ChromaArrayType is not equal to 0, the chroma motion vectors mvCL0 and mvCL1, the reference indices refIdxL0 and refIdxL1 and the prediction list utilization flags predFlagL0 and predFlagL1 as outputs.

High Efficiency Video Coding, Series H: Audiovisual And Multimedia Systems: Infrastructure Of Audiovisual Services – Coding Of Moving Video Rec. ITU-T H.265 at § 8.5.3.1 (February 2018).

428. On information and belief, Microsoft has directly infringed and continues to directly infringe the '529 patent by, among other things, making, using, offering for sale, and/or selling technology for implementing a motion estimation technique that assigns at least one motion vector to each of the image blocks and generating a modification motion vector for at least the first image block.

429. On information and belief, the encoded video stream received by the Microsoft '529 Products is encoded using inter-picture prediction that makes use of the temporal correlation between pictures to derive a motion-compensated prediction (MCP) for a block of image samples. For this block-based motion compensated prediction, a video picture is divided into rectangular blocks. Assuming homogeneous motion inside one block, and that moving objects are larger than one block, for each block, a corresponding block in a previously decoded picture can be found that serves as a predictor. The general concept of inter-frame-based encoding using motion-compensated prediction based on a translational motion model is illustrated below.



Benjamin Bross, *Inter-Picture Prediction In HEVC*, HIGH EFFICIENCY VIDEO CODING (HEVC) at 114 (September 2014).

430. On information and belief, the Microsoft '529 Products perform the step of selecting a second image block where the motion vector that is assigned to the first image block passes. Specifically, the Microsoft '529 Products, in the use of inter-picture prediction, look at two or more blocks in different frames wherein the vector passes through both the first and second

image block. The following excerpts from documentation relating the video estimation technique used by the Microsoft '529 Products explains how HEVC uses motion estimation to determine a temporal intermediate position between two images wherein two image blocks are selected that have a motion vector passing in both the first and second image block.

> One way of achieving high video compression is to predict pixel values for a frame based on prior and succeeding pictures in the video. Like its predecessors, H.265 features the ability to predict pixel values between pictures, and in particular, to specify in which order pictures are coded and which pictures are predicted from which. The coding order is specified for Groups Of Pictures (GOP), where a number of pictures are grouped together and predicted from each other in a specified order. The pictures available to predict from, called reference pictures, are specified for every individual picture.

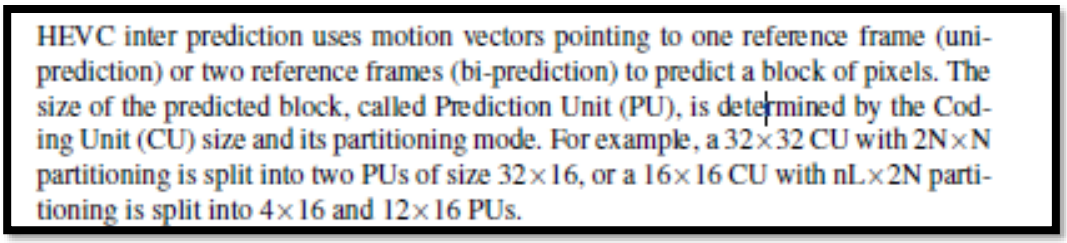
Johan Bartelmess, *Compression Efficiency of Different Picture Coding Structures in High Efficiency Video Coding (HEVC),* UPTEC STS 16006 at 4 (March 2016) (emphasis added).

431. On information and belief, the Microsoft '529 Products receive encoded video data that is encoded using inter-frame coding. Specifically, the encoded video stream received by the Microsoft '529 Products is coded using its predecessor frame. Inter-prediction used in the encoded video data received by the Microsoft '529 Products allows a transform block to span across multiple prediction blocks for inter-picture predicted coding units to maximize the potential coding efficiency benefits of the quadtree-structured transform block partitioning.

> The basic source-coding algorithm is a hybrid of interpicture prediction to exploit temporal statistical dependences, intrapicture prediction to exploit spatial statistical dependences, and transform coding of the prediction residual signals to further exploit spatial statistical dependences.

G. J. Sullivan, J.-R. Ohm, W.-J. Han, and T. Wiegand, *Overview of the High Efficiency Video Coding (HEVC) standard*, IEEE TRANS. CIRCUITS SYST. VIDEO TECHNOL., Vol. 22, No. 12, p. 1654 (December 2012) (emphasis added).

432. The following excerpt from an article describing the architecture of the video stream received by the Microsoft '529 Products describes the functionality wherein the second encoded frame of the video data is dependent on the encoding of a first frame. "HEVC inter prediction uses motion vectors pointing to one reference frame . . . to predict a block of pixels."



HEVC inter prediction uses motion vectors pointing to one reference frame (uni-prediction) or two reference frames (bi-prediction) to predict a block of pixels. The size of the predicted block, called Prediction Unit (PU), is determined by the Coding Unit (CU) size and its partitioning mode. For example, a 32×32 CU with 2N×N partitioning is split into two PUs of size 32×16, or a 16×16 CU with nL×2N partitioning is split into 4×16 and 12×16 PUs.

Mehul Tikekar, *et al.*, *Decoder Hardware Architecture for HEVC*, HIGH EFFICIENCY VIDEO CODING (HEVC) (September 2014).

433. On information and belief, any implementation of the HEVC standard infringes the '529 patent as every possible implementation of the standard requires: determining at least a second image block through which the motion vector assigned to the first image block at least partially passes; generating the modified motion vector as a function of a motion vector assigned to at least the second image block; and assigning the modified motion vector as the motion vector to the first image block. Further, the functionality of the motion estimation process in HEVC uses "motion vector[s]: A two-dimensional vector used for *inter prediction* that provides an offset from the coordinates in the decoded picture to the coordinates in a reference picture," as defined in definition 3.83 of the *ITU-T H.265 Series H: Audiovisual and Multimedia Systems* (2018) (emphasis added); *see also, e.g.*, Gary J. Sullivan, Jens-Rainer Ohm, Woo-Jin Han, and Thomas Wiegand, *Overview of the High Efficiency Video Coding (HEVC) Standard*, published in IEEE TRANSACTIONS ON CIRCUITS AND SYSTEMS FOR VIDEO TECHNOLOGY, Vol. 22, No. 12 at 1650 (December 2012) ("The encoder and decoder generate identical inter picture prediction signals by applying motion compensation (MC) using the MV and mode decision data.").

434. The motion estimation done by the Microsoft '529 Products is done through a PU matching method where the motion vector represents the displacement between the current PU in the current frame and the matching PU in the reference frame.

> Motion estimation compares the current prediction unit (PU) with the spatially neighboring PUs in the reference frames, and chooses the one with the least difference

> to the current PU. The displacement between the current PU and the matching PU in the reference frames is signaled using a motion vector.

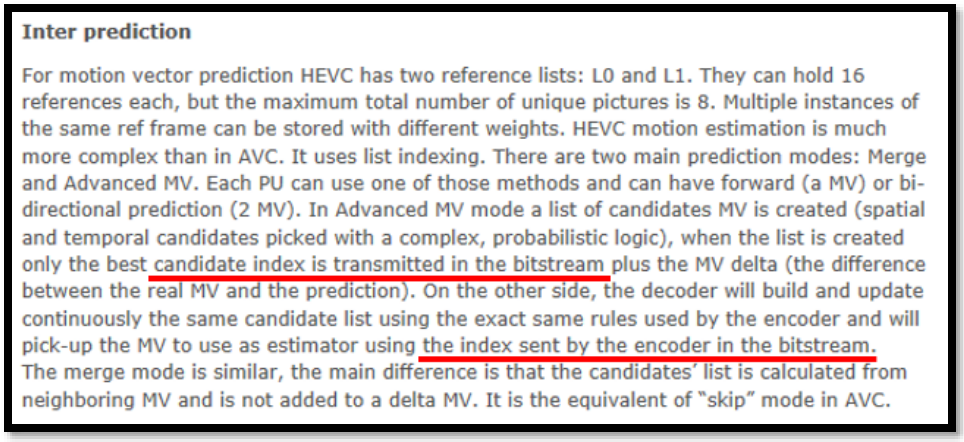
Sung-Fang Tsai, *et al.*, *Encoder Hardware Architecture for HEVC*, HIGH EFFICIENCY VIDEO CODING (HEVC) at 347 (September 2014) (emphasis added).

435. On information and belief, the Microsoft '529 Products perform the step of assigning the modified motion vector as the motion vector to the first image block. Specifically, the Microsoft '529 Products, through the use of AMVP and Merge Mode, select the modified motion vector and assign it to a first block. The displacement between the current prediction unit and the matching prediction unit in the second image (reference image) is signaled using a motion vector. Further, the Microsoft '529 Products take the modified motion vector "computed from corresponding regions of previously decoded pictures" and transmit the residual.

> A block-wise prediction residual ***is computed from corresponding regions of previously decoded pictures (inter-picture motion compensated prediction) or neighboring previously decoded samples from the same picture (intra-picture spatial prediction***). The residual is then processed by a block transform, and the transform coefficients are quantized and entropy coded. Side information data such as motion vectors and mode switching parameters are also encoded and transmitted.

Standardized Extensions of High Efficiency Video Coding (HEVC), IEEE JOURNAL OF SELECTED TOPICS IN SIGNAL PROCESSING, Vol. 7, No. 6 at 1002 (December 2013) (emphasis added).

436. On information and belief, the Microsoft '529 Products transmit into the bitstream the candidate index of motion vectors. HEVC documentation states that the coding process will "pick up the MV [motion vector] to use as an estimator using the index sent by the encoder in the bitstream."



Inter prediction

For motion vector prediction HEVC has two reference lists: L0 and L1. They can hold 16 references each, but the maximum total number of unique pictures is 8. Multiple instances of the same ref frame can be stored with different weights. HEVC motion estimation is much more complex than in AVC. It uses list indexing. There are two main prediction modes: Merge and Advanced MV. Each PU can use one of those methods and can have forward (a MV) or bi-directional prediction (2 MV). In Advanced MV mode a list of candidates MV is created (spatial and temporal candidates picked with a complex, probabilistic logic), when the list is created only the best candidate index is transmitted in the bitstream plus the MV delta (the difference between the real MV and the prediction). On the other side, the decoder will build and update continuously the same candidate list using the exact same rules used by the encoder and will pick-up the MV to use as estimator using the index sent by the encoder in the bitstream. The merge mode is similar, the main difference is that the candidates' list is calculated from neighboring MV and is not added to a delta MV. It is the equivalent of "skip" mode in AVC.

Fabio Sonnati, *H265 – Part I: Technical Overview*, VIDEO ENCODING & STREAMING TECHNOLOGIES WEBSITE (June 20, 2014) (emphasis added).

437. On information and belief, one or more Microsoft subsidiaries and/or affiliates use the Microsoft '529 Products in regular business operations.

438. On information and belief, Microsoft has directly infringed and continues to directly infringe the '529 Patent by, among other things, making, using, offering for sale, and/or selling technology for determining motion vectors that are each assigned to individual image regions, including but not limited to the Microsoft '529 Products.

439. On information and belief, the Microsoft '529 Products are available to businesses and individuals throughout the United States.

440. On information and belief, the Microsoft '529 Products are provided to businesses and individuals located in the Eastern District of Texas.

441. By making, using, testing, offering for sale, and/or selling products and services for interpolating a pixel during the interlacing of a video signal, including but not limited to the Microsoft '529 Products, Microsoft has injured Dynamic Data and is liable to the Plaintiff for directly infringing one or more claims of the '529 Patent, including at least claim 1 pursuant to 35 U.S.C. § 271(a).

442. On information and belief, Microsoft also indirectly infringes the '529 patent by actively inducing infringement under 35 USC § 271(b).

443. Microsoft has had knowledge of Dynamic Data's patent portfolio, and each of the patents-in-suit, since at least August 20, 2018, when Dynamic Data's Chinese counsel sent a letter to Microsoft regarding Dynamic Data's patent portfolio, in which Dynamic Data identified each of the patents-in-suit, including the '529 patent.

444. Alternatively, on information and belief, Microsoft has had knowledge of the '529 patent since at least service of the Original Complaint in this case or shortly thereafter, and on information and belief, Microsoft knew of the '529 patent and knew of its infringement, including by way of this lawsuit.

445. On information and belief, Microsoft intended to induce patent infringement by third-party customers and users of the Microsoft '529 Products and had knowledge that the inducing acts would cause infringement or was willfully blind to the possibility that its inducing acts would cause infringement. Microsoft specifically intended and was aware that the normal and customary use of the accused products would infringe the '529 patent. Microsoft performed the acts that constitute induced infringement, and would induce actual infringement, with knowledge of the '529 patent and with the knowledge that the induced acts would constitute infringement. For example, Microsoft provides the Microsoft '529 Products that have the capability of operating in a manner that infringe one or more of the claims of the '529 patent, including at least claim 1, and Microsoft further provides documentation and training materials that cause customers and end users of the Microsoft '529 Products to utilize the products in a manner that directly infringe one or more claims of the '529 patent.[34] By providing instruction and training to customers and end-

[34] *See, e.g., CnX Player – Powerful Ultra HD 4K Video Player*, MICROSOFT WEBSITE, *available at:* https://www.microsoft.com/en-us/p/cnx-player-powerful-ultra-hd-4k-video-

users on how to use the Microsoft '529 Products in a manner that directly infringes one or more claims of the '529 patent, including at least claim 1, Microsoft specifically intended to induce infringement of the '529 patent. On information and belief, Microsoft engaged in such inducement to promote the sales of the Microsoft '529 Products, e.g., through Microsoft user manuals, product support, marketing materials, and training materials to actively induce the users of the accused products to infringe the '529 patent. Accordingly, Microsoft has induced and continues to induce users of the accused products to use the accused products in their ordinary and customary way to infringe the '529 patent, knowing that such use constitutes infringement of the '529 patent.

446. The '529 patent is well-known within the industry as demonstrated by multiple citations to the '529 patent in published patents and patent applications assigned to technology companies and academic institutions. Microsoft is utilizing the technology claimed in the '529 patent without paying a reasonable royalty. Microsoft is infringing the '529 patent in a manner best described as willful, wanton, malicious, in bad faith, deliberate, consciously wrongful, flagrant, or characteristic of a pirate.

447. To the extent applicable, the requirements of 35 U.S.C. § 287(a) have been met with respect to the '529 patent.

448. As a result of Microsoft's infringement of the '529 patent, Dynamic Data has suffered monetary damages, and seeks recovery in an amount adequate to compensate for

player/9nblggh1r7w5?activetab=pivot:overviewtab (last visited Nov. 2018); *Getting to know Windows 10*, MICROSOFT IT SHOWCASE, *available at*: https://www.microsoft.com/en-us/itpro/windows-10/end-user-readiness (last visited Nov. 2018); *Windows 10 Subscription Activation*, MICROSOFT WEBSITE (May 22, 2018); Bott, Ed, *Introducing Windows 10 for IT Professionals, Preview Edition*, MICROSOFT PRESS (2015); *Tutorial: Upload, encode, and stream videos using APIs*, MICROSOFT AZURE WEBSITE (Oct. 15, 2018); *Quickstart: Stream video files - .NET*, MICROSOFT AZURE WEBSITE (Oct. 15, 2018); *Quickstart: Create an Azure CDN profile and endpoint*, MICROSOFT AZURE WEBSITE (May 23, 2018).

Microsoft's infringement, but in no event less than a reasonable royalty for the use made of the invention by Microsoft together with interest and costs as fixed by the Court.

COUNT XI
INFRINGEMENT OF U.S. PATENT NO. 7,542,041

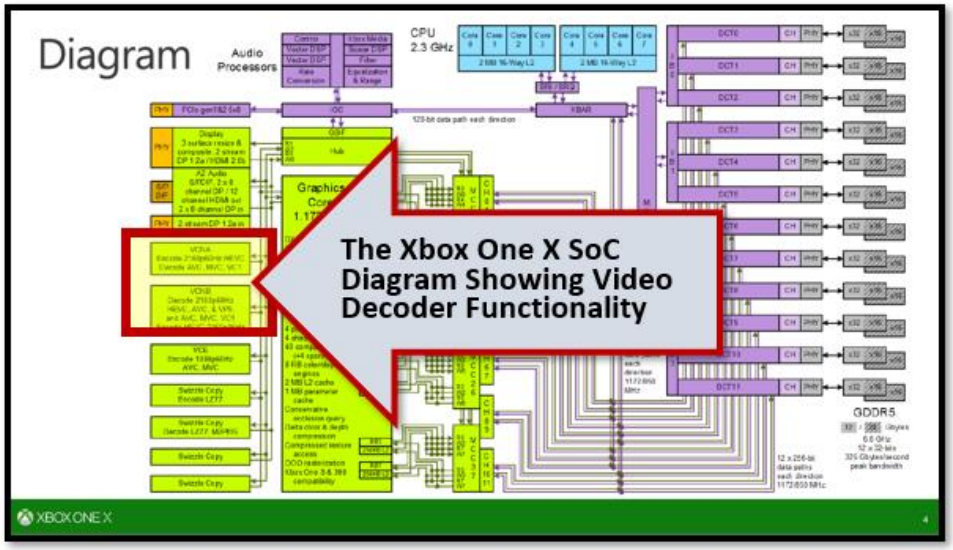
449. Dynamic Data references and incorporates by reference the preceding paragraphs of this Complaint as if fully set forth herein.

450. Microsoft designs, makes, uses, sells, and/or offers for sale in the United States products and/or services for dynamically configuring a multi-pipe pipeline system.

451. Microsoft designs, makes, sells, offers to sell, imports, and/or uses Microsoft products that contain a dynamically configured multi-pipe pipeline, including but not limited to Microsoft Xbox One, Xbox One S, and Xbox One X (collectively, the "Microsoft '041 Product(s)").

452. On information and belief, one or more Microsoft subsidiaries and/or affiliates use the Microsoft '041 Products in regular business operations.

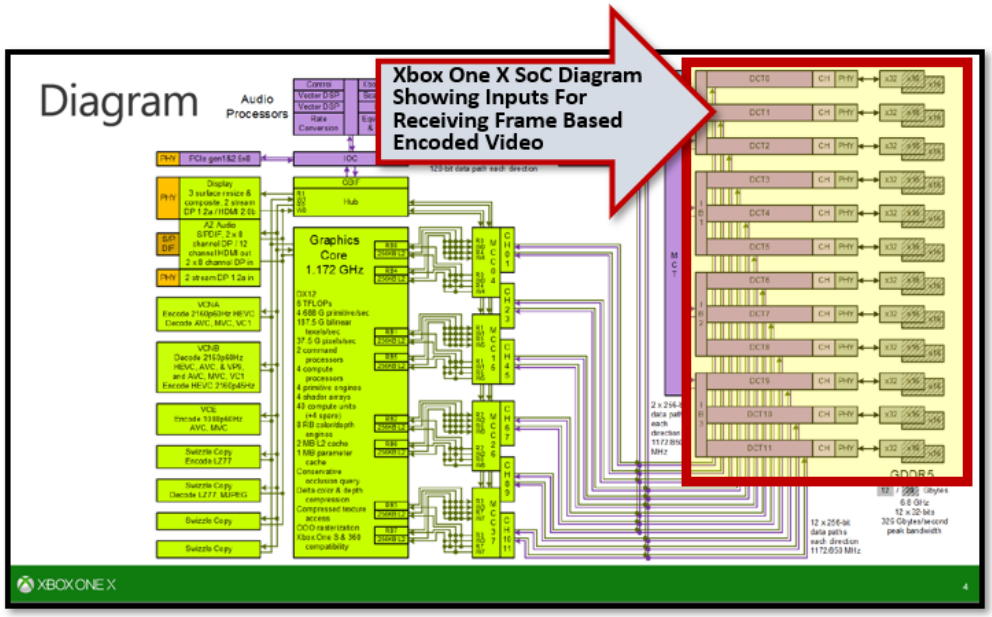
453. On information and belief, one or more of the Microsoft '041 Products include technology for dynamically configuring a multi-pipe pipeline system.



Xbox *One X Scorpio Engine*, MICROSOFT PRESENTATION at 4 (November 7, 2017) (annotations added).

454. On information and belief, Microsoft has directly infringed and continues to directly infringe the '041 patent by, among other things, making, using, offering for sale, and/or selling technology for dynamically configuring a multi-pipe pipeline system, including but not limited to the Microsoft '041 Products.

455. On information and belief, one or more of the Microsoft '041 Products contain a processing system that includes a plurality of pipelines, with each pipeline of the plurality including a plurality of core pipeline elements that are configured to sequentially process data as it traverses the pipeline.



Xbox One X Scorpio Engine, MICROSOFT PRESENTATION at 4 (November 7, 2017) (annotations added).

456. On information and belief, one or more of the Microsoft '041 Products contain a processing system that includes a plurality of auxiliary elements, each auxiliary element of the plurality of auxiliary elements being configured to be selectively coupled to multiple pipelines of the plurality of pipelines.

457. On information and belief, one or more of the Microsoft '041 Products contain a processing system wherein the auxiliary elements are responsive to external coupling-select signals.

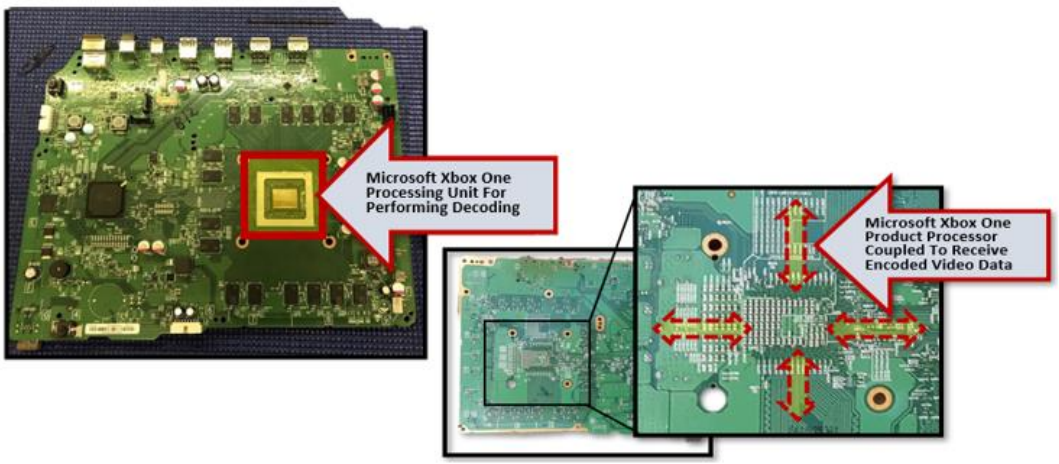
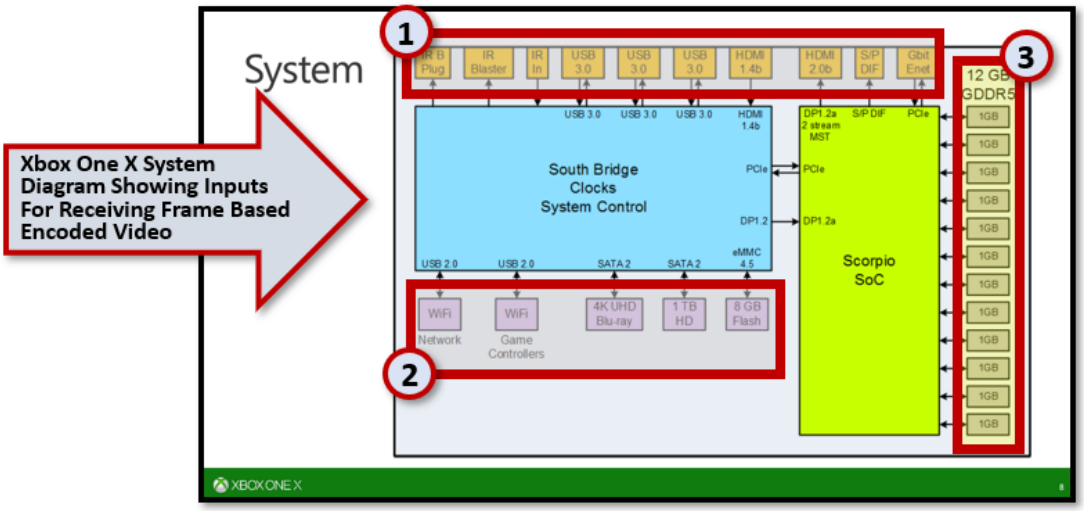


IMAGE OF MICROSOFT XBOX ONE S MOTHERBOARD: DETAILED PRODUCT ANALYSIS (2018) (annotation showing the processor for decoding video data).

458. On information and belief, one or more of the Microsoft '041 Products contain a processing system wherein a plurality of auxiliary elements are within a selected pipeline of the multiple pipelines, between a pair of core pipeline elements of the plurality of core pipeline elements to process the data as it traverses between the pair of core elements.



Xbox One X Scorpio Engine, MICROSOFT PRESENTATION at 5 (November 7, 2017) (annotations added showing inputs including (1) USB, HDMI, Ethernet; (2) WiFi, Flash Drive, Blue Ray Drive; and (3) Graphics Double Data Rate Memory).

459. On information and belief, the Microsoft '041 Products are available to businesses and individuals throughout the United States.

460. On information and belief, the Microsoft '041 Products are provided to businesses and individuals located in the Eastern District of Texas.

461. By making, using, testing, offering for sale, and/or selling products and services for dynamically configuring a multi-pipe pipeline system, including but not limited to the Microsoft '041 Products, Microsoft has injured Dynamic Data and is liable to the Plaintiff for directly infringing one or more claims of the '041 patent, including at least claim 1 pursuant to 35 U.S.C. § 271(a).

462. On information and belief, Microsoft also indirectly infringes the '041 patent by actively inducing infringement under 35 USC § 271(b).

463. Microsoft has had knowledge of Dynamic Data's patent portfolio, and each of the patents-in-suit, since at least August 20, 2018, when Dynamic Data's Chinese counsel sent a letter to Microsoft regarding Dynamic Data's patent portfolio, in which Dynamic Data identified each of the patents-in-suit, including the '041 patent.

464. Alternatively, on information and belief, Microsoft has had knowledge of the '041 patent since at least service of the Original Complaint in this case or shortly thereafter, and on information and belief, Microsoft knew of the '041 patent and knew of its infringement, including by way of this lawsuit.

465. Alternatively, Microsoft has had knowledge of the '041 patent since at least April 19, 2011, when U.S. Patent No. 7,929,599, which is owned by Microsoft and cites the '041 patent as relevant prior art, was issued.

466. On information and belief, Microsoft intended to induce patent infringement by third-party customers and users of the Microsoft '041 Products and had knowledge that the inducing acts would cause infringement or was willfully blind to the possibility that its inducing

acts would cause infringement. Microsoft specifically intended and was aware that the normal and customary use of the accused products would infringe the '041 patent. Microsoft performed the acts that constitute induced infringement, and would induce actual infringement, with knowledge of the '041 patent and with the knowledge that the induced acts would constitute infringement. For example, Microsoft provides the Microsoft '041 Products that have the capability of operating in a manner that infringe one or more of the claims of the '041 patent, including at least claim 1, and Microsoft further provides documentation and training materials that cause customers and end users of the Microsoft '041 Products to utilize the products in a manner that directly infringe one or more claims of the '041 patent.[35] By providing instruction and training to customers and end-users on how to use the Microsoft '041 Products in a manner that directly infringes one or more claims of the '041 patent, including at least claim 1, Microsoft specifically intended to induce infringement of the '041 patent. On information and belief, Microsoft engaged in such inducement to promote the sales of the Microsoft '041 Products, e.g., through Microsoft user manuals, product support, marketing materials, and training materials to actively induce the users of the accused products to infringe the '041 patent. Accordingly, Microsoft has induced and continues to induce users of the accused products to use the accused products in their ordinary and customary way to infringe the '041 patent, knowing that such use constitutes infringement of the '041 patent.

467. The '041 patent is well-known within the industry as demonstrated by multiple citations to the '041 patent in published patents and patent applications assigned to technology

[35] *See, e.g.*, *What is 4K?, Video: Set up 4K and HDR*, XBOX WEBSITE, *available at*: https://support.xbox.com/en-US/xbox-one/console/4k-on-xbox-one (last visited Nov. 2018); *Capturing 4K HDR game clips and screenshots*, XBOX WEBSITE, *available at*: https://support.xbox.com/en-US/xbox-one/console/capture-4k-HDR-game-clips-and-screenshots (last visited Nov. 2018); *Set up your Xbox One X console*, XBOX SUPPORT WEBSITE, *available at*: https://support.xbox.com/en-US/xbox-one/console/set-up-new-xbox-x-solution (last visited Nov. 2018).

companies and academic institutions. Microsoft is utilizing the technology claimed in the '041 patent without paying a reasonable royalty. Microsoft is infringing the '041 patent in a manner best described as willful, wanton, malicious, in bad faith, deliberate, consciously wrongful, flagrant, or characteristic of a pirate.

468. To the extent applicable, the requirements of 35 U.S.C. § 287(a) have been met with respect to the '041 patent.

469. As a result of Microsoft's infringement of the '041 patent, Dynamic Data has suffered monetary damages, and seeks recovery in an amount adequate to compensate for Microsoft's infringement, but in no event less than a reasonable royalty for the use made of the invention by Microsoft together with interest and costs as fixed by the Court.

COUNT XII
INFRINGEMENT OF U.S. PATENT NO. 7,571,450

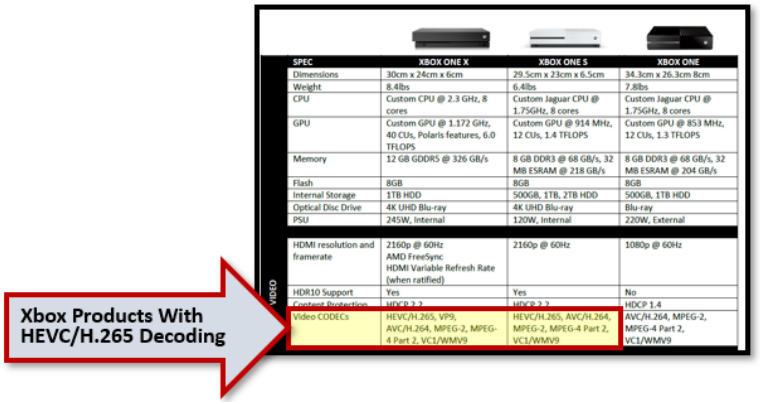
470. Dynamic Data references and incorporates by reference the preceding paragraphs of this Complaint as if fully set forth herein.

471. Microsoft designs, makes, uses, sells, and/or offers for sale in the United States products and/or services for displaying information.

472. Microsoft designs, makes, sells, offers to sell, imports, and/or uses Microsoft products capable of decoding video data in compliance with the H.265 standard. By way of example, the following Microsoft Products perform decoding pursuant to the H.265 standard: Microsoft Xbox One DX, Microsoft Xbox One S, Windows 10 products (including Windows 10 Home, Windows 10 Pro, Windows 10 Enterprise, Windows 10 Education, Windows 10 Pro Education, and Windows 10 LTSB). and Microsoft Azure (including Microsoft Azure Media Services and Azure Content Delivery Network) (collectively, the "Microsoft '450 Product(s)").

473. The Microsoft '450 Products perform video decoding compliant with the H.265/HEVC standard. *See e.g.*, *Xbox One Family of Devices*, MICROSOFT XBOX SPECIFICATION SHEET at 1 (October 2017) (stating that the Xbox One X and Xbox One S support HEVC/H.265 decoding). *Comparison of Azure on Demand Media Encoder*, AZURE MEDIA SERVICES DOCUMENTATION (October 23, 2018), *available at*: https://docs.microsoft.com/en-us/azure/media-services/previous/media-services-compare-encoders (showing that the Media Encoder Standard And Premium Workflow supports HEVC input); *Microsoft H.265 Video Decoder*, MICROSOFT MEDIA FOUNDATION DOCUMENTATION (MAY 30, 2018), *available at*: https://docs.microsoft.com/en-us/windows/desktop/medfound/ ("The Media Foundation H.265 video decoder is a Media Foundation Transform that supports decoding H.265/HEVC content in Annex B format and can be used in playback of mp4 and m2ts files.").

474. Further, Microsoft documentation establishes that the Microsoft Xbox Products include input for receiving and decoding HEVC video data. "10-bit HD High Efficiency Video Coding (HEVC) platform support added: 10-bit HD HEVC enables video-streaming apps, like Netflix, to use lower bandwidth to deliver HD-quality video streams." *Xbox One 2015 Operation System Update*, XBOX.COM WEBSITE (last visited August 2018), *available at*: https://support.xbox.com/en-US/xbox-one/console/system-update-operating-system-2015.



Xbox One Family of Devices, MICROSOFT XBOX SPECIFICATION SHEET at 1 (October 2017) (annotation added), *available at*: https://news.xbox.com/wp-content/uploads/Xbox_One_Spec_Sheet.pdf.

475. On information and belief, by complying with the HEVC standard, the Microsoft devices – such as the Microsoft '450 Products - necessarily infringe the '450 patent. Mandatory sections of the HEVC standard require the elements required by certain claims of the '450 patent, including but not limited to claim 8. *High Efficiency Video Coding*, SERIES H: AUDIOVISUAL AND MULTIMEDIA SYSTEMS: INFRASTRUCTURE OF AUDIOVISUAL SERVICES – CODING OF MOVING VIDEO REC. ITU-T H.265 (February 2018). The following sections of the HEVC Standard are relevant to Microsoft's infringement of the '450 patent: "5.3 Logical operators;" "5.10 Variables, syntax elements and tables;" "5.11 Text description of logical operations;" "7.2 Specification of syntax functions and descriptors;" "7.3.1 NAL unit syntax;" "7.3.2 Raw byte sequence payloads, trailing bits and byte alignment syntax;" "7.3.5 Supplemental enhancement information message syntax;" "7.4.2 NAL unit semantics;" and "7.4.6 Supplemental enhancement information message semantics."

476. On information and belief, the Microsoft '450 Products receive data that is segmented into Network Abstraction Layer ("NAL") Units. NAL Units are segments of data that can include video data and overlay data (such as captions and overlay images). The Microsoft '450 Products support the receipt of VCL and non-VCL NAL units. The VCL NAL units contain

the data that represents the values of the samples in the video pictures, and the non-VCL NAL units contain any associated additional information such as parameter sets or overlay data.

> HEVC uses a NAL unit based bitstream structure. A coded bitstream is partitioned into NAL units which, when conveyed over lossy packet networks, should be smaller than the maximum transfer unit (MTU) size. Each NAL unit consists of a NAL unit header followed by the NAL unit payload. There are two conceptual classes of NAL units. Video coding layer (VCL) NAL units containing coded sample data, e.g., coded slice NAL units, whereas non-VCL NAL units that contain metadata typically belonging to more than one coded picture, or where the association with a single coded picture would be meaningless, such as parameter set NAL units, or where the information is not needed by the decoding process, such as SEI NAL units.

Rickard Sjöberg et al, *Overview of HEVC High-Level Syntax and Reference Picture Management*, IEEE TRANSACTIONS ON CIRCUITS AND SYSTEMS FOR VIDEO TECHNOLOGY, Vol. 22, No. 12 at 1859 (December 2012) (emphasis added).

477. The Microsoft '450 Products process data in the form of VCL NAL Units that contain segments of data which are used to generate an image (e.g., HEVC image) on a display device. Each VCL NAL Unit comprises a discrete number of bites which make up a segment. The following excerpt from the HEVC specification describes a NAL unit as being a segment with a "demarcation" setting forth where the segment ends and begins.

> NumBytesInNalUnit specifies the size of the NAL unit in bytes. This value is required for decoding of the NAL unit. Some form of demarcation of NAL unit boundaries is necessary to enable inference of NumBytesInNalUnit. One such demarcation method is specified in Annex B for the byte stream format. Other methods of demarcation may be specified outside of this Specification.

High Efficiency Video Coding, SERIES H: AUDIOVISUAL AND MULTIMEDIA SYSTEMS: INFRASTRUCTURE OF AUDIOVISUAL SERVICES – CODING OF MOVING VIDEO REC. ITU-T H.265 at § 7.4.2.1 (February 2018) (emphasis added).

478. The Microsoft '450 Products receive VCL NAL units that contain the data that represents the values of the samples in the video pictures, and non-VCL NAL units that contain associated additional information such as parameter sets or overlay data.

> HEVC uses a NAL unit based bitstream structure. A coded bitstream is partitioned into NAL units which, when conveyed over lossy

> packet networks, should be smaller than the maximum transfer unit (MTU) size. Each NAL unit consists of a NAL unit header followed by the NAL unit payload. There are two conceptual classes of NAL units. Video coding layer (VCL) NAL units containing coded sample data, e.g., coded slice NAL units, whereas non-VCL NAL units that contain metadata typically belonging to more than one coded picture, or where the association with a single coded picture would be meaningless, such as parameter set NAL units, or where the information is not needed by the decoding process, such as SEI NAL units.

Rickard Sjöberg et al, *Overview of HEVC High-Level Syntax and Reference Picture Management*, IEEE TRANSACTIONS ON CIRCUITS AND SYSTEMS FOR VIDEO TECHNOLOGY, Vol. 22, No. 12 at 1859 (December 2012) (emphasis added).

479. The Microsoft'450 Products perform filtering, wherein the filtering enables a user to select a data element based on the user's selection. Specifically, a user can select the display of Non-VCL NAL Unit data which can include closed captions or other overlay information that is selected based on the user interaction. The data that is selected by the user is parsed by the system and filtered. The Non-VCL NAL Units include supplemental enhancement information ("SEI") messages. The SEI data that is received contains overlay information that can be combined with the image data that has already been received.

sei_message( ) {	Descriptor
payloadType = 0	
while(next_bits(8) == 0xFF) {	
ff_byte /* equal to 0xFF */	f(8)
payloadType += 255	
}	
last_payload_type_byte	u(8)
payloadType += last_payload_type_byte	
payloadSize = 0	
while(next_bits(8) == 0xFF) {	
ff_byte /* equal to 0xFF */	f(8)
payloadSize += 255	
}	
last_payload_size_byte	u(8)
payloadSize += last_payload_size_byte	
sei_payload(payloadType, payloadSize)	
}	

High Efficiency Video Coding, SERIES H: AUDIOVISUAL AND MULTIMEDIA SYSTEMS: INFRASTRUCTURE OF AUDIOVISUAL SERVICES – CODING OF MOVING VIDEO REC. ITU-T H.265 at § 7.3.5 (February 2018).

480. The Microsoft ‘450 Products perform rendering of an output image to be displayed on a display device on the basis of the first data-element selected by the filter. The overlay data is used to render overlays of the display data. The amount of overlay data that is downloaded in the form of Non-VCL data comprises a portion of the overlay that is displayed.

481. On information and belief, Microsoft has directly infringed and continues to directly infringe the ‘450 patent by, among other things, making, using, offering for sale, and/or selling technology for displaying information, including but not limited to the Microsoft ‘450 Products.

482. On information and belief, one or more of the Microsoft ‘450 Products enable methods and systems wherein a user does not need to make a new selection after being switched from one service to a second service.

483. On information and belief, one or more of the Microsoft ‘450 Products perform a method of displaying information on a display device wherein receiving a transport stream comprises services, with the services having elementary streams of video and of data elements.

484. On information and belief, one or more of the Microsoft ‘450 Products perform a method of displaying information on a display device wherein user actions of making a user selection of a type of information to be displayed on the device are received.

485. On information and belief, one or more of the Microsoft ‘450 Products perform a method of displaying information on a display device wherein filtering to select a data element of a first one of the services on the basis of the user selection is performed.

486. On information and belief, one or more of the Microsoft ‘450 Products perform a method of displaying information on a display device wherein rendering to calculate an output

image to be displayed on the display device, on the basis of the first data element selected by the filer is performed.

487. On information and belief, one or more of the Microsoft '450 Products perform a method of displaying information on a display device wherein switching from the first one of the services to a second one of the services, characterized in comprising a second step of filtering to select a second data-element of the second one of the services, on the basis of the user selection is performed.

488. On information and belief, one or more of the Microsoft '450 Products perform a method of displaying information on a display device wherein being switched from the first one of the services to the second one of the services, with the data-element and the second data-element being mutually semantically related and a second step of rendering to calculate the output image to be displayed on the display device, on the basis of the second data-element selected by the filter is performed.

489. On information and belief, the Microsoft '450 Products are available to businesses and individuals throughout the United States.

490. On information and belief, the Microsoft '450 Products are provided to businesses and individuals located in the Eastern District of Texas.

491. By making, using, testing, offering for sale, and/or selling products and services for displaying information, including but not limited to the Microsoft '450 Products, Microsoft has injured Dynamic Data and is liable to the Plaintiff for directly infringing one or more claims of the '450 Patent, including at least claim 8 pursuant to 35 U.S.C. § 271(a).

492. On information and belief, Microsoft also indirectly infringes the '450 patent by actively inducing infringement under 35 USC § 271(b).

493. Microsoft has had knowledge of Dynamic Data's patent portfolio, and each of the patents-in-suit, since at least August 20, 2018, when Dynamic Data's Chinese counsel sent a letter to Microsoft regarding Dynamic Data's patent portfolio, in which Dynamic Data identified each of the patents-in-suit, including the '450 patent.

494. Alternatively, on information and belief, Microsoft has had knowledge of the '450 patent since at least service of the Original Complaint in this case or shortly thereafter, and on information and belief, Microsoft knew of the '450 patent and knew of its infringement, including by way of this lawsuit.

495. On information and belief, Microsoft intended to induce patent infringement by third-party customers and users of the Microsoft '450 Products and had knowledge that the inducing acts would cause infringement or was willfully blind to the possibility that its inducing acts would cause infringement. Microsoft specifically intended and was aware that the normal and customary use of the accused products would infringe the '450 patent. Microsoft performed the acts that constitute induced infringement, and would induce actual infringement, with knowledge of the '450 patent and with the knowledge that the induced acts would constitute infringement. For example, Microsoft provides the Microsoft '450 Products that have the capability of operating in a manner that infringe one or more of the claims of the '450 patent, including at least claim 8, and Microsoft further provides documentation and training materials that cause customers and end users of the Microsoft '450 Products to utilize the products in a manner that directly infringe one or more claims of the '450 patent.[36] By providing instruction and training to customers and end-

[36] *See, e.g., CnX Player – Powerful Ultra HD 4K Video Player*, MICROSOFT WEBSITE, *available at:* https://www.microsoft.com/en-us/p/cnx-player-powerful-ultra-hd-4k-video-player/9nblggh1r7w5?activetab=pivot:overviewtab (last visited Nov. 2018); *Getting to know Windows 10*, MICROSOFT IT SHOWCASE, *available at*: https://www.microsoft.com/en-us/itpro/windows-10/end-user-readiness (last visited Nov. 2018); *Windows 10 Subscription Activation*, MICROSOFT WEBSITE (May 22, 2018); Bott, Ed, *Introducing Windows 10 for IT*

users on how to use the Microsoft '450 Products in a manner that directly infringes one or more claims of the '450 patent, including at least claim 8, Microsoft specifically intended to induce infringement of the '450 patent. On information and belief, Microsoft engaged in such inducement to promote the sales of the Microsoft '450 Products, e.g., through Microsoft user manuals, product support, marketing materials, and training materials to actively induce the users of the accused products to infringe the '450 patent. Accordingly, Microsoft has induced and continues to induce users of the accused products to use the accused products in their ordinary and customary way to infringe the '450 patent, knowing that such use constitutes infringement of the '450 patent.

496. The '450 patent is well-known within the industry as demonstrated by multiple citations to the '450 patent in published patents and patent applications assigned to technology companies and academic institutions. Microsoft is utilizing the technology claimed in the '450 patent without paying a reasonable royalty. Microsoft is infringing the '450 patent in a manner best described as willful, wanton, malicious, in bad faith, deliberate, consciously wrongful, flagrant, or characteristic of a pirate.

497. To the extent applicable, the requirements of 35 U.S.C. § 287(a) have been met with respect to the '450 patent.

498. As a result of Microsoft's infringement of the '450 patent, Dynamic Data has suffered monetary damages, and seeks recovery in an amount adequate to compensate for Microsoft's infringement, but in no event less than a reasonable royalty for the use made of the invention by Microsoft together with interest and costs as fixed by the Court.

Professionals, Preview Edition, MICROSOFT PRESS (2015); *Tutorial: Upload, encode, and stream videos using APIs*, MICROSOFT AZURE WEBSITE (Oct. 15, 2018); *Quickstart: Stream video files - .NET*, MICROSOFT AZURE WEBSITE (Oct. 15, 2018); *Quickstart: Create an Azure CDN profile and endpoint*, MICROSOFT AZURE WEBSITE (May 23, 2018).

COUNT XIII
INFRINGEMENT OF U.S. PATENT NO. 7,750,979

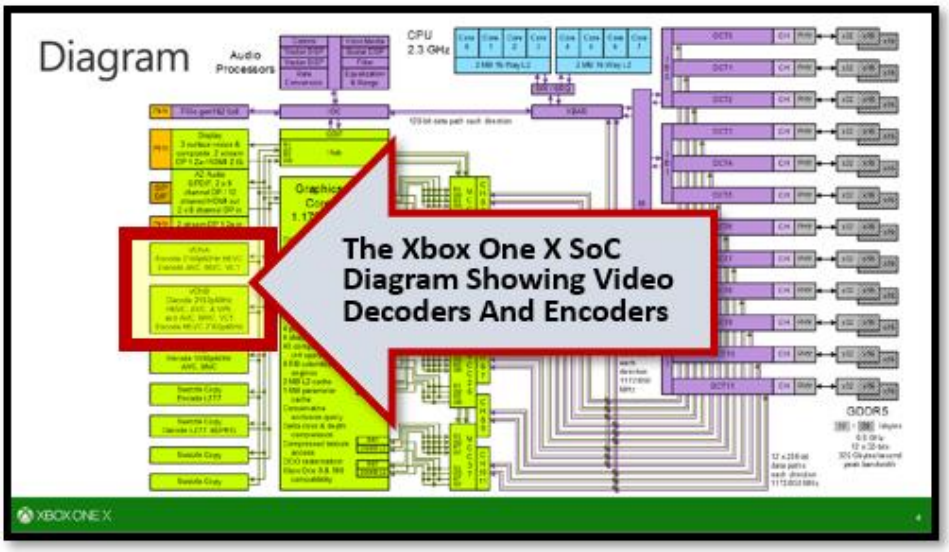
499. Dynamic Data references and incorporates by reference the preceding paragraphs of this Complaint as if fully set forth herein.

500. Microsoft designs, makes, uses, sells, and/or offers for sale in the United States products and/or services for motion compensation in video signal processing.

501. Microsoft designs, makes, sells, offers to sell, imports, and/or uses Microsoft video processing circuitry that contains Graphics Core Next ("GCN") (Versions 2-4) including but not limited to, Microsoft Xbox One, Xbox One S, and Xbox One X (collectively, the "Microsoft '979 Product(s)").

502. On information and belief, one or more Microsoft subsidiaries and/or affiliates use the Microsoft '979 Products in regular business operations.

503. On information and belief, the Microsoft '979 Products are sold by Microsoft under the Xbox brand and contain AMD GCN circuitry.



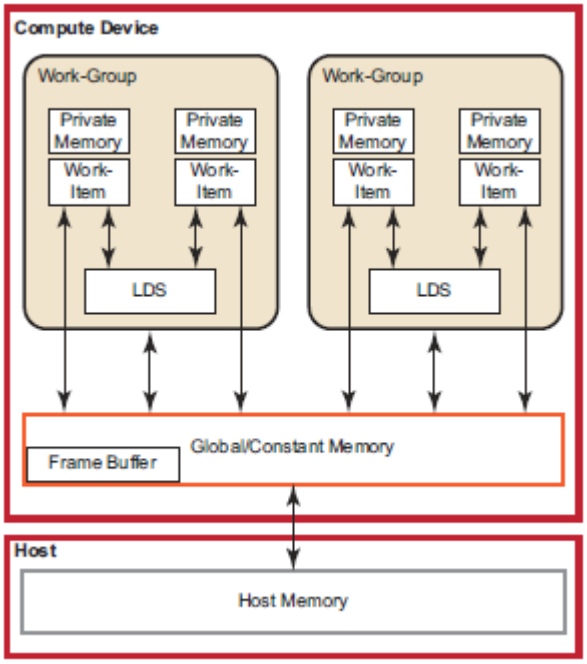
Xbox One X Scorpio Engine, MICROSOFT PRESENTATION at 4 (November 7, 2017) (annotations added).

504. On information and belief, one or more of the Microsoft '979 Products include technology for motion compensation in video signal processing.

505. On information and belief, Microsoft has directly infringed and continues to directly infringe the '979 patent by, among other things, making, using, offering for sale, and/or selling technology for motion compensation in video signal processing, including but not limited to the Microsoft '979 Products.

506. On information and belief, one or more of the Microsoft '979 Products have a variable window size for sampling subsets of the array as a two-dimensional window that spans the pixels in the array.

507. The Microsoft '979 Products perform the step of establishing a window size. The below documentation from AMD shows how the Microsoft '979 Products pass the data for display in the window through a buffer.



AMD REFERENCE GUIDE: GRAPHICS CORE NEXT ARCHITECTURE, GENERATION 3 REV. 1.1 at § 10.1 (August 2016).

508. The Microsoft '979 Products contain functionality wherein the data that is passed to the buffer is of an established window size. The below excerpt from AMD documentation describes how the Render Back Ends calculate the window size and pass the corresponding data for the window display to the buffer.

> Once the pixels fragments in a tile have been shaded, they flow to the Render Back-Ends (RBEs). The RBEs apply depth, stencil and alpha tests to determine whether pixel fragments are visible in the final frame. The visible pixels fragments are then sampled for coverage and color to construct the final output pixels. The RBEs in GCN can access up to 8 color samples (i.e. 8x MSAA) from the 16KB color caches and 16 overage samples (i.e. for up to 16x EQAA) from the 4KB depth caches per pixel. The color samples are blended using weights determined by the coverage samples to generate a final anti-aliased pixel color. The results are written out to the frame buffer, through the memory controllers.

AMD Graphic Cores Next ("GCN") Architecture, AMD WHITEPAPER at 13 (June 2012) (emphasis added).

509. On information and belief, one or more of the Microsoft '979 Products have a video processing stage that inputs pixels using a fixed number of pixels.

510. On information and belief, one or more of the Microsoft '979 Products performs a method for delivering the input stream of pixels to the video processing stage.

511. The Microsoft '979 Products place the data for the corresponding sample window in two buffers which are called the DMIF or Display Memory Interface FIFO and the line buffer. The data that is based to the DMIF and line buffer comprise data sufficient for display in the window.

> DRAM is most commonly placed in self-refresh due to stutter mode when the internal GPU is in use. The display buffer in the GPU is a combination of a large buffer known as the DMIF (Display Memory Interface FIFO) and a smaller line buffer. The DMIF takes data originating from DRAM and sends it to the line buffer to draw to the screen. When the data level in the DMIF is full, DRAM is placed in self-refresh, and incoming DRAM requests are queued. As the DMIF drains, it eventually falls below a predefined watermark level, at which point hardware pulls DRAM out of self-refresh and services all the requests in the queue. Once all the requests are

> complete and the DMIF is full again, a transition back into self-refresh occurs if the stutter mode conditions are still met.

BKDG for AMD Family 15h Models 70h-7Fh Processors, AMD DOCUMENT NO. 55072 REV. 3.09 at 73 (June 2018) (emphasis added)

512. On information and belief, one or more of the Microsoft '979 Products performs a method comprising establishing a window size and a sampling-window size, such that the window size is a multiple of the sampling-window size and the sampling-window size defines the fixed number of pixels.

513. On information and belief, one or more of the Microsoft '979 Products performs a method comprising storing pixels from the input stream into a first set of line butters, the pixels stored in the first set of line butters including pixels for the established window size.

514. On information and belief, one or more of the Microsoft '979 Products performs a method comprising prefetching the stored pixels from the first set of line butters into a second set of line buffers, the second set of line buffers being sufficiently long to store at least the pixels corresponding to the established sampling-window size.

515. On information and belief, one or more of the Microsoft '979 Products performs a method comprising fetching the fixed number of pixels from the second set of line buffers for the video processing stage.

516. On information and belief, one or more of the Microsoft '979 Products performs a method wherein storing pixels from the input stream into a first set of line butters, the pixels stored in the first set of line butters including pixels for the established window size, prefetching the stored pixels from the first set of line butters into a second set of line buffers, and fetching the fixed number of pixels from the second set of line buffers for the video processing stage are performed concurrently.

517. On information and belief, the Microsoft '979 Products are available to businesses and individuals throughout the United States.

518. On information and belief, the Microsoft '979 Products are provided to businesses and individuals located in the Eastern District of Texas.

519. By making, using, testing, offering for sale, and/or selling products and services for motion compensation in video signal processing, including but not limited to the Microsoft '979 Products, Microsoft has injured Dynamic Data and is liable to the Plaintiff for directly infringing one or more claims of the '979 patent, including at least claim 1 pursuant to 35 U.S.C. § 271(a).

520. On information and belief, Microsoft also indirectly infringes the '979 patent by actively inducing infringement under 35 USC § 271(b).

521. Microsoft has had knowledge of Dynamic Data's patent portfolio, and each of the patents-in-suit, since at least August 20, 2018, when Dynamic Data's Chinese counsel sent a letter to Microsoft regarding Dynamic Data's patent portfolio, in which Dynamic Data identified each of the patents-in-suit, including the '979 patent.

522. Alternatively, on information and belief, Microsoft has had knowledge of the '979 patent since at least service of the Original Complaint in this case or shortly thereafter, and on information and belief, Microsoft knew of the '979 patent and knew of its infringement, including by way of this lawsuit.

523. On information and belief, Microsoft intended to induce patent infringement by third-party customers and users of the Microsoft '979 Products and had knowledge that the inducing acts would cause infringement or was willfully blind to the possibility that its inducing acts would cause infringement. Microsoft specifically intended and was aware that the normal and customary use of the accused products would infringe the '979 patent. Microsoft performed the

acts that constitute induced infringement, and would induce actual infringement, with knowledge of the '979 patent and with the knowledge that the induced acts would constitute infringement. For example, Microsoft provides the Microsoft '979 Products that have the capability of operating in a manner that infringe one or more of the claims of the '979 patent, including at least claim 1, and Microsoft further provides documentation and training materials that cause customers and end users of the Microsoft '979 Products to utilize the products in a manner that directly infringe one or more claims of the '979 patent.[37] By providing instruction and training to customers and end-users on how to use the Microsoft '979 Products in a manner that directly infringes one or more claims of the '979 patent, including at least claim 1, Microsoft specifically intended to induce infringement of the '979 patent. On information and belief, Microsoft engaged in such inducement to promote the sales of the Microsoft '979 Products, e.g., through Microsoft user manuals, product support, marketing materials, and training materials to actively induce the users of the accused products to infringe the '979 patent. Accordingly, Microsoft has induced and continues to induce users of the accused products to use the accused products in their ordinary and customary way to infringe the '979 patent, knowing that such use constitutes infringement of the '979 patent.

524. To the extent applicable, the requirements of 35 U.S.C. § 287(a) have been met with respect to the '979 patent.

525. As a result of Microsoft's infringement of the '979 patent, Dynamic Data has suffered monetary damages, and seeks recovery in an amount adequate to compensate for

[37] *See, e.g.*, *What is 4K?, Video: Set up 4K and HDR*, XBOX WEBSITE, *available at*: https://support.xbox.com/en-US/xbox-one/console/4k-on-xbox-one (last visited Nov. 2018); *Capturing 4K HDR game clips and screenshots*, XBOX WEBSITE, *available at*: https://support.xbox.com/en-US/xbox-one/console/capture-4k-HDR-game-clips-and-screenshots (last visited Nov. 2018); *Set up your Xbox One X console*, XBOX SUPPORT WEBSITE, *available at*: https://support.xbox.com/en-US/xbox-one/console/set-up-new-xbox-x-solution (last visited Nov. 2018).

Microsoft's infringement, but in no event less than a reasonable royalty for the use made of the invention by Microsoft together with interest and costs as fixed by the Court.

COUNT XIV
INFRINGEMENT OF U.S. PATENT NO. 6,639,944

526. Dynamic Data references and incorporates by reference the preceding paragraphs of this Complaint as if fully set forth herein.

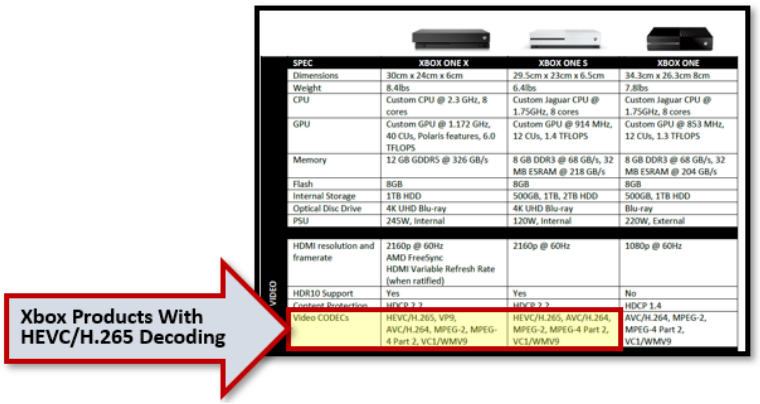
527. Microsoft designs, makes, uses, sells, and/or offers for sale in the United States products and/or services for sub-pixel accurate motion vector estimation and motion-compensated interpolation or prediction.

528. Microsoft designs, makes, sells, offers to sell, imports, and/or uses Microsoft products capable of decoding video data in compliance with the H.265 standard. By way of example, the following Microsoft Products perform decoding pursuant to the H.265 standard: Microsoft Xbox One DX, Microsoft Xbox One S, Windows 10 products (including Windows 10 Home, Windows 10 Pro, Windows 10 Enterprise, Windows 10 Education, Windows 10 Pro Education, and Windows 10 LTSB). and Microsoft Azure (including Microsoft Azure Media Services and Azure Content Delivery Network) (collectively, the "Microsoft '944 Product(s)").

529. The Microsoft '944 Products perform video decoding compliant with the H.265/HEVC standard. *See e.g.*, *Xbox One Family of Devices*, MICROSOFT XBOX SPECIFICATION SHEET at 1 (October 2017) (stating that the Xbox One X and Xbox One S support HEVC/H.265 decoding). *Comparison of Azure on Demand Media Encoder*, AZURE MEDIA SERVICES DOCUMENTATION (October 23, 2018), *available at*: https://docs.microsoft.com/en-us/azure/media-services/previous/media-services-compare-encoders (showing that the Media Encoder Standard And Premium Workflow supports HEVC input); *Microsoft H.265 Video Decoder*, MICROSOFT

MEDIA FOUNDATION DOCUMENTATION (MAY 30, 2018), *available at*: https://docs.microsoft.com/en-us/windows/desktop/medfound/ ("The Media Foundation H.265 video decoder is a Media Foundation Transform that supports decoding H.265/HEVC content in Annex B format and can be used in playback of mp4 and m2ts files.").

530. Further, Microsoft documentation establishes that the Microsoft Xbox Products include input for receiving and decoding HEVC video data. "10-bit HD High Efficiency Video Coding (HEVC) platform support added: 10-bit HD HEVC enables video-streaming apps, like Netflix, to use lower bandwidth to deliver HD-quality video streams." *Xbox One 2015 Operation System Update*, XBOX.COM WEBSITE (last visited August 2018), *available at*: https://support.xbox.com/en-US/xbox-one/console/system-update-operating-system-2015.



SPEC	XBOX ONE X	XBOX ONE S	XBOX ONE
Dimensions	30cm x 24cm x 6cm	29.5cm x 23cm x 6.5cm	34.3cm x 26.3cm 8cm
Weight	8.4lbs	6.4lbs	7.8lbs
CPU	Custom CPU @ 2.3 GHz, 8 cores	Custom Jaguar CPU @ 1.75GHz, 8 cores	Custom Jaguar CPU @ 1.75GHz, 8 cores
GPU	Custom GPU @ 1.172 GHz, 40 CUs, Polaris features, 6.0 TFLOPS	Custom GPU @ 914 MHz, 12 CUs, 1.4 TFLOPS	Custom GPU @ 853 MHz, 12 CUs, 1.3 TFLOPS
Memory	12 GB GDDR5 @ 326 GB/s	8 GB DDR3 @ 68 GB/s, 32 MB ESRAM @ 218 GB/s	8 GB DDR3 @ 68 GB/s, 32 MB ESRAM @ 204 GB/s
Flash	8GB	8GB	8GB
Internal Storage	1TB HDD	500GB, 1TB, 2TB HDD	500GB, 1TB HDD
Optical Disc Drive	4K UHD Blu-ray	4K UHD Blu-ray	Blu-ray
PSU	245W, Internal	120W, Internal	220W, External
VIDEO			
HDMI resolution and framerate	2160p @ 60Hz AMD FreeSync HDMI Variable Refresh Rate (when ratified)	2160p @ 60Hz	1080p @ 60Hz
HDR10 Support	Yes	Yes	No
Content Protection	HDCP 2.2	HDCP 2.2	HDCP 1.4
Video CODECs	HEVC/H.265, VP9, AVC/H.264, MPEG-2, MPEG-4 Part 2, VC1/WMV9	HEVC/H.265, AVC/H.264, MPEG-2, MPEG-4 Part 2, VC1/WMV9	AVC/H.264, MPEG-2, MPEG-4 Part 2, VC1/WMV9

Xbox One Family of Devices, MICROSOFT XBOX SPECIFICATION SHEET at 1 (October 2017) (annotation added), *available at*: https://news.xbox.com/wp-content/uploads/Xbox_One_Spec_Sheet.pdf.

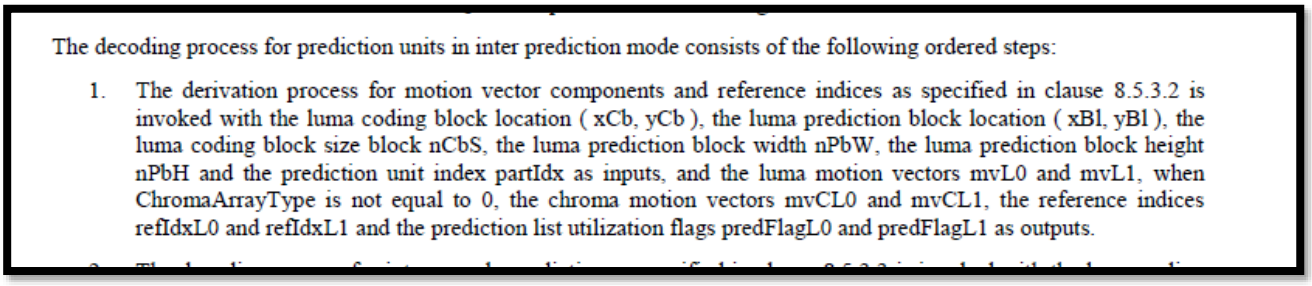
531. On information and belief, one or more Microsoft subsidiaries and/or affiliates use the Microsoft '944 Products in regular business operations.

532. On information and belief, one or more of the Microsoft '944 Products include technology for sub-pixel accurate motion vector estimation and motion-compensated interpolation or prediction.

533. On information and belief, one or more Microsoft subsidiaries and/or affiliates use the Microsoft '944 Products in regular business operations.

534. On information and belief, one or more of the Microsoft '944 Products perform a method of generating an intermediate image using sub-pixel accurate motion vectors having vector components that may have non-integer values, from first and second images having a given mutual temporal distance, the intermediate image being at a fractional distance from said first image, said fractional distance being a fraction of said given mutual temporal distance.

535. On information and belief, the Microsoft '944 Products comply with the HEVC standard, which requires determining motion vectors assigned to individual image regions of an image.



The decoding process for prediction units in inter prediction mode consists of the following ordered steps:

1. The derivation process for motion vector components and reference indices as specified in clause 8.5.3.2 is invoked with the luma coding block location (xCb, yCb), the luma prediction block location (xBl, yBl), the luma coding block size block nCbS, the luma prediction block width nPbW, the luma prediction block height nPbH and the prediction unit index partIdx as inputs, and the luma motion vectors mvL0 and mvL1, when ChromaArrayType is not equal to 0, the chroma motion vectors mvCL0 and mvCL1, the reference indices refIdxL0 and refIdxL1 and the prediction list utilization flags predFlagL0 and predFlagL1 as outputs.

High Efficiency Video Coding, SERIES H: AUDIOVISUAL AND MULTIMEDIA SYSTEMS: INFRASTRUCTURE OF AUDIOVISUAL SERVICES – CODING OF MOVING VIDEO REC. ITU-T H.265 at § 8.5.3.1 (February 2018).

536. On information and belief, one or more of the Microsoft '944 Products perform a method that includes deriving first and second vectors from said sub-pixel accurate motion vectors.

537. On information and belief, one or more of the Microsoft '944 Products perform a method that includes generating an intermediate image by combining first positions in a first image shifted over first vectors and second positions in said second image shifted over second vectors.

> One way of achieving high video compression is to predict pixel values for a frame based on prior and succeeding pictures in the video. Like its predecessors, H.265 features the ability to predict pixel values between pictures, and in particular, to specify in which order pictures are coded and which pictures are predicted from which. The coding order is specified for Groups Of Pictures (GOP), where a

> number of pictures are grouped together and predicted from each other in a specified order. The pictures available to predict from, called reference pictures, are specified for every individual picture.

Johan Bartelmess, Compression Efficiency of Different Picture Coding Structures in High Efficiency Video Coding (HEVC), UPTEC STS 16006 at 4 (March 2016) (emphasis added).

538. On information and belief, one or more of the Microsoft '944 Products perform a method that includes deriving first and second vectors from sub-pixel accurate motion vectors by multiplying the vector components of the sub-pixel accurate motion vectors by a fraction to obtain fractional vector components.

> three spatially neighboring MVs. HEVC improves the MV prediction by applying an MV prediction competition as initially proposed in [18]. In HEVC, this competition was further adapted to large block sizes with so-called *advanced motion vector prediction* (AMVP) in [19]. In the DIS *Main profile*, AMVP has two predictor candidates competing for the prediction. Two spatial motion vector predictor (MVP) candidates are considered and, when at least one of them is not available or they are redundant, a temporal motion vector prediction (TMVP) candidate is considered. The candidates

Philipp Helle, Simon Oudin, Benjamin Bross, Detlev Marpe, M. Oguz Bici, Kemal Ugur, Joel Jung, Gordon Clare, and Thomas Wiegand, *Block Merging for Quadtree-Based Partitioning in HEVC*, IEEE TRANS. CIR. AND SYS. FOR VIDEO TECHNOLOGY, Vol. *22* No. 12 (December 2012) ("AMVP has two predictor candidates competing for the prediction. Two spatial motion vector predictor (MVP) candidates are considered and, when at least one of them is not available or they are redundant, a temporal motion vector prediction (TMVP) candidate is considered.").

539. In AMVP, the motion vector selection process is composed by two steps wherein the candidate motion vectors are constructed into an index and then the motion vectors are compared. "In AMVP, the motion vector selection process is composed by two steps in encoder implementation. The first step is the motion vector candidate set construction process and the second step is the best motion vector selection step. In the first step, the motion vector candidate set is organized by selecting the motion vectors spatially and temporally." Gwo-Long Li, Chuen-

Ching Wang, and Kuang-Hung Chiang, *An Efficient Motion Vector Prediction Method for Avoiding AMVP Data Dependency For HEVC*, 2014 IEEE INTERNATIONAL CONFERENCE ON ACOUSTIC, SPEECH AND SIGNAL PROCESSING (ICASSP) at 7412-13 (2014).

540. On information and belief, one or more of the Microsoft '944 Products perform a method that includes deriving first and second vectors from sub-pixel accurate motion vectors by rounding the fractional vector components to obtain vector components of the first vectors, which have only integer vector components.

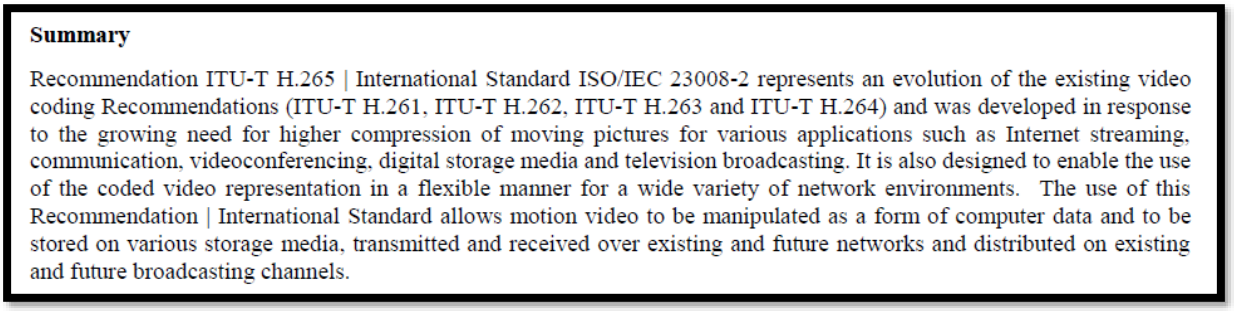
> Using a translational motion model, the position of the block in a previously decoded picture is indicated by a motion vector: Δx; Δy where Δx specifies the horizontal and Δy the vertical displacement relative to the position of the current block. The motion vectors: Δx; Δy could be of fractional sample accuracy to more accurately capture the movement of the underlying object. Interpolation is applied on the reference pictures to derive the prediction signal when the corresponding motion vector has fractional sample accuracy. The previously decoded picture is referred to as the reference picture and indicated by a reference index Δt to a reference picture list. These translational motion model parameters, i.e. motion vectors and reference indices, are further referred to as motion data.

Benjamin Bross, *Inter-Picture Prediction In HEVC*, IN HIGH EFFICIENCY VIDEO CODING (HEVC) (Vivienne Sze, Madhukar Budagavi, and Gary J. Sullivan (Editors)) at 114 (September 2014) (emphasis added).

541. On information and belief, one or more of the Microsoft '944 Products perform a method that includes deriving first and second vectors from sub-pixel accurate motion vectors by subtracting the first vector from the candidate vector to obtain the second vector, whereby the second vectors have vector components that, depending on the candidate vector and the fraction, may have non-integer values.

542. The Microsoft '944 Products contain functionality for motion compensation where two or more motion vectors can be applied. Further, one or two motion vectors can be applied to the image processing process. The application of the motion vectors leads to uni-predictive or bi-

predictive coding, respectively, where bi-predictive coding uses an averaged result of two predictions to form the final prediction.



Summary

Recommendation ITU-T H.265 | International Standard ISO/IEC 23008-2 represents an evolution of the existing video coding Recommendations (ITU-T H.261, ITU-T H.262, ITU-T H.263 and ITU-T H.264) and was developed in response to the growing need for higher compression of moving pictures for various applications such as Internet streaming, communication, videoconferencing, digital storage media and television broadcasting. 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.

Series H: Audiovisual and Multimedia Systems- Infrastructure of Audiovisual Services – Coding of Moving Video, INTERNATIONAL TELECOMMUNICATIONS UNIONS - TU-T H.265, V.5 at I (February 2018).

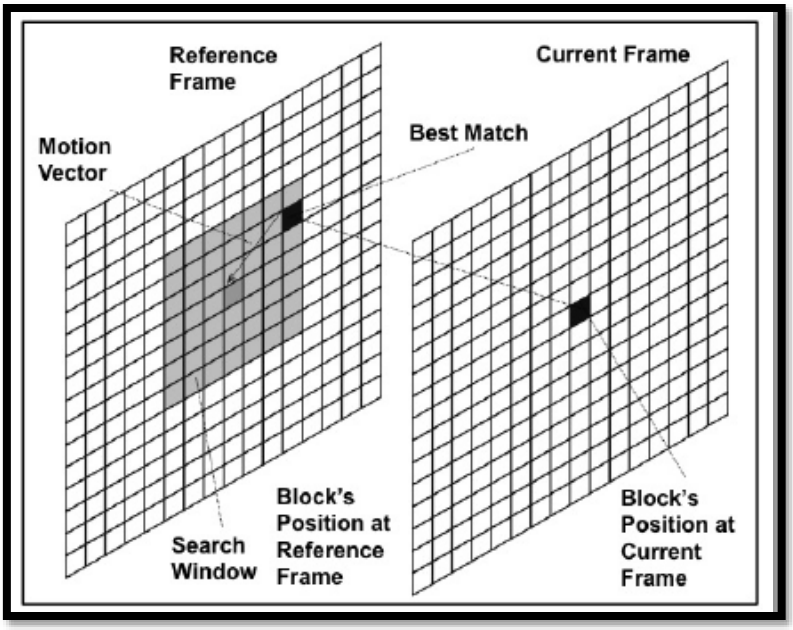
543. On information and belief, Microsoft has directly infringed and continues to directly infringe the ’944 patent by, among other things, making, using, offering for sale, and/or selling technology for sub-pixel accurate motion vector estimation and motion-compensated interpolation or prediction, including but not limited to the Microsoft ’944 Products.

544. The following excerpt from a book describes that the motion estimation is done through PU matching method and that the MV represents the displacement between the current PU in the current frame and the matching PU in the reference frame.

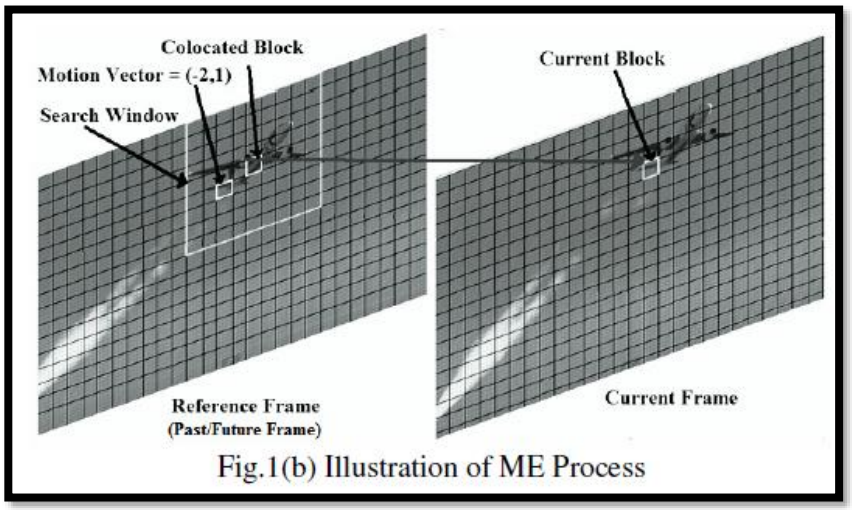
> Motion estimation compares the current prediction unit (PU) with the spatially neighboring PUs in the reference frames, and chooses the one with the least difference to the current PU. The displacement between the current PU and the matching PU in the reference frames is signaled using a motion vector.

Sung-Fang Tsai, *et al.*, *Encoder Hardware Architecture for HEVC*, High Efficiency Video Coding (HEVC) at 347 (September 2014) (emphasis added).

545. The following exemplary drawings reflect that the corresponding image segment of a reference picture is co-located with the current image segment of a current picture.



R.C. LINS, *et al., A Faster Pixel-Decimation Method for Block Motion Estimation in H.264/AVC*, PUBLISHED IN TEND. MAT. APL. COMPUT., VOL. 15, NO. 1 at 120 (2014), *available at*: http://www.scielo.br/scielo.php?script=sci_arttext&pid=S2179-84512014000100010.



Purnachand Nalluri, *et al., Fast Motion Estimation Algorithm for HEVC Video Encoder*, published in 9TH CONFERENCE ON TELECOMMUNICATIONS, Vol. 1 at 1 (May 2013) (attached hereto as Exhibit_ZL 5), *available at*: https://www.it.pt/Publications/PaperConference/14332

546. For the AMVP mode with the motion estimation, the main goal of the motion estimation is to find the best matching block of each current PU and determine the real MV which represents the motion translation in the successive frame. The MV difference between the optimal AMVP candidate and the real MV derived from the motion estimation is encoded and transmitted

together with other information, e.g., the optimal AMVP and reference frame indexes. The motion estimation is conducted in two stages, the integer motion estimation IME") at integer pixel accuracy and the fractional motion estimation (FME) at subpixel accuracy. According to the "High Efficiency Video Coding (HEVC) Test Model 16 (HM 16) Improved Encoder Description Update 9" approved by JCT-VC, the best candidate MVP selected from the AMVP candidate list is used as an initial search center of the IME, which indicates that the search center of the IME is offset from the co-located block within the reference frame by the best candidate MVP.

547. Therefore, when the Microsoft Product processes the video data using AMVP mode based on the IME, the co-located block within the reference frame of the current PU corresponds to the selected image segment, and the best candidate MVP corresponds to the offset vector within the reference frame from the co-located block of the current PU (i.e., the selected image segment to the search center.

> To derive the motion vector(s) for each PU, a block matching algorithm is performed in the HM encoder. For AMVP, find the best candidate MV predictor for each ref_idx and ref_pic_list using xEstimateMvPredAMVP(), called from predInterSearch(). The default search range for the first search in the HM encoder is 96 integer pixels, however the CTC [3] uses a value of 64. A search window is defined according to the search range, relative to the **best candidate MV predictor**. Firstly an integer-pel search is performed, followed by a fractional-pel refinement search.

The Joint Collaborative Team on Video Coding (JCT-VC), *High Efficiency Video Coding (HEVC) Test Model 16 (HM 16) Improved Encoder Description Update 9*, ISO/IEC JTC1/SC29/WG11 N17047 at 43 (July 2017) (emphasis added), *available at*: https://mpeg.chiariglione.org/standards/mpeg-h/high-efficiency-video-coding/n17047-high-efficiency-video-coding-hevc-test-model-16.

548. On information and belief, by complying with the HEVC standard, the Microsoft products – such as the Microsoft '944 Products - necessarily infringe the '944 patent. The mandatory sections of the HEVC standard require the elements required by certain claims of the '944 patent, including but not limited to claim 2 of the '944 patent. *High Efficiency Video Coding*, SERIES H: AUDIOVISUAL AND Multimedia SYSTEMS: INFRASTRUCTURE OF AUDIOVISUAL SERVICES

– CODING OF MOVING VIDEO REC. ITU-T H.265 (February 2018) (The following sections of the HEVC Standard are relevant to Microsoft's infringement of the '944 patent: "8.3.2 Decoding process for reference picture set;" "8.5.4 Decoding process for the residual signal of coding units coded in inter prediction mode;" "8.6 Scaling, transformation and array construction process prior to deblocking filter process;" "8.5.2 Inter prediction process;" "8.5.3 Decoding process for prediction units in inter prediction mode;" and "8.7.2 Deblocking filter process;" "8.7.3 Sample adaptive offset process.").

549. On information and belief, one or more of the Microsoft '944 Products perform a method that includes deriving first and second vectors from said sub-pixel accurate motion vectors.

550. On information and belief, one or more of the Microsoft '944 Products perform a method that includes generating an intermediate image by combining first positions in a first image shifted over first vectors and second positions in said second image shifted over second vectors.

551. On information and belief, one or more of the Microsoft '944 Products perform a method that includes deriving first and second vectors from sub-pixel accurate motion vectors by multiplying the vector components of the sub-pixel accurate motion vectors by a fraction to obtain fractional vector components.

552. On information and belief, one or more of the Microsoft '944 Products perform a method that includes deriving first and second vectors from sub-pixel accurate motion vectors by rounding the fractional vector components to obtain vector components of the first vectors, which have only integer vector components.

553. On information and belief, one or more of the Microsoft '944 Products perform a method that includes deriving first and second vectors from sub-pixel accurate motion vectors by subtracting the first vector from the candidate vector to obtain the second vector, whereby the

second vectors have vector components that, depending on the candidate vector and the fraction, may have non-integer values.

554. On information and belief, the Microsoft '944 Products are available to businesses and individuals throughout the United States.

555. On information and belief, the Microsoft '944 Products are provided to businesses and individuals located in the Eastern District of Texas.

556. By making, using, testing, offering for sale, and/or selling products and services for sub-pixel accurate motion vector estimation and motion-compensated interpolation or prediction, including but not limited to the Microsoft '944 Products, Microsoft has injured Dynamic Data and is liable to the Plaintiff for directly infringing one or more claims of the '944 Patent, including at least claim 2 pursuant to 35 U.S.C. § 271(a).

557. On information and belief, Microsoft also indirectly infringes the '944 Patent by actively inducing infringement under 35 USC § 271(b).

558. Microsoft has had knowledge of the '944 Patent since at least service of this First Amended Complaint or shortly thereafter, and on information and belief, Microsoft knew of the '944 Patent and knew of its infringement, including by way of this lawsuit.

559. On information and belief, Microsoft intended to induce patent infringement by third-party customers and users of the Microsoft '944 Products and had knowledge that the inducing acts would cause infringement or was willfully blind to the possibility that its inducing acts would cause infringement. Microsoft specifically intended and was aware that the normal and customary use of the accused products would infringe the '944 Patent. Microsoft performed the acts that constitute induced infringement, and would induce actual infringement, with knowledge of the '944 Patent and with the knowledge that the induced acts would constitute infringement.

For example, Microsoft provides the Microsoft '944 Products that have the capability of operating in a manner that infringe one or more of the claims of the '944 Patent, including at least claim 2, and Microsoft further provides documentation and training materials that cause customers and end users of the Microsoft '944 Products to utilize the products in a manner that directly infringe one or more claims of the '944 Patent.[38] By providing instruction and training to customers and end-users on how to use the Microsoft '944 Products in a manner that directly infringes one or more claims of the '944 Patent, including at least claim 2, Microsoft specifically intended to induce infringement of the '944 Patent. On information and belief, Microsoft engaged in such inducement to promote the sales of the Microsoft '944 Products, e.g., through Microsoft user manuals, product support, marketing materials, and training materials to actively induce the users of the accused products to infringe the '944 Patent. Accordingly, Microsoft has induced and continues to induce users of the accused products to use the accused products in their ordinary and customary way to infringe the '944 Patent, knowing that such use constitutes infringement of the '944 Patent.

560. The '944 Patent is well-known within the industry as demonstrated by multiple citations to the '944 Patent in published patents and patent applications assigned to technology companies and academic institutions. Microsoft is utilizing the technology claimed in the '944 Patent without paying a reasonable royalty. Microsoft is infringing the '944 Patent in a manner

[38] *See, e.g.*, *CnX Player – Powerful Ultra HD 4K Video Player*, MICROSOFT WEBSITE, *available at:* https://www.microsoft.com/en-us/p/cnx-player-powerful-ultra-hd-4k-video-player/9nblggh1r7w5?activetab=pivot:overviewtab (last visited Nov. 2018); *Getting to know Windows 10*, MICROSOFT IT SHOWCASE, *available at*: https://www.microsoft.com/en-us/itpro/windows-10/end-user-readiness (last visited Nov. 2018); *Windows 10 Subscription Activation*, MICROSOFT WEBSITE (May 22, 2018); Bott, Ed, *Introducing Windows 10 for IT Professionals, Preview Edition*, MICROSOFT PRESS (2015); *Tutorial: Upload, encode, and stream videos using APIs*, MICROSOFT AZURE WEBSITE (Oct. 15, 2018); *Quickstart: Stream video files - .NET*, MICROSOFT AZURE WEBSITE (Oct. 15, 2018); *Quickstart: Create an Azure CDN profile and endpoint*, MICROSOFT AZURE WEBSITE (May 23, 2018).

best described as willful, wanton, malicious, in bad faith, deliberate, consciously wrongful, flagrant, or characteristic of a pirate.

561. To the extent applicable, the requirements of 35 U.S.C. § 287(a) have been met with respect to the '944 Patent. As a result of Microsoft's infringement of the '944 Patent, Dynamic Data has suffered monetary damages, and seeks recovery in an amount adequate to compensate for Microsoft's infringement, but in no event less than a reasonable royalty for the use made of the invention by Microsoft together with interest and costs as fixed by the Court.

COUNT XV
INFRINGEMENT OF U.S. PATENT NO. 6,760,376

562. Dynamic Data references and incorporates by reference the preceding paragraphs of this Complaint as if fully set forth herein.

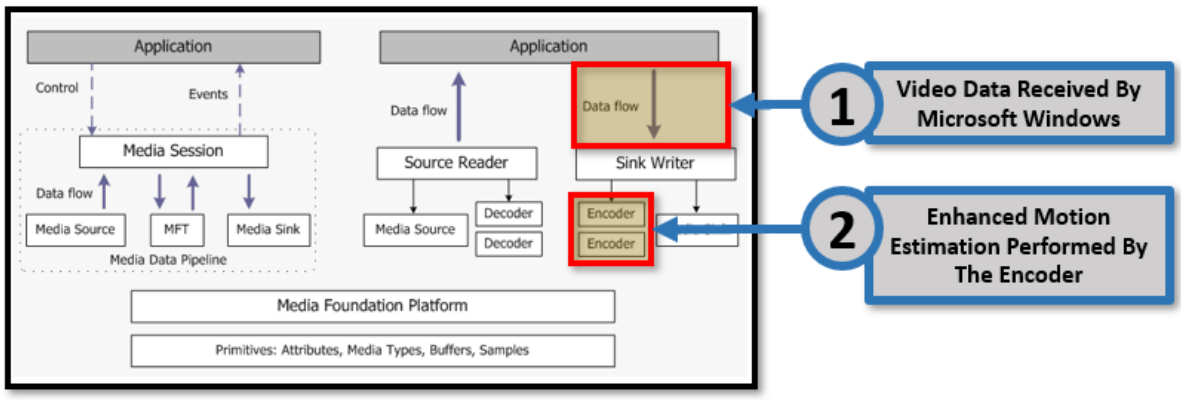
563. Microsoft designs, makes, uses, sells, and/or offers for sale in the United States products and/or services for motion compensated upconversion in a video image that uses motion compensation to generate an interpolated video field using motion vectors.

564. Microsoft designs, makes, sells, offers to sell, imports, and/or uses Microsoft products that comply with the H.265 video encoding standard. By way of example, the following Microsoft Products perform encoding pursuant to the H.265 standard: Windows 10 products (including Windows 10 Home, Windows 10 Pro, Windows 10 Enterprise, Windows 10 Education, Windows 10 Pro Education, and Windows 10 LTSB) and Microsoft Azure (including Microsoft Azure Media Services and Azure Content Delivery Network) (collectively, the "Microsoft '376 Product(s)").

565. The Microsoft '376 Products perform video encoding compliant with the H.265/HEVC standard. *Comparison of Azure on Demand Media Encoder,* AZURE MEDIA

SERVICES DOCUMENTATION (October 23, 2018), *available at*: https://docs.microsoft.com/en-us/azure/media-services/previous/media-services-compare-encoders (showing that the Media Encoder Premium Workflow supports HEVC output); *Microsoft H.265 Video Encoder*, MICROSOFT MEDIA FOUNDATION DOCUMENTATION (MAY 30, 2018) *available at*: https://docs.microsoft.com/en-us/windows/desktop/medfound/ ("The Media Foundation H.265 video encoder is a Media Foundation Transform that supports encoding content into the H.265/HEVC format.").

566. Microsoft '376 Products perform video processing through the use of a video encoder for motion estimation. The below image identifies an exemplar of the image processing component in the Microsoft '376 Products.



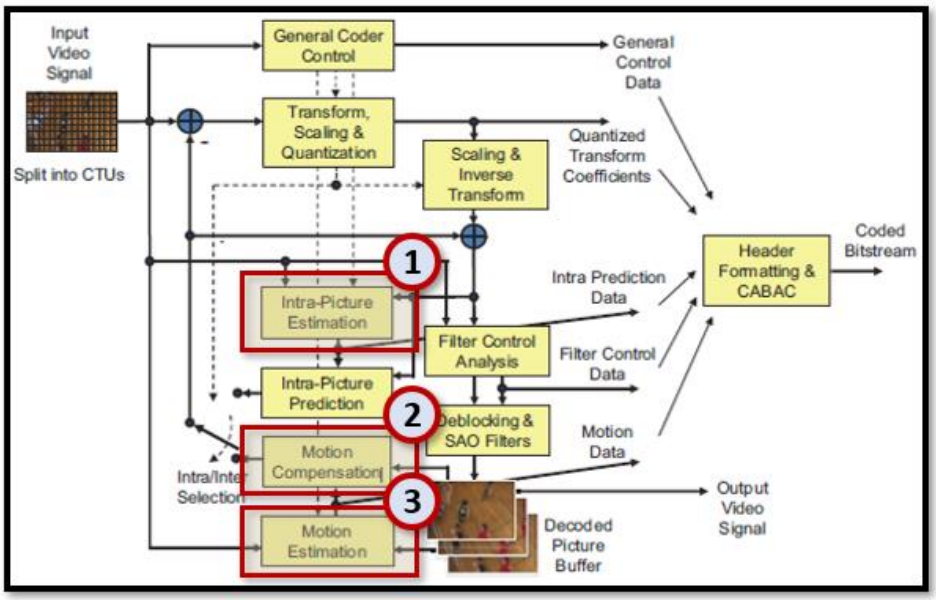
Overview of the Media Foundation Architecture, MICROSOFT DEVELOPER DOCUMENTATION, May 30, 2018 (annotations added).

567. On information and belief, one or more Microsoft subsidiaries and/or affiliates use the Microsoft '376 Products in regular business operations.

568. On information and belief, one or more of the Microsoft '376 Products include technology for motion compensated upconversion in a video image that uses motion compensation to generate an interpolated video field using motion vectors.

569. On information and belief, one or more of the Microsoft '376 Products use upconversion units to generate an interpolated field using motion vectors to in the process of performing motion compensation.

570. The Microsoft '376 Products use upconversion units within an image retrieved from memory. The frames are then processed using both motion compensation and motion estimation. The motion compensation functionality used by the Microsoft '376 Products include quarter-sample precision for the motion vectors and 7-tap or 8-tap filters that are used for interpolation of fractional-sample positions.



Standardized Extensions of High Efficiency Video Coding (HEVC), IEEE JOURNAL OF SELECTED TOPICS IN SIGNAL PROCESSING, VOL. 7, NO. 6 at 1002 (December 2013) (emphasis added) (the annotations showing (1) intra-picture prediction, (2) motion compensation, and (3) motion estimation).

571. On information and belief, one or more of the Microsoft '376 Products calculate a correlation value from the values of causal neighbor pixels of a generated field and from the values of corresponding neighbor pixels of a next field.

> It can be seen from Fig. 5.4b that only motion vectors from spatial neighboring blocks to the left and above the current block are considered as spatial MVP candidates. This can be explained by the fact that the blocks to the right and below

> the current block are not yet decoded and hence, their motion data is not available. Since the co-located picture is a reference picture which is already decoded, it is possible to also consider motion data from the block at the same position, from blocks to the right of the co-located block or from the blocks below**.** In HEVC, the block to the bottom right and at the center of the current block have been determined to be the most suitable to provide a good temporal motion vector predictor (TMVP).

Benjamin Bross, *et al., Inter-picture prediction in HEVC,* in HIGH EFFICIENCY VIDEO CODING (HEVC) at 119 (2014) (emphasis added).

572. On information and belief, one or more of the Microsoft '376 Products compare the correlation value with a threshold value.

> Motion estimation compares the current prediction unit (PU) with the spatially neighboring PUs in the reference frames, and chooses the one with the least difference to the current PU. The displacement between the current PU and the matching PU in the reference frames is signaled using a motion vector.

Sung-Fang Tsai, *et al., Encoder Hardware Architecture for HEVC,* HIGH EFFICIENCY VIDEO CODING (HEVC) at 347 (September 2014) (emphasis added).

573. On information and belief, one or more of the Microsoft '376 Products set the value of a pixel to be created within the generated field to be equal to the value of a corresponding pixel of the next field if the correlation value is less than the threshold value.

574. On information and belief, Microsoft has directly infringed and continues to directly infringe the '376 patent by, among other things, making, using, offering for sale, and/or selling technology for motion compensated upconversion in a video image that uses motion compensation to generate an interpolated video field using motion vectors, including but not limited to the Microsoft '376 Products.

575. On information and belief, by complying with the HEVC standard, the Microsoft products – such as the Microsoft '376 Products - necessarily infringe the '376 patent. The mandatory sections of the HEVC standard require the elements required by certain claims of the '376 patent, including but not limited to claim 4 of the '376 patent. *High Efficiency Video Coding*, SERIES H: AUDIOVISUAL AND Multimedia SYSTEMS: INFRASTRUCTURE OF AUDIOVISUAL SERVICES

– CODING OF MOVING VIDEO REC. ITU-T H.265 (February 2018) (The following sections of the HEVC Standard are relevant to Microsoft's infringement of the '376 patent: "8.3.2 Decoding process for reference picture set;" "8.5.4 Decoding process for the residual signal of coding units coded in inter prediction mode;" "8.6 Scaling, transformation and array construction process prior to deblocking filter process;" "8.5.2 Inter prediction process;" "8.5.3 Decoding process for prediction units in inter prediction mode;" and "8.7.2 Deblocking filter process;" "8.7.3 Sample adaptive offset process.").

576. On information and belief, one or more of the Microsoft '376 Products perform a method of motion compensation for use in a video image upconversion unit of the type that uses motion compensation to generate an interpolated field using motion vectors.

577. On information and belief, one or more of the Microsoft '376 Products perform a method of motion compensation that includes calculating a correlation value from the values of causal neighbor pixels of a generated field and from the values of corresponding neighbor pixels of a next field.

578. On information and belief, one or more of the Microsoft '376 Products perform a method of motion compensation that includes comparing the correlation value with a threshold value.

579. On information and belief, one or more of the Microsoft '376 Products perform a method of motion compensation that includes setting the value of a pixel to be created within the generated field to be equal to the value of a corresponding pixel of the next field if the correlation value is less than the threshold value.

580. On information and belief, the Microsoft '376 Products are available to businesses and individuals throughout the United States.

581. On information and belief, the Microsoft ’376 Products are provided to businesses and individuals located in the Eastrern District of Texas.

582. By making, using, testing, offering for sale, and/or selling products and services for motion compensated upconversion in a video image that uses motion compensation to generate an interpolated video field using motion vectors, including but not limited to the Microsoft ’376 Products, Microsoft has injured Dynamic Data and is liable to the Plaintiff for directly infringing one or more claims of the ’376 Patent, including at least claim 4 pursuant to 35 U.S.C. § 271(a).

583. On information and belief, Microsoft also indirectly infringes the ’376 Patent by actively inducing infringement under 35 USC § 271(b).

584. Microsoft has had knowledge of the ’376 Patent since at least service of this First Amended Complaint or shortly thereafter, and on information and belief, Microsoft knew of the ’376 Patent and knew of its infringement, including by way of this lawsuit.

585. On information and belief, Microsoft intended to induce patent infringement by third-party customers and users of the Microsoft ’376 Products and had knowledge that the inducing acts would cause infringement or was willfully blind to the possibility that its inducing acts would cause infringement. Microsoft specifically intended and was aware that the normal and customary use of the accused products would infringe the ’376 Patent. Microsoft performed the acts that constitute induced infringement, and would induce actual infringement, with knowledge of the ’376 Patent and with the knowledge that the induced acts would constitute infringement. For example, Microsoft provides the Microsoft ’376 Products that have the capability of operating in a manner that infringe one or more of the claims of the ’376 Patent, including at least claim 4, and Microsoft further provides documentation and training materials that cause customers and end users of the Microsoft ’376 Products to utilize the products in a manner that directly infringe one

or more claims of the '376 Patent.[39] By providing instruction and training to customers and end-users on how to use the Microsoft '376 Products in a manner that directly infringes one or more claims of the '376 Patent, including at least claim 4, Microsoft specifically intended to induce infringement of the '376 Patent. On information and belief, Microsoft engaged in such inducement to promote the sales of the Microsoft '376 Products, e.g., through Microsoft user manuals, product support, marketing materials, and training materials to actively induce the users of the accused products to infringe the '376 Patent. Accordingly, Microsoft has induced and continues to induce users of the accused products to use the accused products in their ordinary and customary way to infringe the '376 Patent, knowing that such use constitutes infringement of the '376 Patent.

586. The '376 Patent is well-known within the industry as demonstrated by multiple citations to the '376 Patent in published patents and patent applications assigned to technology companies and academic institutions. Microsoft is utilizing the technology claimed in the '376 Patent without paying a reasonable royalty. Microsoft is infringing the '376 Patent in a manner best described as willful, wanton, malicious, in bad faith, deliberate, consciously wrongful, flagrant, or characteristic of a pirate.

587. To the extent applicable, the requirements of 35 U.S.C. § 287(a) have been met with respect to the '376 Patent. As a result of Microsoft's infringement of the '376 Patent, Dynamic Data has suffered monetary damages, and seeks recovery in an amount adequate to

[39] *See, e.g., CnX Player – Powerful Ultra HD 4K Video Player*, MICROSOFT WEBSITE, *available at:* https://www.microsoft.com/en-us/p/cnx-player-powerful-ultra-hd-4k-video-player/9nblggh1r7w5?activetab=pivot:overviewtab (last visited Nov. 2018); *Getting to know Windows 10*, MICROSOFT IT SHOWCASE, *available at*: https://www.microsoft.com/en-us/itpro/windows-10/end-user-readiness (last visited Nov. 2018); *Windows 10 Subscription Activation*, MICROSOFT WEBSITE (May 22, 2018); Bott, Ed, *Introducing Windows 10 for IT Professionals, Preview Edition*, MICROSOFT PRESS (2015); *Tutorial: Upload, encode, and stream videos using APIs*, MICROSOFT AZURE WEBSITE (Oct. 15, 2018); *Quickstart: Stream video files - .NET*, MICROSOFT AZURE WEBSITE (Oct. 15, 2018); *Quickstart: Create an Azure CDN profile and endpoint*, MICROSOFT AZURE WEBSITE (May 23, 2018).

compensate for Microsoft's infringement, but in no event less than a reasonable royalty for the use made of the invention by Microsoft together with interest and costs as fixed by the Court.

PRAYER FOR RELIEF

WHEREFORE, Dynamic Data respectfully requests that this Court enter:

A. A judgment in favor of Dynamic Data that Microsoft has infringed, either literally and/or under the doctrine of equivalents, the '073, '257, '054, '918, '689, '177, '039, '112, '688, '529, '041, '450, '979, '944, and '376 patents;

B. An award of damages resulting from Microsoft's acts of infringement in accordance with 35 U.S.C. § 284;

C. A judgment and order finding that Microsoft's infringement was willful, wanton, malicious, bad-faith, deliberate, consciously wrongful, flagrant, or characteristic of a pirate within the meaning of 35 U.S.C. § 284 and awarding to Dynamic Data enhanced damages.

D. A judgment and order finding that this is an exceptional case within the meaning of 35 U.S.C. § 285 and awarding to Dynamic Data its reasonable attorneys' fees against Microsoft.

E. Any and all other relief to which Dynamic Data may show themselves to be entitled.

JURY TRIAL DEMANDED

Pursuant to Rule 38 of the Federal Rules of Civil Procedure, Dynamic Data Technologies, LLC requests a trial by jury of any issues so triable by right.

Dated: January 28, 2019

Respectfully submitted,

/s/ Daniel P. Hipskind
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Attorneys for Dynamic Data Technologies, LLC

CERTIFICATE OF SERVICE

I hereby certify that counsel of record who are deemed to have consented to electronic service are being served this 28th of January, 2019 with a copy of this document via the Court's CM/ECF System per Local Rule CV-5(a)(3). Any other counsel of record will be served by electronic mail, facsimile transmission and/or first class mail on this same date.

/s/ Daniel P. Hipskind
Daniel P. Hipskind