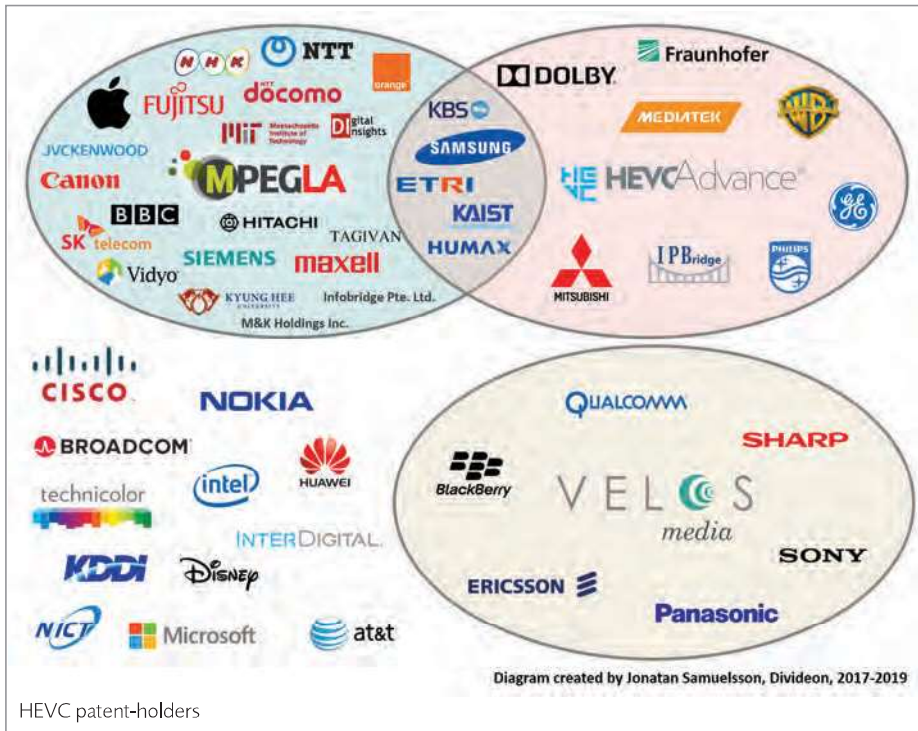


Video coding developments in a multi-codec world



community to doubt the ability of some licence holders to publish clear licensing terms in a timely manner. Six years after the HEVC standard was finalized, it is still impossible to create a business plan with an accurate estimate of the total licensing cost without signing multiple NDAs and expending considerable effort in commercial discussions. HEVC licenses are required from three patent pools: MPEG LA, HEVC Advance and Velos Media. In addition, there are many likely HEVC IP holders who are not members of any of the three pools and who have not made their licensing terms public, as illustrated in the diagram to the left (reproduced with the kind permission of Divideon).

A NEW ENTRANT: AV1

The complex licensing structure for HEVC has caused some key market segments, such as video streaming, to be reluctant to implement it. The Alliance for Open Media identified this gap in the market and has sought to fill it with the AV1 specification, which is claimed to be royalty-free. AV1 is supported by some major technology companies: the founding members are Amazon, Apple, ARM, Cisco, Facebook, Google, IBM, Intel, Microsoft, Mozilla, Netflix, and Nvidia.

There is still a shortage of well-conducted, neutral comparisons of the compression efficiency of AV1 and HEVC, but they seem to be roughly comparable in terms of compression efficiency. However, AV1 appears to require a significantly more complex encoder in order to achieve this performance, so it may be more difficult to use for real-time applications.

The desire to improve the real-world adoption of MPEG standards, by reassuring potential users that the licensing mistakes of HEVC will not be repeated, has led several industry players to get together and form the Media Coding Industry Forum (MC-IF). This provides a forum where members from different parts of the video compression ecosystem can meet to discuss and resolve a broad range of potential barriers to the deployment of MPEG standards, with an initial focus on VVC. The first board of directors of MC-IF was elected in January 2019, with directors from

The video compression industry has become used to a regular pattern of key milestones: once per decade a new video coding standard has been developed that offers approximately twice the coding efficiency of the previous one. MPEG-2, the first generic video compression standard to be widely adopted, was developed in the early 1990s. H.264/AVC, offering the same subjective quality at about half the bit rate, was developed in the early 2000s. HEVC, giving a further factor of two improvement in compression efficiency, was developed in the early 2010s.

However, this pattern of one dominant video codec per decade now appears to be changing, as we move into a more complex, multi-codec world.

FROM HEVC TO VVC?

Each of the standards mentioned above was developed through collaboration

between the same two standardization bodies: ISO/IEC MPEG and ITU-T VCEG. These two bodies are now working together again on a new video coding standard, known as Versatile Video Coding (VVC). Responses to a Call for Proposals were analyzed at a meeting in April 2018, with some proposals demonstrating compression efficiency gains of about 40% compared to HEVC.

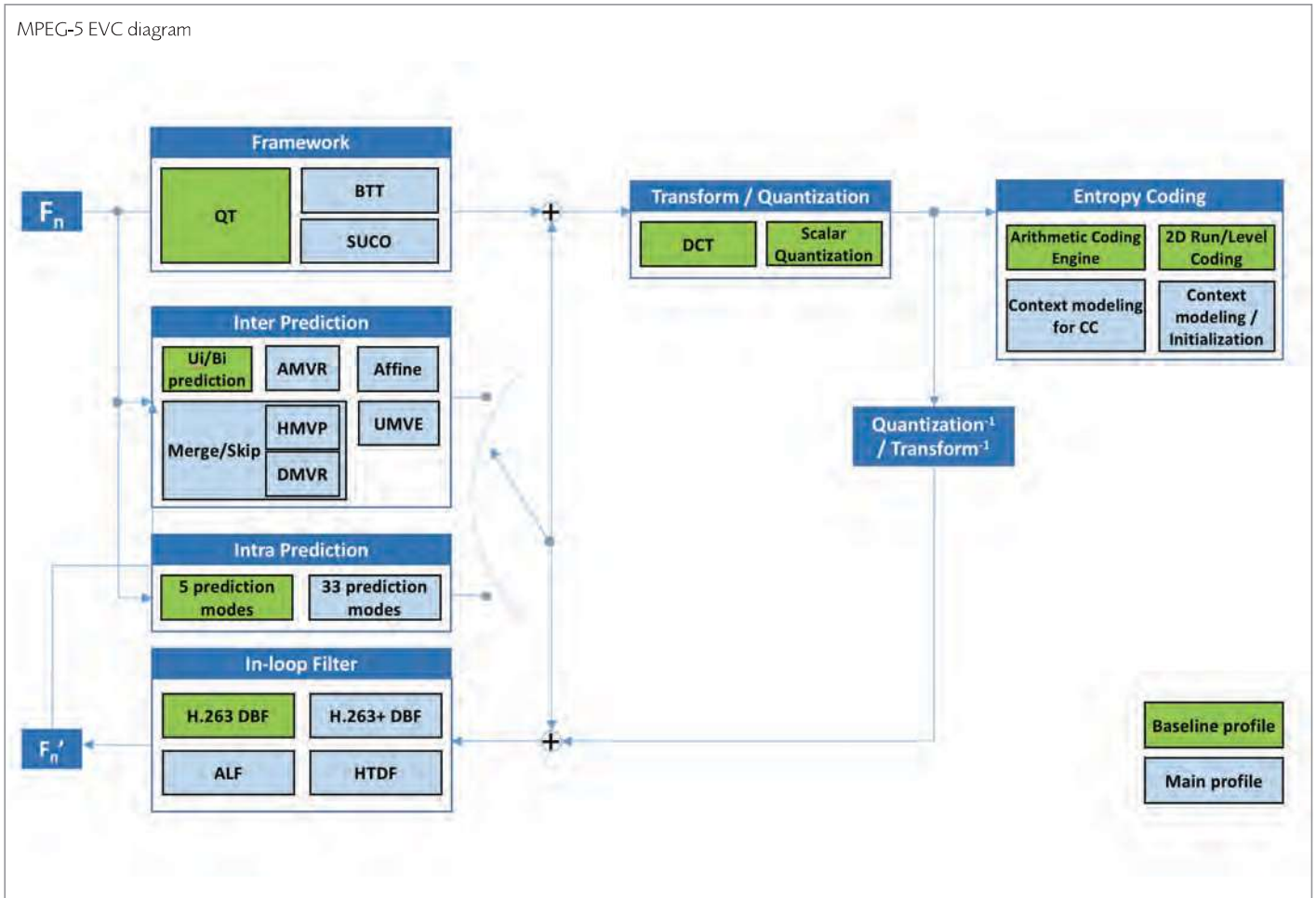
The goal for the development of VVC is to provide yet another factor of two improvement in compression performance compared to HEVC, with a target completion date in October 2020. As of the MPEG meeting in January 2019, the technical work appears to be on target.

However, the commercial environment for VVC is more uncertain, since experience with HEVC has caused many segments of the potential user



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MPEG-5 EVC diagram



Apple, CableLabs, Divideo, Ericsson, Intel, InterDigital, Nokia, Orange and Tencent. The work of MC-IF is intended to be complementary to that of the standardization bodies themselves and it may include consideration of licensing issues that go beyond the scope of activities allowed by the Common Patent Policy for ITU-T, ITU-R, ISO and IEC.

MPEG-5: ONLY THE ESSENTIALS?
 In a further development, MPEG itself has recognized the requirement to create a new standard that has a higher probability of addressing business needs in use cases where existing MPEG video coding standards have not been as widely deployed as might be expected from purely technical considerations. At the October 2018 MPEG meeting, MPEG issued a Call for Proposals for a new video coding standard to be developed using a streamlined process. This standard has subsequently become

known as MPEG-5 Essential Video Coding (EVC).

MPEG-5 EVC will include a Baseline profile that contains only technologies that are over 20 years old or are otherwise expected to be royalty-free. A Main profile will add a small number of additional tools, without these constraints. Each of these additional tools is individually capable of being either cleanly switched off or else cleanly switched over to the corresponding Baseline tool. This capability is intended to make it easier for an MPEG “customer” organization, such as DVB, to define its own profile. A future DVB profile could be optimized to meet both commercial and technical requirements for DVB-compliant applications, e.g. by omitting any Main profile tools that may be found to be problematic to implement.

The January 2019 MPEG meeting evaluated the responses to the Call for

Proposals for EVC and produced an initial test model, which is illustrated in the simplified block diagram above.

The main functions are the framework for block partitioning, inter-picture prediction, intra-picture prediction, in-loop filtering, the block transform and quantization, and entropy coding. Within each of these functions, the tools in the Baseline profile are shown in green. The additional tools in the Main profile are shown in light blue; each Main profile tool can each be either switched off or else switched over to the corresponding Baseline tool, on an individual basis. With the Main profile tools all turned on, the compression performance was measured to be approximately 24% better than HEVC.

The tools in the initial MPEG-5 EVC test model are based on a three-company response to the Call for Proposals from Samsung Electronics, Huawei and Qualcomm. The proponents of this proposal have made a commitment to publish the licensing terms for their Main Profile tools within two years of completion of the standard, to help potential users to create business plans as early as possible. The development of the MPEG-5 EVC standard is expected to be completed in early 2020.

THIS PATTERN OF ONE DOMINANT VIDEO CODEC PER DECADE NOW APPEARS TO BE CHANGING, AS WE MOVE INTO A MORE COMPLEX, MULTI-CODEC WORLD.